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RESEARCH ARTICLE

Narrative Risk Communication as a *Lingua Franca* for Environmental Hazard Preparation

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ABSTRACT
Incorporating narrative elements into risk communication may encourage preparation for environmental hazards in ways that scientific language alone does not. We integrate narrative theory, narrative persuasion, and risk theories into a Narrative Risk Communication Framework and then assess the effectiveness of character selection as a narrative mechanism in scientific risk communication as compared to conventional science messaging alone. We utilize a survey experiment with residents along the flood-prone Yellowstone River in Montana and analyze the resulting data with a parallel and serial mediation statistical model. We find that positive affective response mediates the influence of narratives featuring hero character language. Positive affective response appears to overcome the risk perception paradox both by circumventing rational analysis of risk and by shaping risk perception. Overall, the results suggest that inspirational hero language is superior to language of fear or victimization in encouraging preparation – an important lesson for practitioners working to help citizens prepare for environmental disasters.

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Introduction

Risk communication is a centerpiece of efforts to improve public preparedness for environmental hazards. However, communication comprised primarily of scientific language often falls short in producing the desired level of action among non-expert audiences (Dahlstrom, 2014). According to critics, such language can often be too jargonistic, probabilistic, and technical to effect change (Fischhoff, 1995). A growing area of research explores how narrative-based environmental communication might result in better assimilation of scientific information and greater persuasiveness to reduce risk (Cooper & Nisbet, 2016; Moyer-Gusé et al., 2019; Oschatz & Marker, 2020). Our study builds on such work with the overarching goal of understanding mechanisms by which narratives might serve as a translational or common language – a *lingua franca* – for conveying risk to the public in a way that influences attitudes and intended risk mitigation behaviors. We add to this

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developing literature by proposing a Narrative Risk Communication Framework (NRCF) that draws from and integrates insights from literatures on narrative theory, narrative persuasion, and risk. While some communication scholars (e.g. Cooper & Nisbet, 2016) have recently proposed and examined linkages in this framework, we believe this is the first attempt to articulate them comprehensively in a named framework that might serve as an impetus for a coordinated research agenda.

Within this broader framework, we then focus on testing a specific causal mechanism within narratives (i.e. character selection) according to a clear theoretical anchoring, thereby allowing for future replicability across domains. We statistically model the proposed relationships with a parallel serial mediation model and test our hypotheses with data from a survey experiment conducted with a large sample of participants *in situ* within a specific natural hazard domain. Our resulting evidence that narrative construction of risk messages using hero language can motivate people to prepare through positive affect is a critical finding that could be very useful for emergency personnel and practitioners.

Narrative Risk Communication Framework

This section proceeds through multiple subsections that elucidate different general concepts and relationships operating within our NRCF. We follow Ostrom's (2010) notion of a "framework" as including the "most general set of variables" for analysis and as containing both theories and models (p. 646). As such, this framework should be general enough to encompass a variety of relevant theories, causal mechanisms, and assumptions from different domains. Below, we detail the NRCF components and relationships as presented in Figure 1.

Narrative theory & risk messaging

The starting point in the NRCF is the risk message, which includes the content communicated to the audience (Figure 1). Risk messages might have multiple goals, including informing and persuading, as well as different mechanisms for achieving these goals (see National Research Council, 1989). As with any scientific inquiry, identifying and isolating specific causal mechanisms that explain a phenomenon is critical to advancing knowledge (Illari & Williamson, 2012). To understand what makes narrative risk messages effective, we identify specific "narrative mechanisms" to test against conventional risk messaging, which tends to emphasize the probability and magnitude of a negative event (i.e. the two components of risk).

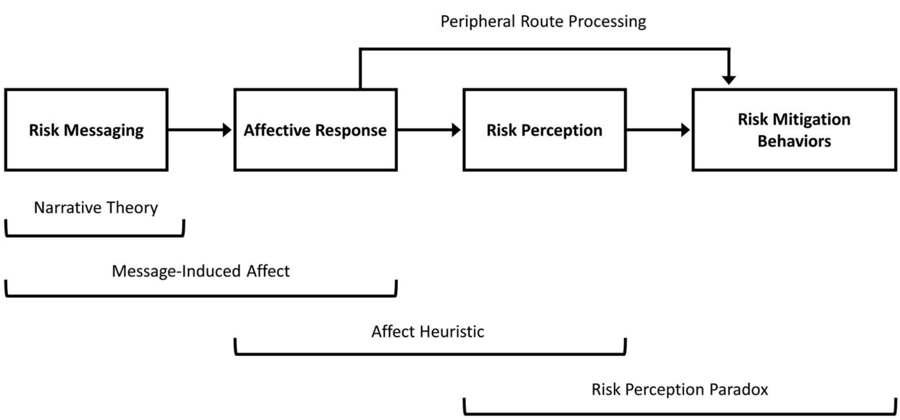

Figure 1. Narrative Risk Communication Framework.

We focus on narratives in communicating risk because narratives are central to being human and because we both make meaning of and communicate about our experiences through narratives (Bruner, 1986). The cognitive phenomenon of "dual processing" helps to explain the power of narratives, as humans rely not only on systematic, slow systems of logical and analytical reasoning but also on intuitive, fast systems that employ heuristics and affect to make decisions (Kahneman, 2011). Applied to environmental communication, narrative messages can produce an affective experience, whereas science communication typically presumes activation of the analytic system used in rational decision making. Use of narratives in communicating about environmental hazards is likely to be more effective because these messages are more engaging and memorable (Dahlstrom, 2014; Harcourt et al., 2020).

Many studies of narrative communication use the whole message as the unit of analysis when comparing the persuasiveness of narrative messages to non-narrative or science messages (e.g. Murphy et al., 2013). To advance our understanding of the power of narratives to persuade, we advocate for more precise testing of specific narrative mechanisms, which are discovered in the structure of the risk messages (Shanahan et al., 2019). For example, Dahlstrom (2012) has found that narratives constructed with causal statements are more memorable and more likely to be perceived as true. Kahneman and Tversky's (1979) prospect theory has demonstrated the power of gain and loss frames in influencing different kinds of decisions. Others have discovered the power of first-person accounts over third-person accounts (Nan et al., 2015). In this study, we investigate the persuasive power of the narrative mechanism of character selection.

We theoretically ground our investigation in the Narrative Policy Framework (NPF), which is informed by both narrative and cognitive theories (Shanahan et al., 2018b). On the one hand, the NPF asserts that our understanding of realities such as risk is socially constructed. On the other hand, the NPF asserts that narratives can be measured systematically and reliably over time due to the stable structure of narrative form in elements such as characters, plot, setting, and moral of the story. As such, the NPF embraces the ontology of social construction and the epistemology of objective and replicable measures, thereby providing a congruent match with Rickard's (2021) view of the dual functions of risk communication – pragmatic (objective) and constitutive (social construction).

While the NPF recognizes many of the structural elements of narrative, the minimal requirement for a message to be considered a narrative is inclusion of at least one character (e.g. hero, villain, victim) and a moral of the story, which gives purpose or causality to the character's action (Shanahan et al., 2013). Scholarship rooted in other disciplines similarly specifies characters and causally linked events as necessary components of a narrative (Bilandzic & Busselle, 2013, p. 201; Braddock & Dillard, 2016, p. 447; Kreuter et al., 2007, p. 222). Given the centrality of characters to narrative, this study seeks to understand precisely how narratives persuade by isolating and testing character selection as a specific narrative mechanism. Such theoretical grounding is important for replication studies and the building of knowledge across risk domains.

