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"If worse comes to worst, my neighbors come first": social identity as a collective resilience factor in areas threatened by sea floods

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Abstract

Research on collective resilience processes still lacks a detailed understanding of psychological mechanisms at work when groups cope with adverse conditions, i.e., long-term processes, and how such mechanisms affect physical and mental well-being. As collective resilience will play a crucial part in facing looming climate change-related events such as floods, it is important to investigate these processes further. To this end, this study takes a novel holistic approach by combining resilience research, social psychology, and an archeological perspective to investigate the role of social identity as a collective resilience factor in the past and present. We hypothesize that social identification buffers against the negative effects of environmental threats in participants, which increases somatic symptoms related to stress, in a North Sea region historically prone to floods. A cross-sectional study ($N = 182$) was conducted to analyze the moderating effects of social identification on the relations between perceived threat of North Sea floods and both well-being and life satisfaction. The results support our hypothesis that social identification attenuates the relationship between threat perception and well-being, such that the relation is weaker for more strongly identified individuals. Contrary to our expectations, we did not find this buffering effect to be present for life satisfaction. Future resilience studies should further explore social identity as a resilience factor and how it operates in reducing environmental stress put on individuals and groups. Further, to help communities living in flood-prone areas better cope with future environmental stress, we recommend implementing interventions strengthening their social identities and hence collective resilience.

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Introduction

Floods are stressful events for any affected population and threaten the very fabric of their shared existence. They cause distress on the individual and collective levels and therefore harm people's and group's physical and mental well-being. Considering the intensification of future devastating climate change-related flood events (CRED and UNDRR 2020), there is some urgency in gaining comprehensive knowledge of collective resilience factors facilitating a population's physical and mental well-being, and in turn, the willingness to stay in flood-prone areas. For example, Ntontis et al. (2019) and Drury (2018) investigated social identification as a factor helping the group to counter negative effects of stress by focusing on the psychological and behavioral processes of individuals in the aftermath of a flood. However, relying mainly on individual accounts of group performance *after* such emergency events took place, provides an unbalanced assessment of social identity as a collective resilience factor. Therefore, exploring collective resilience from different temporal perspectives provides a more nuanced picture of how the process is shaped by operating resilience factors. Subsequently, we contribute to the growing collective resilience literature by focusing on the group level via a social identity approach.

To this end, we aim to investigate social identification as a collective resilience factor in a flood-prone coastal area in Germany (East Frisia), during a time of no acute threat of flooding and combine the findings with archeological evidence from the same area. The knowledge we gain from such a combined "past and present perspective" can strengthen future responses to climate change-related events, because not all populations have the means (e.g., economically) or willingness (e.g., culturally) to relocate. For example, in medieval times, floods would unquestionably have had detrimental psychological outcomes on an already deprived population (Brown 2021). However, past populations endured in East Frisia for centuries and demonstrated their ability to cope, to adapt and to implement technical solutions to secure their survival and well-being. Hence, by examining well-being and life satisfaction in relation to the social identity theory as resilience outcomes in the past and present, we contribute to psychological research directed at possible flood-related mental health issues such as anxiety, post-traumatic stress disorder (PTSD), depression, and most relevant to our study, a "decreased sense of self and identity from loss of place and grief reactions" (Palinkas and Wong 2020, p. 12).

Theoretical background

Theoretical and conceptual framework

As shown in Fig. 1, we connect the concept of collective resilience to well-being and life satisfaction via the social identity theory (Jetten et al. 2012; Tajfel and Turner 1979; Turner et al. 1987). Here, the social identity theory acts as a merger in the resilience process by shaping collective cognition and action (Turner 2010). Social identification has previously been found to increase the well-being of the group and its members (Jetten et al. 2012) and is linked to mechanisms relating to
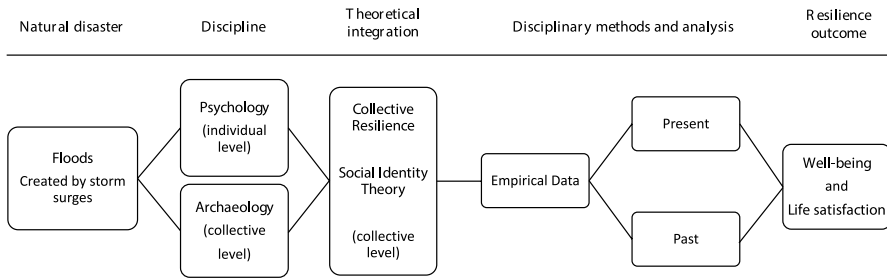
Fig. 1 An interdisciplinary theoretical and conceptual model for collective flood resilience