Message-induced affect

For scholars studying narrative persuasion, the audience's affective response to the risk message is central and represents the first link in the NRCF (Figure 1). Narratives can induce narrative transportation, which occurs when the audience is effectively lifted into the events of the story and *feels* the story experiences of the characters (Appel & Richter, 2010; Green & Brock, 2000). Two operational dimensions of narrative transportation of import to his study are affect (Green et al., 2012) and identification or attachment to the protagonist (Green & Brock, 2000; Sestir & Green, 2010). The former is the audience's positive or negative response to the narrative, while the latter is the extent to which the audience identifies with the characters.

We consider character selection as a causal mechanism for inducing affective responses in narratives. In the NPF, characters are human and non-human entities "who act or are acted upon"

(Shanahan et al., 2018a, p. 335). Our investigation utilizes "hero" characters, defined as fixers of problems, and "victim" characters, defined as those suffering or fearing harm from problems (Shanahan et al., 2018a). We have constructed all the narrative messages to situate the audience member (i.e. the homeowner along the Yellowstone River in Montana) in the character role, thereby controlling for the influence of identification (and associated influences like perceived character likability or capability) and isolating the affective response. This is important because identification can also generate narrative persuasion (see Igartua, 2010). The hero of the story is the audience member who engages in risk mitigation behaviors; the victim of the story is the audience member who suffers negative repercussions of the extreme environmental event. Existing research has tended to find that hero characters produce positive affective responses while victim characters produce negative ones, with grounding in Character Theory and Affect Control Theory (Bergstrand & Jasper, 2018). We envision corresponding affective responses to messages featuring these characters as compared to conventional science messages, which tend to emphasize technical details. We refer to messages combining scientific language and narrative elements as "narrative science messages."

H_1: Narrative science messages with hero character language will produce a larger positive affective response than will conventional science messages.

H_2: Narrative science messages with victim character language will produce a larger negative affective response than will conventional science messages.

Affect heuristic

The NRCF next incorporates the link between the affective response to risk messages and the perception of risk (Figure 1). This linkage is known as the "affect heuristic" (Finucane et al., 2000; Slovic, 2010). The theory underlying the affect heuristic posits that feelings, which tend to operate automatically and quickly, are often used as cognitive shortcuts for evaluating risk, thereby allowing people to avoid the heavy cognitive burden of rational analysis. Many studies on the affect heuristic examine negative feelings, with the standard finding that negative affect is associated with higher risk perception (Leiserowitz, 2006; Skagerlund et al., 2020; Slovic et al., 2004). The mechanisms for this relationship appear to be the stimulation of fear, anxiety, and/or dread (Lerner et al., 2015; Lowenstein et al., 2001) and the ready cognitive availability of information tied to such feelings (Keller et al., 2006).

The influence of positive affect on risk perception, on the other hand, has received less attention. The studies that evaluate this relationship (e.g. Cooper & Nisbet, 2016; Finucane et al., 2000; Greenaway & Fielding, 2020; Rickard et al., 2021) sometimes suggest an inverse relationship, with greater positive affect reducing risk perception. However, our narrative mechanism is designed to highlight danger even while inducing positive feelings with hero characters. The intention is to increase risk perception through positive (rather than negative) feelings in a way that might be more potent and durable than effects based on fear and anxiety (see Huddy et al., 2005; O'Neill & Nicholson-Cole, 2009; Ruiter et al., 2014). Given that our experimental treatment will differ in a key way from those that have produced most findings in the literature, we leave the directionality of the relationship open.

H_3: Positive affective response will influence personal risk perception.

H_4: Negative affective response will increase personal risk perception based on the stimulation of fear, anxiety, and dread.

Risk perception paradox

The final segment of the NRCF addresses the risk perception paradox (Figure 1). The essence of the paradox is the frequently negligible relationship between risk perception and corresponding behaviors to reduce risk (Wachinger et al., 2013). One potential approach for overcoming the paradox is influencing intended behaviors more directly through the affect heuristic, thereby choosing feeling over analytical risk perception. In the theoretical approach of Petty and Cacioppo (1986), this is use of the "peripheral" rather "central" processing route (alternatively System 1 and System 2 in Kahneman [2011]). As shown at the top of Figure 1, this would be a direct jump from affective response to risk mitigation behaviors.

On the positive side, positive affective response becomes the mediating mechanism (i.e. the explanatory causal linkage) between hero language and intended behavior due to the motivating nature of positive feelings. The "angel shift," in which the hero is cast as a winner, is one implementation of this mechanism in the NPF (Shanahan et al., 2018a). Positive feelings such as hope and enthusiasm have various desirable consequences, which include prompting greater engagement and renewed effort (Brader, 2005; Dillard & Seo, 2013) and facilitating changed assessment of the likelihood of achieving goals (Dillard & Nabi, 2006). On the negative side, reviews of the literature suggest a link between negative feelings like fear or worry and increased flood mitigation measures, though the effect sizes are small (Bubeck et al., 2012). If the use of victim characters activates such negative feelings, we might expect a similar relationship to emerge in our data. However, the mechanism is unclear, and the previously mentioned shortcomings of fear and worry as motivators are an obstacle.

H_5: Positive affective response to narrative science messages with hero language will mediate the relationship between risk messaging and intention to engage in risk mitigation behaviors as respondents engage in peripheral processing.

H_6: Negative affective response to narrative science messages with victim language will mediate the relationship between risk messaging and intention to engage in risk mitigation behaviors as respondents engage in peripheral processing.

Another potential mechanism, again potentially working through the affect heuristic, would be promotion of intended risk mitigation behaviors through increased risk perception (rather than working around risk perception). To the extent affect is involved at all, the standard approach in flood preparation communication relies on a causal chain that emphasizes implicit victim characters (e.g. the probability of disaster happening to *you*); negative affective response (e.g. fear, worry, anxiety, dread); heightened risk perception; and corresponding risk mitigation behaviors. However, the basic thrust of the risk perception paradox is that such a chain frequently falls apart. Although we will also test for this negative pathway using victim language, our expectation is that the combination of hero language and scientific risk information will heighten risk perception and empower individuals to feel like they can do something about it.

H_7: The use of hero language in narrative science messages will induce positive affective response in a way that increases perceived risk and motivates intended risk mitigation behaviors.

H_8: The use of victim language in narrative science messages will induce negative affective response in a way that increases perceived risk and motivates intended risk mitigation behaviors.

Covariates

Our analyses will also consider covariates that are pertinent to the relationships covered by these hypotheses. We implement these covariates mostly as statistical controls. Literature overviews supply extensive information about these variables and any expected relationships (see Botzen et al., 2009; Bubeck et al., 2012; Kellens et al., 2013; Wachinger et al., 2013). Briefly, such overviews suggest that more objective risk indicators like elevation or situation in a floodplain are related to risk perception and mitigation in the flood domain. They also suggest that previous event experience has a mixed relationship with risk perception but a positive relationship with mitigation. Further, the overviews suggest the following for socioeconomic variables: risk perception is often higher for women, age has a mixed relationship with risk perception, and both income and education sometimes have a negative relationship with risk perception. However, socioeconomic variables like income, sex, age, and education tend to have limited relationships with intended or actual protective behaviors. Results for perceived self-efficacy are also surprisingly mixed, though greater self-efficacy is sometimes associated with greater mitigation (see Grothmann & Reusswig, 2006; Ryan et al., 2018).

Materials and methods

We implemented a cross-sectional design to answer our broader question of whether narratives can serve as a *lingua franca* for conveying flood risk to the public in a way that influences attitudes and encourages risk mitigation behaviors. A mail survey with an embedded experiment was the method of data collection. Residences near the Yellowstone River in Montana served as the real-life hazard area. We chose the Yellowstone River based on the lack of impoundments (water storage dams) on the mainstem of the river and the associated flood risk posed to riverine communities. The flood risk is evident in the flood insurance requirements that have proven controversial in some communities along the river (Bergmann et al., 2020).

Data collection & message construction

Public cadastral (property) data were the starting point for constructing the population of all residences near the Yellowstone River in Montana. Using public maps, we selected all properties that intersected the 800-meter buffered channel polygon and then excluded addresses that clearly did not include a residence. The U.S. Postal Service cleaned the remaining addresses to remove those with invalid mailing addresses. The survey went to all 9355 addresses in the population, 634 of which still proved undeliverable as addressed.

The mailing included a cover letter that provided basic information about the study, along with the questionnaire and a business reply envelope. Postcard reminders followed approximately two weeks later. We had pilot-tested an earlier draft of the questionnaire in small-group sessions with university students who had home addresses in the study area. This testing led to minor changes in wording and design (see Supplement 1 for relevant questionnaire language). Each questionnaire included one of nine different messages about flooding as part of the messaging experiment (see Supplement 2 for message language). The questionnaire versions were randomly distributed to the residences along the Yellowstone River, resulting in equally sized groups.

We decided to collapse the nine different messages into five categories following initial analysis of the resulting data. Based on emerging findings about different responses to probability versus certainty language in earthquakes preparedness (see Jones, 2018), all messages besides the *Base message* had both probability and certainty versions of the science language. Finding no difference between the two versions in any case, we collapsed for the sake of simplicity in the analysis and the presentation of results. The *Base message*, envisioned as a control, included only a scientifically derived definition of flooding, while the *Science message* (which would become the comparison category for statistical hypothesis testing) added standard scientific language used by entities such as the Federal Emergency Management Agency (FEMA).

Using an innovative mixed-methods process designed to reduce threats to validity and reliability (Shanahan et al., 2019), we developed three narrative texts containing different character language to accompany the science statements. We integrated character language of three types – *Hero*, *Victim*, and *Victim-to-hero* – separately into science messages. While heroes and victims represent classically cast characters, we also included the lesser-used victim-to-hero character to capture another kind of hero – one who has triumphed in the face of hard times (Wright, 2016). We do not have separate hypotheses for this character type.

Development of the narrative language was a multistage process, beginning with human coding of language about flooding (using NVivo 11) that was collected via semi-structured interviews with 45 residents from multiple communities along the Yellowstone River. The intention was to build a vocabulary about flooding in the words of the residents themselves. Multiple human coders first applied an NPF codebook to the interview transcripts to identify segments that fell into "hero" (Cohen's kappa = 0.88) and "victim" (0.88) categories. We then applied natural language processing and automated content analysis to calculate transformed relative frequencies of words in the corpora of coded language, thereby identifying words more often associated with heroes or victims, respectively. The automated content analysis was a form of word classification executed in the *R* computing environment. The next step was algorithmic construction of the narrative messages using the dictionaries of hero and victim character words (see Shanahan et al., 2019).

We subsequently tested message validity and reliability with dial response technology in sessions with residents of three towns along the Yellowstone River. The dial response technology continuously records participants' affective responses to the risk message as they turn the dial up for positive responses and down for negative responses. The dial response sessions assessed whether the messages reliably produced differing affective responses as anticipated. Finding strong validity and reliability, we proceeded with insertion of the messages into the questionnaires. We note that the messages themselves differ in length. However, given our desire to evaluate the influence of adding character language to conventional science language, this was unavoidable. The treatments were also brief, as the longest was 208 words.

The survey was in the field from 19 February to 29 March 2019, with later responses excluded due to a possibility that spring runoff could influence results. The number of returned questionnaires was 3320, producing a response rate of 38.1% (out of 8721). Additional cleaning removed addresses that did not contain a residence or for which the responding individual was not the owner, trustee, or administrator. Thus, 2901 (87.4%) of the returned questionnaires were available for analysis after this final cleaning. The response rates across the nine different conditions were very similar, ranging from 35.8–40.2%. While population data are not available for comparison, the initial response by sex (43.1% female) and age categories seemed reasonable.

Variables used in statistical analyses

Table 1 contains descriptions of the variables used in statistical analyses, including basic descriptive statistics. The *Risk message variables* section shows the five different messages variables after collapsing. These are binary indicator variables for different conditions.

In the *Outcome/mediating variables* section of Table 1, *Positive affective response* and *Negative affective response* are adapted from the 20-item Positive and Negative Affect Schedule (PANAS), a well-established set of positive and negative mood scales (Watson et al., 1988). Immediately after reading a message, respondents were asked to rate the extent to which they were experiencing each of 10 positive and negative PANAS feelings. Our version of the PANAS includes the five positive items (i.e. inspired, determined, proud, attentive, alert) most related to risk of extreme flood. Response options ranged from "not at all" to "extremely". *Positive affective response* is calculated as the average across the five positive items (Cronbach's $\alpha = 0.86$). Similarly, *Negative affective response* includes the five negative items (i.e. afraid, nervous, upset, distressed, hostile) most related to risk of extreme flood (Cronbach's $\alpha = 0.85$).

Given that risk is a combination of the likelihood and severity of a negative event (see discussion in Wolff et al., 2019), *Personal risk perception* multiplies two scores. The first is the individual's evaluation of the likelihood that an extreme flood would damage their Yellowstone River residence, with 5 response options ranging upward from "extremely unlikely" to "extremely likely." The second is an average across the self-reported, projected severity of personal economic loss and the disruption to the individual's personal life if an extreme flood occurred, with five response options ranging from "no impact" to "catastrophic impact" for each.

Table 1. Description of variables used in statistical analyses.