group maintenance (Molenaar et al. 2021). However, it has yet to be corroborated more thoroughly as a *collective* resilience factor. Archeology, on the other hand, adds a bird's eye perspective on long-term social developments. There is archeological evidence for strategies of collectively navigating the stressor of floods by adapting settlement structures to the given environmental situation and the needs of the group. For example Swierczynski et al. (2013) report on changes in Neolithic settlements, located at the Mondsee in the Alps. There, inhabitants collectively changed their settlement pattern from "dwellings on the wetlands […] to constructing lake dwellings on piles upon the water" in order to cope with increased flood risk from the lake around 5400–4700 cal. yr. BP (Swierczynski et al. 2013, p. 1610). Hence, archeology fuses well with the social identity theory and collective resilience processes which are assessed using each discipline's methods of analysis. Concerning psychology, the present research incorporates empirically collected survey data from a population potentially affected by floods. Regarding archeology, material findings from excavations are contextually interpreted based on theoretical concepts, i.e., social identity and collective resilience. We accomplish a present no-threat and past perspective on collective flood resilience by focusing the psychological data and archeological evidence on well-being and life satisfaction as the outcome of a collective resilience process.

Collective resilience

Resilience at an individual or collective level is a wide-ranging topic and its definitions heavily depend on the context and stressors studied (Southwick et al. 2014). Broadly speaking, resilience at the individual level can be defined as a "capacity and dynamic process of adaptively overcoming stress and adversity while maintaining normal psychological and physical functioning" (Wu et al. 2013, p. 1). Moreover, research has looked at resilience factors, which help the individual counter harmful effects of stress and thus increase well-being (Diehl et al. 2012). However, in the last decade, researchers have realized that focusing on the individual level alone misses the processes and factors that help groups demonstrate resilience after being exposed to stressors, e.g., natural disasters. Therefore, recent resilience literature has prioritized the collective levels (see Drury et al. 2009; Lyons et al. 2016; Norris et al. 2008). Similar to individual resilience, collective resilience definitions center

on how communities deal with adverse conditions by overcoming them with a positive outcome of either returning to *status ante* or achieving an even better condition than prior to the negative event (Lyons et al. 2016; Southwick et al. 2014).

Resilience and well-being are two inseparable concepts (Harms et al. 2018). A recent study on twins and siblings argues for a strong correlation between well-being and resilience, with both having "some causal effects on each other" (de Vries et al. 2021, p. 11). Moreover, de Vries et al. (2021) found that this relationship is determined equally by genetic and environmental factors. Hu et al. (2015) highlight the necessity to measure the positive as well as negative indicators of mental health since both have a significant impact on the resilience process. Therefore, it is critical to measure negative aspects of well-being (physical complaints) and positive aspects of well-being (life satisfaction) as resilience outcomes. Furthermore, several collective resilience factors relevant to overcoming natural disasters and well-being include social support (Kaniasty 2012; Kaniasty and Norris 2008; Masson et al. 2019; Norris et al. 2008), collective efficacy (Benight 2004; Norris et al. 2008), and community cohesion (Hetherington et al. 2018; Kaniasty 2012).

Appraisal-coping processes also influence how individuals and groups deal with stressors and the extent to which this negatively affects their well-being (Jetten et al. 2012; Lazarus and Folkman 1984). Having experienced a flood will result in a sense-making process by which the individuals and groups appraise "causes, danger and future threat" (Biggs et al. 2017; Rochford and Blocker 1991, p. 176). Especially the "primary appraisal determines the meaning and significance of a transaction to wellbeing" (Biggs et al. 2017, p. 353). In this sense-making process, individuals and groups can appraise a flood event as a stressor, and if those affected think of it as a threatening or harmful event then negative emotions associated with threat and harm can have negative effects on well-being (Biggs et al. 2017; Rochford and Blocker 1991; Tapsell and Tunstall 2008). Therefore, we hypothesized that threat perception in relation to floods is a key stressor for people living in flood-prone areas and this is likely to have a negative effect on well-being and life satisfaction, hence we predict:

Hypothesis 1 The perception of threat (by floods) in present-day inhabitants of Krummhörn is related to their levels of (a) well-being and (b) life satisfaction.