Risk message variables (i.e. predictors)		Mean	S.D.	Range
Base message	Binary indicator that individual received base (definitional) message only	0.103	0.304	0.00–1.00
Science message	Binary indicator that individual received science message (probability or certainty) only	0.214	0.410	0.00–1.00
Hero message	Binary indicator that individual received hero character language only in message	0.228	0.420	0.00–1.00
Victim message	Binary indicator that individual received victim character language only in message	0.224	0.417	0.00–1.00
Victim-to-hero message	Binary indicator that individual received victim-to-hero arc in message	0.230	0.421	0.00–1.00
Outcome/mediating variables				
Positive affective response	Averaged indicator across five positive feelings (inspired, determined, proud, attentive, alert) experienced after message	2.295	0.955	1.00–5.00
Negative affective response	Averaged indicator across five negative feelings (afraid, nervous, upset, distressed, hostile) experienced after message	1.383	0.597	1.00–5.00
Personal risk perception	Multiplicative indicator combining respondent's assessment of likelihood and severity of extreme flood for self	6.351	5.545	1.00–25.00
Intended risk mitigation behaviors	Intention to engage in up to 11 flood mitigation behaviors not already undertaken; behaviors weighted by inverse proportion of respondents already having taken the action	0.219	0.184	0.00–1.00
Covariates				
Perceived self-efficacy	Averaged indicator across 6 items dealing with individual's perceived ability to deal with aspects of flood emergency	3.508	0.904	1.00–5.00
Undertaken behaviors	Flood risk mitigation behaviors already undertaken; behaviors weighted by inverse proportion of respondents already having taken the action	0.050	0.096	0.00–0.895
Elevation	Elevation of the property relative to base flow river elevation (in meters)	11.434	13.948	−4.1–175.3
Flood experience	Binary indicator of whether the individual has owned or lived in any residence damaged	0.203	0.402	0.00–1.00
Floodplain	Self-assessment of whether residence falls within FEMA's 100-year floodplain	0.348	0.365	0.00–1.00
Time owned	Ordinal indicator of time having owned the residence, with 4 increasing time categories	3.451	0.730	1.00–4.00
Income	Ordinal indicator of household's 2017 total pre-tax income, in 7 increasing categories	4.158	1.807	1.00–7.00
Female	Binary indicator for females (=1) vs. other	0.426	0.495	0.00–1.00
Age	Age of respondent in years, in 7 increasing categories	4.389	1.409	1.00–7.00
Education	Highest educational degree completed, with 6 increasing categories	4.039	1.470	1.00–6.00

Notes**:** Descriptive statistics are calculated based on the cases (1938) included in the parallel and serial mediation model. The range is the observed range in the data. The means for the five message variables represent the proportion of participants in the analyzed sample who received such a message.

Intended risk mitigation behaviors incorporates responses to 11 different questionnaire items about the likelihood that the residential owner would engage in specific flood mitigation behaviors in the next year. The specific behaviors were derived from government documentation and our earlier resident interviews. Response options ranged from "Definitely won't do it" to "Definitely will do it" on a five-point response scale. Respondents also had the option of indicating they had already undertaken each action. The resulting aggregate score ranges from 0 to 1, with "0" indicating that the respondent definitely will not do anything they have not already done and "1" indicating that the respondent definitely will do all things they have not yet done. Scores for each of the items are weighted for difficulty based on the inverse of the sample proportion already having engaged in that mitigation behavior. The calculation allowed for up to two of 11 missing values before the respondent was deemed to be missing data for the aggregate score. Otherwise, the calculation was made across the total number of items for which data were available.

In the *Covariates* section in Table 1, *Perceived self-efficacy* averages across six items (adapted from Ryan et al., 2018) addressing the individual's perceived ability to deal with aspects of a flood emergency, including self-protection; financial resources for recovery; food and water supplies; personal losses; emotions; and return to a normal routine. The calculation allowed for up to two missing values in a similar fashion. Non-resident owners were instructed to respond "non-applicable" to items more relevant to residents. Such responses were similarly treated as missing values. *Undertaken behaviors* is similar to *Intended behaviors* but instead measures the flood risk mitigation actions already undertaken. Again, scores range from 0 to 1, with "0" meaning the respondent had not yet taken any of the 11 actions and "1" meaning the respondent had already taken all 11. Again, items are weighted by the inverse proportion of people who have already undertaken each action. Based on public maps and data, *Elevation* provides the elevation of the geometric midpoint of each property relative to the base-flow (i.e. late summer) river elevation. The remaining covariates in Table 1 require no additional explanation.

In addition to asking which self-protective behaviors respondents have taken or plan to take, we asked two contingent valuation questions to measure respondents' willingness to pay (WTP) for collective actions to reduce community-wide flood risk through increased taxes, local prices, and fees (for relevant materials, see Supplement 3). We analyze the responses to these questions to determine whether WTP for community-wide flood risk reduction varies across respondents in ways that are consistent with the causal pathways that influence individual behaviors.

Data analysis

Bringing together the concepts in the NRCF is best accomplished in a serial mediation model that assumes a directional causal chain of mediators. Such a model facilitates evaluating mediation mechanisms and estimating the magnitude and significance of both direct and indirect effects. The model also needs a parallel structure to allow for separate consideration of positive and negative affective responses to the risk messages. Consequently, we implement a parallel and serial mediation model using the regression bootstrapping method in the PROCESS model 80 developed by Hayes (2018).

Figure 2 shows the potential pathways through which the experimental treatments (i.e. the risk message conditions, X_i) might work through the parallel mediators of positive affective response (M_1, via a_1 and b_1) and negative affective response (M_2, via a_2 and b_2). The figure also shows the causal path for working through the serial mediator of risk perception (M_3) on the positive affective response side (through a_1 then d_1 and b_3) and the negative affective response side (through a_2 then d_2 and b_3). The model accounts for potential direct pathways, including any direct effect of the risk messages on the ultimate outcome of intended risk mitigation behaviors (Y, via c'). Finally, the model controls for the effects of 10 covariates (F_{1-10}) for all causal pathways in the model. Measurement error shows up in the diagram via the e terms.

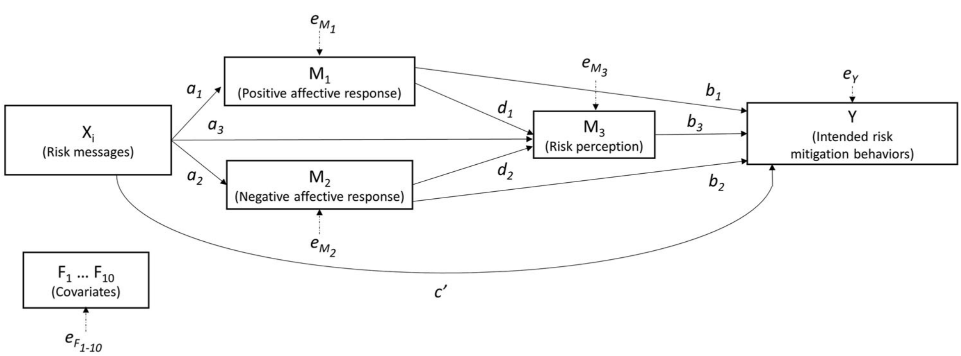

Figure 2. Proposed casual pathways tested with parallel and serial mediation model.

The statistical model uses ordinary least squares path analysis in estimating model coefficients to determine the direct and indirect effects of risk messaging on intended risk mitigation behaviors. Indirect effects of X on Y through the mediators (M_1, M_2, M_3) are the product of each path (e.g. $a_1 \times d_1 \times b_3$). Bootstrapping produces bias-corrected 95% confidence intervals for making statistical inferences about indirect effects (Preacher & Hayes, 2008). We conducted the analyses using the PROCESS macro (V.3.4.1, model 80) in IBM SPSS Statistical Package V.26.