The social identity approach

The social identity approach encapsulates all the positive and negative effects group memberships can have on the individuals' sense of self that arises from their membership within these groups (Jetten et al. 2012). This approach is based on the social identity theory by Tajfel and Turner (1979) and self-categorization theory by Turner et al. (1987). While Tajfel and Turner (1979) investigated intergroup relations and how belonging to a group shapes the sense of self and perception of other groups, there has recently been a turn toward the positive effects group memberships have on the well-being of the individual.

The physical and mental health benefits of social identification, also known as the *social cure effect*, are now a main focus of social identity research (Haslam et al.

2018; Jetten et al. 2012). For social identification to have a positive effect on physical and mental well-being, groups must be valuable to the individual, and a "sense of sharing" that social identity (Häusser et al. 2012, p. 973) needs to be salient (DeMarco and Newheiser 2019). Moreover, research shows that social identification relates to better physical and mental health via the resilience factors of social support and collective efficacy (Avanzi et al. 2015, 2018a, b; Junker et al. 2019).

The underlying mechanisms of the *social cure effect* are as follows: with higher social identification (a) group members get more social support (Frisch et al. 2014) and (b) develop a stronger "sense of collective self-efficacy" (Van Dick et al. 2017, p. 2) which is associated with high group esteem (DeMarco and Newheiser 2019). In addition, social identification is then able to satisfy psychological needs (Greenaway et al. 2016) such as the need for certainty or belonging (Van Dick et al. 2017) and successfully reduces negative effects of stress in response to threat by decreasing cortisol levels (Häusser et al. 2012), cardiovascular responses to stress (Gallagher et al. 2014), depression (Cruwys et al. 2014), and burnout symptoms (Steffens et al. 2014).

Recent work on mass emergencies and community resilience linked to natural disasters highlights the importance of a *shared social identity* in explaining the rapid growth of cohesion and solidarity in emergency situations such as floods (Drury et al. 2019). Emanating from "shared self-categorization" (Williams and Drury 2009, p. 295), s*hared social identities* are created by individuals recognizing the common fate of all group members involved, i.e., neighbors or the whole village (Williams and Drury 2009). Hence, on the group level, s*hared social identity* fosters "cognitive, relational and emotional transformations which allow people to co-act effectively and thereby constitute a source of social power" (Reicher et al. 2018, p. 29) and motivates collective action (De Weerd and Klandermans 1999). Williams and Drury (2009) established the term *collective psychosocial resilience* to describe the resilience process of people acting as a group in emergency situations. It is assumed that "collective reactions to emergencies and disasters are more typically resilient" (Williams and Drury 2009, p. 294), as instead of panic and chaos exhibited only by very few individuals, it is cohesion, solidarity, and social support that make up the group's response to adversity (Drury et al. 2019).

The mechanism that helps groups to exhibit collective resilience can also be traced back to group appraisal-coping processes and the extent to which a stressor negatively affects collective well-being (see Häusser et al. 2020). However, as noted before, social identification has been found to buffer against negative effects of stress by positively influencing appraisal-coping mechanism on the group level (Jetten et al. 2012), and thus we predict:

Hypothesis 2 Social identification moderates the relations between threat perception and (a) well-being and (b) life satisfaction, such that highly identified residents will be less negatively affected by perceptions of threat.

Background of the study area

Our specific research area Krummhörn is located in the south-eastern region of the North Sea coast in Germany, also known as East Frisia. Krummhörn is located in the *Wadden Sea* landscape comprising marshlands, geest, and peat bogs which are shaped by the tidal nature of the North Sea. Moreover, its location at a mean sea level of 0 means the area is exposed to North Sea storm surges as no natural elevation exists. Consequently, when storm surges approach Krummhörn's coastline they flood the surrounding landscape with ease if no protection such as dykes exists. The National Oceanic and Atmospheric Administration defines a storm surge as "the abnormal rise in seawater level during a storm, measured as the height of the water above the normal predicted astronomical tide" (NOAA 2020) and depending on "the orientation of the coastline with the storm track; the intensity, size, and speed of the storm", they can be a very destructive and deadly natural event (NOAA 2020).

Such a special and dynamic landscape also shapes the local ways of life eternally, with Brinckerhoff Jackson (1984, p. 8) noting:

> Landscape is not a natural feature of the environment but a synthetic space, a man-made system of spaces superimposed on the face of the land, functioning and evolving not according to the natural laws but to serve a community - for the collective character of the landscape is one thing that all generations and all points of view have agreed upon. […] A landscape is thus a space deliberately created to speed up or slow down the process of nature.