Results

The results from the parallel and serial mediation model analysis appear in Table 2. The first column of results is for *Positive affective response* as the outcome variable. All messages with character language (i.e. narrative science messages) influence *Positive affective response* in a positive manner, though the two message types that include hero language have a much larger effect. Since *Science message* is the excluded comparison category, these coefficients represent the mean shift compared to *Science message* in the messaging experiment. (We note no meaningful difference between *Base message* and *Science message* in any of our analyses.) The results support H_1, which proposed a

Table 2. Parallel and serial mediation model results across four outcome variables.

		Positive affective response	Negative affective response	Personal risk perception	Intended risk mitigation behaviors
Predictors	Hero message	0.344***	0.003	−0.472	−0.002
		(0.063)	(0.038)	(0.303)	(0.011)
	Victim message	0.127*	0.057	−0.825**	0.014
		(0.063)	(0.038)	(0.302)	(0.011)
	Victim-to-hero message	0.333***	0.068	−0.591*	−0.004
		(0.063)	(0.037)	(0.302)	(0.011)
	Base message	0.023	0.004	−0.177	0.028
		(0.079)	(0.047)	(0.378)	(0.014)
Mediators	Positive affective response			0.332**	0.044***
				(0.116)	(0.004)
	Negative affective response			2.432***	0.003
				(0.194)	(0.008)
	Personal risk perception				0.006***
					(0.001)
Covariates	Perceived self-efficacy	−0.076**	−0.227***	−1.865***	−0.025***
		(0.025)	(0.015)	(0.126)	(0.005)
	Undertaken behaviors	1.220***	0.316*	1.841	0.239***
		(0.224)	(0.134)	(1.081)	(0.040)
	Elevation	−0.001	−0.002	−0.078***	−0.001*
		(0.002)	(0.001)	(0.007)	(0.001)
	Flood experience	0.129*	0.144***	0.560*	−0.002
		(0.053)	(0.032)	(0.254)	(0.010)
	Floodplain	0.242***	0.166***	2.287***	0.039***
		(0.061)	(0.036)	(0.293)	(0.011)
	Time owned	−0.052	−0.007	−0.132	−0.010
		(0.032)	(0.019)	(0.151)	(0.006)
	Income	−0.002	0.009	0.078	0.004
		(0.013)	(0.008)	(0.064)	(0.002)
	Female	0.051	0.001	0.256	0.019*
		(0.044)	(0.026)	(0.209)	(0.008)
	Age	0.093***	−0.008	−0.052	−0.001
		(0.017)	(0.010)	(0.082)	(0.003)
	Education	−0.033*	−0.005	0.162*	0.003
		(0.016)	(0.009)	(0.074)	(0.003)
	Constant	2.107***	2.112***	8.703***	0.142***
		(0.167)	(0.100)	(0.891)	(0.034)

Notes: Reported coefficients are unstandardized. Standard errors appear in parentheses. All tests are two tailed. The number of cases included in the analysis is 1938. The R^2 value for each equation, in order, is: 0.08, 0.16, 0.38, and 0.22. The excluded comparison category for the first four independent variables is *Science message*. The software used was PROCESS Procedure for SPSS Version 3.4.1. ***$p \leq 0.001$ **$p \leq 0.01$ *$p \leq 0.05$.

larger positive affective response for messages with hero language as compared to those with only conventional science language. Figure 3 graphs the standardized coefficients (not shown in Table 2) from the model for those variables with statistically significant effects. For the outcome of *Positive affective response*, the risk messages that incorporate hero language clearly outpace all other influences.

The second column of results in Table 2 is for *Negative affective response* as the outcome variable. The risk messages do not differentially influence this variable. Therefore, the results fail to support

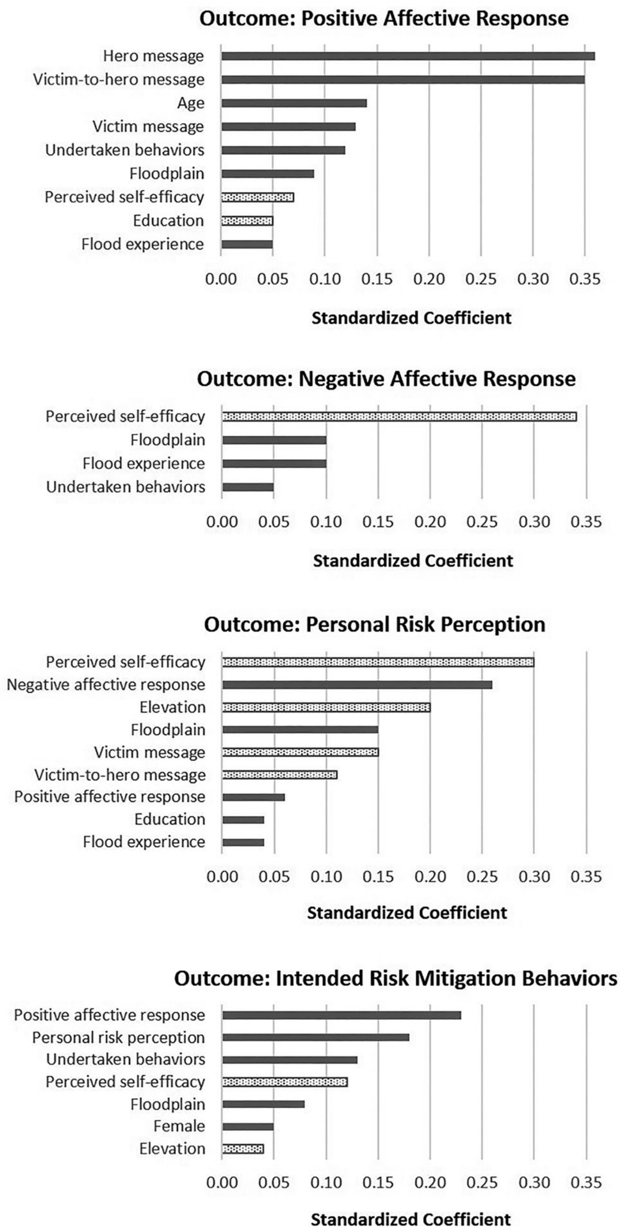

Figure 3. Standardized Effects on Four Outcome Variables.

Notes: Solid bars are for positive effects, while bars with patterns are for negative effects. Only statistically significant coefficients (see Table 2) are shown in the figure.

H_2, which proposed a larger negative affective response for messages with victim language as compared to those with only conventional science language. *Perceived self-efficacy* is a negative influence and is relatively powerful (Figure 3). Interestingly, the causal directions for all the statistically significant variables in the equation with *Negative affective response* as the outcome are the same as for equation with *Positive affective response* as the outcome. This pattern suggests that these are predictors of feeling anything, whether positive or negative in nature.

Personal risk perception is the outcome variable in the third column of results in Table 2. Supporting H_3 and H_4, both *Positive affective response* and *Negative affective response* influence *Personal risk perception*. Both do so in a positive direction. Character language is important, with *Victim message* and *Victim-to-hero message* both influencing *Personal risk perception* in a negative way. While we did not have a formal, direct hypothesis for these message variables, this directionality was unexpected. Figure 3 shows a number of sizeable influences on *Personal risk perception*, which explains why the R^2 for this equation (0.38) is higher than for the others. *Perceived self-efficacy* and *Negative affective response* are the most consequential.

The final column of Table 2 shows the results for the outcome variable of *Intended risk mitigation behaviors*. H_5 proposed a mediating effect of *Positive affective response* between hero language and *Intended risk mitigation behaviors*. Table 3 displays the results for statistically significant indirect effects. Nearly all such effects run through *Positive affective response* in some manner, which is a natural consequence of the magnitude of the message variables' influence on *Positive affective response*. The first row of Table 3 provides supportive evidence for H_5 concerning hero language, though victim language is also mediated through *Positive affective response* to a lesser extent. *Negative affective response*, on the other hand, has no mediating influence on the relationship between character language and intended behaviors, so H_6 is not supported.

We can also evaluate the final two hypotheses using Tables 2 and 3. H_7 proposed a causal pathway from hero character language through both *Positive affective response* and *Personal risk perception*. As shown in Table 3, such a pathway emerges for both hero language and victim-to-hero language, supporting H_7. Somewhat surprisingly, victim language also uses this pathway. H_8 proposed a similar pathway for victim language through *Negative affective response*. This path finds no support in our data. However, negative affect does appear to work on *Intended risk mitigation behaviors* through *Personal risk perception* absent an initiating influence of victim character language (indirect coefficient = 0.014). Finally, in terms of direct effects on *Intended risk mitigation behaviors*, *Personal risk perception* joins *Positive affective response* as having a sizeable influence (Figure 3). The latter is evidence of peripheral route processing.

Results of the analysis of the contingent valuation questions, which measured WTP for community-wide risk reduction, are broadly consistent with those from the mediation model for individual

Table 3. Indirect effects on the outcome of intended risk mitigation behaviors.

Hero message → Positive affective response	0.0151 (0.0031)
Victim message → Positive affective response	0.0056 (0.0027)
Victim-to-hero message → Positive affective response	0.0146 (0.0032)
Victim message → Personal risk perception	−0.0049 (0.0020)
Hero message → Positive affective response → Personal risk perception	0.0007 (0.0003)
Victim message → Positive affective response → Personal risk perception	0.0003 (0.0002)
Victim-to-hero message → Positive affective response → Personal risk perception	0.0007 (0.0003)

Notes: Reported coefficients are unstandardized. Standard errors appear in parentheses. All tests are two tailed. Only statistically significant results (i.e. bootstrapped confidence intervals do not overlap zero) are included in the table.

actions (see Supplement 3). Narratives do not directly influence WTP, but WTP for collective actions is higher among respondents with higher *Positive affective response* and *Personal risk perception*. These complementary results enhance confidence in the validity and generalizability of our main results and also provide some information about preferences over community-level risk reduction actions.

Discussion

This study proposes a Narrative Risk Communication Framework, which we then use to structure our investigation of whether adding narrative elements to conventional scientific risk messages is more effective than conventional scientific language alone at motivating desired attitudes and intended flood mitigation behaviors. Specifically, we focus on how the potential causal mechanism of character selection in narratives influences such attitudes and behaviors through activation of affect (Finucane et al., 2000; Slovic, 2010), one dimension of narrative transportation (Green & Brock, 2000). We find that narrative science messages produce positive affective responses in a way that conventional science messages alone do not. Further, narrative language that emphasizes heroes vastly outpaces victim language in generating these positive affective responses. We also examine the risk perception paradox, which notes a frequent incongruence between risk perception and associated behaviors (Wachinger et al., 2013), as an element of the NRCF. Positive affective response appears to work through two mechanisms to undermine the risk perception paradox: (1) by activating feelings directly in decision making (i.e. peripheral route processing [Petty & Cacioppo, 1986]) and (2) by better aligning risk perception and intended behaviors through the motivating power of positive feelings. Both mechanisms are important based on the strong influence of positive affective response and personal risk perception on intended behaviors. In a complementary analysis, these two variables similarly influence the outcome of WTP for actions to reduce community flood risk.

Narrative language featuring victims does not produce a negative affective response and cannot, therefore, influence risk perception through the affect heuristic in our data. However, victim language does have an undesirable and counterproductive association with a reduced perceived risk of extreme flooding as compared to conventional science messages. Contrarily, negative affect (likely unrelated to our experimental treatments) associates powerfully with increased risk perception. While this relationship is consistent with previous findings that dread and fear increase risk perception (Lerner et al., 2015; Lowenstein et al., 2001), the lack of a mechanism in our study leaves the door open for a different interpretation of the pattern of causality. More specifically, fear or a predisposition toward worry could be driving both high personal risk perception and negative affective response to messages about flooding, regardless of the content of those messages.

Overall, our results reveal that *inspiring* people to prepare is more effective than merely stating the scientific likelihood or certainty of an environmental disaster, while emphasizing individuals' status as victims may be counterproductive. While prior research has tended to look more frequently at negative affective responses to messages, our findings add to a growing list of studies finding that positive affective response is a key element in risk attitudes and behavior (e.g. Cooper & Nisbet, 2016; Finucane et al., 2000; Greenaway & Fielding, 2020; Rickard et al., 2021). As such, the standard approach of emphasizing victimization by environmental hazards seems ripe for rethinking.

Perceived self-efficacy (Grothmann & Reusswig, 2006) also proves influential in our results. Self-efficacy dulls affective responses to messages, though this is much more the case for negative affective response. Essentially, individuals who feel greater control over the situation evince little affective response to messages. Similarly, self-efficacy decreases assessments of personal risk from extreme flooding in noteworthy ways. This may be fine when perceived self-efficacy is based on mitigation actions previously taken but is problematic if self-efficacy represents false confidence. Interestingly, the direct effect of self-efficacy on intended risk mitigation behaviors is positive.

Overall, these self-efficacy results might suggest that finding genuine ways of empowering people to feel like they can deal with extreme flooding should help with preparedness.

We see avenues for additional work arising from this study, based both on our findings and limitations of our approach. Our text-based interventions were brief and involved highly salient subject matter for the audience. The brief interventions produced relatively small indirect effect sizes for the character language itself. This might be expected and is largely consistent with effect sizes in the literature for brief interventions. Recent work on more extensive messaging interventions (e.g. Broockman & Kalla, 2016) is promising – particularly in terms of longer-term effects, and such results might also hold in the narrative risk communication realm. Further, according to social judgment theory (Sherif & Hovland, 1961), significant movement on highly salient issues requires repeated attempts at persuasion. Additionally, given its already complex nature, our work made no attempt to assess trust in information sources (as they were not mentioned), which can be a factor in risk perception (see Wachinger et al., 2013). Future work might consider the credibility of narrators, which is important in the NPF. Finally, the relationship between negative affective response and risk perception appears to be more complicated than suggested by the state of the art. Further work is necessary to clarify the role of preexisting risk perception in message response, as well as the precise causal pathways at work.

Our study adds to a relatively recent and expanding literature. Our articulation of the NRCF sets the stage for building a coherent and reliable body of knowledge. We also see our theoretically derived manipulation of specific causal mechanisms within narratives as a contribution. Rather than testing entirely different narratives and conventional science messages against one another as a whole, we offer precision in understanding how narratives persuade. We find that hero characters and positive affective response are encouraging routes for persuasion, whether by avoiding analytical risk perception or working through it. This contrasts with the standard approach, which is largely negative in nature and leads to expert assessments of under-preparation and insufficient flood mitigation activities. The use of hero characters and the activation of positive affective responses might open new doors in environmental hazard communication. While the WTP results support the generalization of some of our results to other types of flood actions and decisions, we view generalizability to other hazard domains as an open question worthy of investigation and look forward to broader application of the NRCF and associated ideas. We believe our study is a promising step in the direction of establishing narrative risk communication as a legitimate *lingua franca* for environmental hazard preparation.