His thoughts convey similar ideas to those expressed by social ecologists, who propose that "our thinking, feeling and behaviors are influenced by our ecologies, and that our ecologies are shaped in part by our thinking, feeling and behaviors" (Uskul and Oishi 2020, p. 181). Thus, Krummhörn is a place made up of a harsh physical environment, shaping peoples' coping behaviors over centuries and ensuring the continued existence of the population.

Archeology of the study area: theoretical integration and analysis

In addition to our empirical study of present Krummhörn inhabitants, we are especially interested in how past populations coped with storm surges and floods, the tidal nature of the North Sea, and the wet, cold, and stormy weather characteristic of this coast. One feature of the region standing out is the specific type of village settlement pattern known as *Terp*. This type of settlement also exists along the coastline of North Frisia, Groningen, and other regions in the Netherlands bordering the North Sea. From archeological excavations of Krummhörn *Terps*, we know that the construction of these settlements in East Frisia started around 100 BC and ended with the beginning of dyke construction in 1000 AD (Erickson 2018). *Terps* are artificially erected dwelling mounds of an oval to round or long shape (Erickson 2018). The different generations living on these *Terps* accumulated waste materials such as household rubbish, manure, and soil over hundreds of years to increase the elevation of their settlement in order to protect inhabitants from floods. The

Terps in Krummhörn have a height between one and six meters above mean sea level (Nicolay 2014) and are located between one and five kilometers away from the dyke. However, considering the potential intensity of some storm surges and resulting floods, the elevation of the Krummhörn *Terps* are not very high. Moreover, as populations grew over time, these settlements became very densely populated areas as more dwellings were built on top of the *Terps.* This, in turn, might have increased the vulnerability of the population. Therefore, the environmental and social situation at the time of *Terp* building as well as the circumstances during dyke building required resilient collective action from the residents.

Furthermore, the archeological record holds information about the health conditions of individuals living on *Terps*. The cold and wet living conditions in East Frisia were generally tough in the past and the population suffered from heavy physical stress and chronic protein and vitamin deficiency, accompanied by an accumulation of life-threatening cases of mastoiditis and otitis, which are complicated ear infections and inflammations (Bärenfänger 2006; Burkhardt 1998, 2009). Human skeletal remains from the 12th to the sixteenth century AD from Krummhörn and its neighboring regions show traces of different phases of acute malignant otitis externa, an ear infection affecting the "skull base" and "external ear" in such way that the bones become necrotic (Carfrae and Kesser 2008). For example, during excavations in the church of the *Terp* village Rysum, also one of our surveyed villages, archeologists discovered a sixteenth century burial of an eight-year-old girl in the church choir. She was buried without grave goods and her skeletal remains revealed that she was not able to survive the acute ear infection which had already spread to her brain and damaged her skull bones. The slow process of such an infection, which is accompanied by severe pain, can put additional mental health stress not only on the affected individual but also the whole group who has to witness and endure the suffering of others (Burkhardt 1998, 2009).

Hence, *Terp* building might also be an expression of the groups' willingness to stay in such a harsh environment by moving closer together. This gain in extreme closeness among group members is likely to have increased the populations' collective resilience, because it may have helped create a *shared social identity* (group level) leading to collective action (*Terp* building) which, in turn, promoted further physical and mental well-being on the individual and group level. Therefore, we believe that *Terps* are a local feature of the Krummhörn landscape which demonstrate how a *shared social identity* fostered collective action-taking as well as collective resilience among the residents in recurring emergency situations and beyond. It helped the affected population to resist the threats from floods and endure poor living conditions while simultaneously enabling them to continue living in this region. Henceforth, *shared social identity* and its associated cognitive processes (see Williams and Drury 2009, p. 295 on "shared self-categorization") provide a basis for conceptualizing social identity as a potential collective resilience factor.

Empirical study

Methods and materials

Procedure

Recruiting participants from very rural areas is a challenging undertaking as most communities live a segregated way of life. In addition, as there is no good broadband connection in the Krummhörn area, we decided to use a paper and pencil survey method. The study was announced in the local newspaper and the Mayor of the Krummhörn region informed the heads of the villages on our behalf. These heads supported the first author in distributing questionnaires in each of the 19 villages. The questionnaires could be answered alone, as each questionnaire was in a sealed envelope, including a paid return envelope for an easy return to Frankfurt Goethe University. To get closer to random sampling, the author herself went to Krummhörn for a weekend and randomly rang doorbells in each village in order to get in touch with the people, promote the study and distribute 27 more questionnaires. Due to health issues, questionnaires could not be distributed in one village. Importantly, 17 of the 18 participating villages were *Terps*.