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References

Appel, M., & Richter, T. (2010). Transportation and need for affect in narrative persuasion: A mediated moderation model. *Media Psychology*, *13*(2), 101–135. https://doi.org/10.1080/15213261003799847

Bergmann, N. T., McEvoy, J., Shanahan, E. A., Raile, E. D., Reinhold, A. M., Poole, G. C., & Izurieta, C. (2020). Thinking through levees: How political agency extends beyond the human mind. *Annals of the American Association of Geographers*, *110*(3), 827–846. https://doi.org/10.1080/24694452.2019.1655387

Bergstrand, K., & Jasper, J. M. (2018). Villains, victims, and heroes in character theory and affect control theory. *Social Psychology Quarterly*, *81*(3), 228–247. https://doi.org/10.1177/0190272518781050

Bilandzic, H., & Busselle, R. (2013). Narrative persuasion. In J. P. Dillard & L. Shen (Eds.), *The SAGE handbook of persuasion: Developments in theory and practice* (2nd ed., pp. 200–219). SAGE.

Botzen, W. J. W., Aerts, J. C. J. H., & van den Bergh, J. C. J. M. (2009). Dependence of flood risk perceptions on socioeconomic and objective risk factors. *Water Resources Research*, *45*, W10440. https://doi.org/10.1029/2009WR007743

Braddock, K., & Dillard, J. P. (2016). Meta-analytic evidence for the persuasive effect of narratives on beliefs, attitudes, intentions, and behaviors. *Communication Monographs*, *83*(4), 446–467. https://doi.org/10.1080/03637751.2015.1128555

Brader, T. (2005). Striking a responsive chord: How political ads motivate and persuade voters by appealing to emotions. *American Journal of Political Science*, *49*(2), 388–405. https://doi.org/10.1111/j.0092-5853.2005.00130.x

Broockman, D., & Kalla, J. (2016). Durably reducing transphobia: A field experiment on door-to-door canvassing. *Science*, *352*(6282), 220–224. https://doi.org/10.1126/science.aad9713

Bruner, J. S. (1986). *Actual minds, possible worlds*. Harvard University Press.

Bubeck, P., Botzen, W. J. W., & Aerts, J. C. J. H. (2012). A review of risk perceptions and other factors that influence flood mitigation behavior. *Risk Analysis*, *32*(9), 1481–1495. https://doi.org/10.1111/j.1539-6924.2011.01783.x

Cooper, K. E., & Nisbet, E. C. (2016). Green narratives: How affective responses to media messages influence risk perceptions and policy preferences about environmental hazards. *Science Communication*, *38*(5), 626–654. https://doi.org/10.1177/1075547016666843

Dahlstrom, M. F. (2012). The persuasive influence of narrative causality: Psychological mechanism, strength in overcoming resistance, and persistence over time. *Media Psychology*, *15*(3), 303–326. https://doi.org/10.1080/15213269.2012.702604

Dahlstrom, M. F. (2014). Using narratives and storytelling to communicate science with nonexpert audiences. *Proceedings of the National Academy of Sciences*, *111*(Suppl. 4), 13614–13620. https://doi.org/10.1073/pnas.1320645111

Dillard, J. P., & Nabi, R. (2006). The persuasive influence of emotion in cancer prevention and detection messages. *Journal of Communication*, *56*(suppl_1), S123–S139. https://doi.org/10.1111/j.1460-2466.2006.00286.x

Dillard, J. P., & Seo, K. (2013). Affect and persuasion. In J. P. Dillard & L. Shen (Eds.), *The SAGE handbook of persuasion: Developments in theory and practice* (2nd ed., pp. 150–166). SAGE Publications.

Finucane, M. L., Alhakami, A., Slovic, P., & Johnson, S. M. (2000). The affect heuristic in judgments of risks and benefits. *Journal of Behavioral Decision Making*, *13*(1), 1–17. https://doi.org/10.1002/(SICI)1099-0771(200001/03)13:1<1::AID-BDM333>3.0.CO;2-S

Fischhoff, B. (1995). Risk perception and communication unplugged: Twenty years of process. *Risk Analysis*, *15*(2), 137–145. https://doi.org/10.1111/j.1539-6924.1995.tb00308.x

Green, M. C., & Brock, T. C. (2000). The role of transportation in the persuasiveness of narratives. *Journal of Personality and Social Psychology*, *79*(5), 701–721. https://doi.org/10.1037/0022-3514.79.5.701

Green, M. C., Chatham, C., & Sestir, M. A. (2012). Emotion and transportation into fact and fiction. *Scientific Study of Literature*, *2*(1), 37–59. https://doi.org/10.1075/ssol.2.1.03gre

Greenaway, T., & Fielding, K. S. (2020). Positive affective framing of information reduces risk perceptions and increases acceptance of recycled water. *Environmental Communication*, *14*(3), 391–402. https://doi.org/10.1080/17524032.2019.1680408

Grothmann, T., & Reusswig, F. (2006). People at risk of flooding: Why some residents take precautionary action while others do not. *Natural Hazards*, *38*(1-2), 101–120. https://doi.org/10.1007/s11069-005-8604-6

Harcourt, R., Bruine de Bruin, W., Dessai, S., & Taylor, A. (2020). What adaptation stories are UK newspapers telling? A narrative analysis. *Environmental Communication*, *14*(8), 1061–1078. https://doi.org/10.1080/17524032.2020.1767672

Hayes, A. F. (2018). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford Publications.

Huddy, L., Feldman, S., Taber, C., & Lahav, G. (2005). Threat, anxiety, and support of antiterrorism policies. *American Journal of Political Science*, *49*(3), 593–608. https://doi.org/10.1111/j.1540-5907.2005.00144.x

Igartua, J.-J. (2010). Identification with characters and narrative persuasion through fictional feature films. *Communications*, *35*(4), 347–373. https://doi.org/10.1515/comm.2010.019

Illari, P. M., & Williamson, J. (2012). What is a mechanism? Thinking about mechanisms *across* the sciences. *European Journal for Philosophy of Science*, *2*(1), 119–135. https://doi.org/10.1007/s13194-011-0038-2

Jones, L. (2018). *The big ones: How natural disasters have shaped us (and what we can do about them)*. Icon Books.

Kahneman, D. (2011). *Thinking fast and slow*. Farrar, Straus, and Giroux.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, *47*(2), 263–291. https://doi.org/10.2307/1914185

Kellens, W., Terpstra, T., & De Maeyer, P. (2013). Perception and communication of flood risks: A systematic review of empirical research. *Risk Analysis*, *33*(1), 24–49. https://doi.org/10.1111/j.1539-6924.2012.01844.x

Keller, C., Siegrist, M., & Gutscher, H. (2006). The role of the affect and availability heuristics in risk communication. *Risk Analysis*, *26*(3), 631–639. https://doi.org/10.1111/j.1539-6924.2006.00773.x

Kreuter, M. W., Green, M. C., Cappella, J. N., Slater, M. D., Wise, M. E., Storey, D., Clark, E. M., O'Keefe, D. J., Erwin, D. O., Holmes, K., Hinyard, L. J., Houston, T., & Woolley, S. (2007). Narrative communication in cancer prevention and control: A framework to guide research and application. *Annals of Behavioral Medicine*, *33*(3), 221–235. https://doi.org/10.1007/BF02879904

Leiserowitz, A. (2006). Climate change risk perception and policy preferences: The role of affect imagery, and values. *Climatic Change*, *77*(1-2), 45–72. https://doi.org/10.1007/s10584-006-9059-9

Lerner, J., Li, Y., Valdesolo, P., & Kassam, K. (2015). Emotion and decision making. *Annual Review of Psychology*, *66*(1), 799–823. https://doi.org/10.1146/annurev-psych-010213-115043

Lowenstein, G. F., Weber, E. U., Hsee, C. K., & Welch, N. (2001). Risk as feelings. *Psychological Bulletin*, *127*(2), 267–286. https://doi.org/10.1037/0033-2909.127.2.267

Moyer-Gusé, E., Tchernev, J. M., & Walther-Martin, W. (2019). The persuasiveness of a humorous environmental narrative combined with an explicit persuasive appeal. *Science Communication*, *41*(4), 422–441. https://doi.org/10.1177/1075547019862553

Murphy, S. T., Frank, L. B., Chatterjee, J. S., & Baezconde-Garbanati, L. (2013). Narrative versus non-narrative: The role of identification, transportation, and emotion in reducing health disparities. *Journal of Communication*, *63*(1), 116–137. https://doi.org/10.1111/jcom.12007

Nan, X., Dahlstrom, M. F., Richards, A., & Rangarajan, S. (2015). Influence of evidence type and narrative type on HPV risk perception and intention to obtain the HPV vaccine. *Health Communication*, *30*(3), 301–308. https://doi.org/10.1080/10410236.2014.888629

National Research Council. (1989). *Improving risk communication*. The National Academies Press. https://doi.org/10.17226/1189

O'Neill, S., & Nicholson-Cole, S. (2009). "Fear won't do it": Promoting positive engagement with climate change through visual and iconic representations. *Science Communication*, *30*(3), 355–379. https://doi.org/10.1177/1075547008329201

Oschatz, C., & Marker, C. (2020). Long-term persuasive effects in narrative communication research: A meta-analysis. *Journal of Communication*, *70*(4), 473–496. https://doi.org/10.1093/joc/jqaa017

Ostrom, E. (2010). Beyond markets and states: Polycentric governance of complex economic systems. *American Economic Review*, *100*(3), 641–672. https://doi.org/10.1257/aer.100.3.641

Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. *Advances in Experimental Psychology*, *19*, 123–205. https://doi.org/10.1016/S0065-2601(08)60214-2

Preacher, K. J., & Hayes, A. F. (2008). Contemporary approaches to assessing mediation in communication research. In A. F. Hayes, M. D. Slater, & L. B. Snyder (Eds.), *The Sage sourcebook of advanced data analysis methods for communication research* (pp. 43–64). Ashgate.

Rickard, L. N. (2021). Pragmatic and (or) constitutive? On the foundations of contemporary risk communication research. *Risk Analysis*, *41*(3), 466–479. https://doi.org/10.1111/risa.13415

Rickard, L. N., Yang, J. Z., Liu, V., & Boze, T. (2021). Fish tales: How narrative modality, emotion, and transportation influence support for sustainable aquaculture. *Science Communication*, *43*(2), 252–275. https://doi.org/10.1177/1075547020987555

Ruiter, R. A. C., Kessels, L. T. E., Peters, G.-J. Y., & Kok, G. (2014). Sixty years of fear appeal research: Current state of the evidence. *International Journal of Psychology*, *49*(2), 63–70. https://doi.org/10.1002/ijop.12042

Ryan, M. T., Rohrbeck, C. A., & Wirtz, P. W. (2018). The importance of self-efficacy in parental emergency preparedness: A moderated mediation model. *Disaster Medicine and Public Health Preparedness*, *12*(3), 345–351. https://doi.org/10.1017/dmp.2017.80

Sestir, M., & Green, M. C. (2010). You are who you watch: Identification and transportation effects on temporary self-concept. *Social Influence*, *5*(4), 272–288. https://doi.org/10.1080/15534510.2010.490672

Shanahan, E. A., Jones, M. D., & McBeth, M. K. (2018a). How to conduct a Narrative Policy Framework study. *The Social Science Journal*, *55*(3), 332–345. https://doi.org/10.1016/j.soscij.2017.12.002

Shanahan, E. A., Jones, M. D., McBeth, M. K., & Lane, R. R. (2013). An angel on the wind: How heroic policy narratives shape policy realities. *Policy Studies Journal*, *41*(3), 453–483. https://doi.org/10.1111/psj.12025

Shanahan, E. A., Jones, M. D., McBeth, M. K., & Radaelli, C. (2018b). The narrative policy framework. In C. M. Weible & P. A. Sabatier (Eds.), *Theories of the policy process* (4th ed., pp. 173–213). Westview Press.

Shanahan, E. A., Reinhold, A. M., Raile, E. D., Poole, G. C., Ready, R. C., Izurieta, C., McEvoy, J., Bergmann, N. T., & King, H. (2019). Characters matter: How narratives shape affective responses to risk communication. *PLOS ONE*, *14*(12), e0225968. https://doi.org/10.1371/journal.pone.0225968

Sherif, M., & Hovland, C. I. (1961). *Social judgment: Assimilation and contrast effects in communication and attitude change*. Yale University Press.

Skagerlund, K., Forsblad, M., Slovic, P., & Västfjäll, D. (2020). The affect heuristic and risk perception – Stability across elicitation methods and individual cognitive abilities. *Frontiers in Psychology*, *11*. https://doi.org/10.3389/fpsyg.2020.00970

Slovic, P. (Ed.). (2010). *The feeling of risk: New perspectives on risk perception*. Earthscan Publications.

Slovic, P., Finucane, M. L., Peters, E., & MacGregor, D. G. (2004). Risk as analysis and risk as feelings: Some thoughts about affect, reason, risk, and rationality. *Risk Analysis*, *24*(2), 311–322. https://doi.org/10.1111/j.0272-4332.2004.00433.x

Wachinger, G., Renn, O., Begg, C., & Kuhlicke, C. (2013). The risk perception paradox—Implications for governance and communication of natural hazards. *Risk Analysis*, *33*(6), 1049–1065. https://doi.org/10.1111/j.1539-6924.2012.01942.x

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales.. *Journal of Personality and Social Psychology*, *54*(6), 1063–1070. https://doi.org/10.1037/0022-3514.54.6.1063

Wolff, K., Larsen, S., & Øgaard, T. (2019). How to define and measure risk perceptions. *Annals of Tourism Research*, *79*, 102759. https://doi.org/10.1016/j.annals.2019.102759

Wright, S. (2016). "Ah … the power of mothers": bereaved mothers as victim-heroes in media enacted crusades for justice. *Crime, Media, Culture*, *12*(3), 327–343. https://doi.org/10.1177/1741659015623597