In the questionnaire, participants were first informed about the study and then presented with one of the three experimental threat perception conditions. The remaining measures were answered by all participants after the threat perception manipulation. At the end of the questionnaire, participants were informed about the experiment.

Participants

Out of 723 questionnaires sent, 202 residents of Krummhörn participated in this study and filled out an anonymous paper and pencil survey. Our inclusion criteria for the study meant we had to exclude twenty participants as they gave incomplete answers on the measures of the independent and dependent variables, including the variables age and gender. Accordingly, the final sample for statistical analysis includes 182 residents (33.5% women; $M_{age}=57.03$, $SD=16.72$). Due to additional missing values in the demographic section, the following results are based on a sample including 176 residents (33.5% women; $M_{age}=57.08$, $SD=17.00$). The majority of participants (62%, $n = 176$) can trace their ancestry in Krummhörn back three or more generations and 99% have German citizenship. There was only one person with an immigration background in our sample. Fifteen percent of participants ($n = 176$) reported having received degrees at institutions of higher education, 38% completet vocational training, 22% completed Higher Secondary Education (6 years of secondary school), followed by 16% completing Lower Secondary Education (4 years of secondary school). The remaining 9% of participants either completed Gymnasium (8 years of secondary school) or did not complete school. We also asked whether participants would have the financial means to leave Krummhörn and live somewhere else. Out of those who responded ($n=176$), the majority

(72%) answered positively, which means that financial issues are not the main reason to remain in Krummhörn. When asked if they had ever considered moving away, the majority (80%, $n=176$) answered with no. Moreover, the majority (95%) of participants do not have a second place of residence outside of the Krummhörn region, however, 38% of our participants have jobs in neighboring regions or commute further away. On average, participants ($n=176$) live 6.02 km ($SD=3.82$) away from the dyke.

Design

Participants were randomly assigned to one of three experimental conditions of a between-subjects design. The random assignment was assured by stacking the paper and pencil survey in such way, following the order of condition one (high threat), condition two (medium threat) and condition three (control group), condition one (high threat), condition two (medium threat) and continuing. When handing out the questionnaires each participant received a copy (in a sealed envelope) that was on top of the stack.

All experimental conditions manipulated threat perception (independent variable) in order to explore its effect on well-being (dependent variable) and life satisfaction (dependent variable). Three short texts of about 200 words each were presented at the beginning of the questionnaire and included a high threat manipulation, a medium threat manipulation, or a control condition. In the high threat condition ($n=66$), participants were informed about climate change and future rise in North Sea levels, resulting in more destructive North Sea floods. The medium threat condition ($n=61$) was a summary about the soil quality of the Krummhörn region. The control condition ($n=55$) informed participants about the thirteenth century church architecture of Krummhörn. The reading task was followed by the manipulation check in which three questions assessed threat perception (see Measures). The moderating variable was social identification and gender (male and female) was controlled for as a possible extraneous variable that might have an influence on the independent variables.

Measures

An overview of all measures is shown in Table 1, also briefly explaining the connection between stress, well-being and resilience.

Threat perception

We developed three items to assess flood risk perception based on the survey of De Dominicis et al. (2015). Specifically, using a 6-point Likert scale (1=*very low risk* to 6=*very high risk*), participants were asked to rate how high they perceived the risk that: "Your residence will be affected by a flood", "Your residence will be affected by a flood within the next 12 months", and "Your house will be affected by a flood within the next 12 months". Cronbach's α was 0.70.

Table 1 List of items measuring constructs related to stress, resilience, well-being, and social identification

Construct (unobservable variable)	Observed measures	Likert scale range
Flood-risk perception (Rating the risk of likelihood of future floods, stress-related)	"Your residence will be affected by a flood." "Your residence will be affected by a flood within the next 12 months." "Your house will be affected by a flood within the next 12 months."	1 = Very low risk to 6 = very high risk
Well-being (Rating the frequency of somatic symptoms, stress-related)	"Stomach pains" "Feeling of weakness" "Headaches" "Palpitation of the heart" "Dizziness" "Feeling of faintness" "Heartburn"	1 = Rarely to 6 = very often
Life satisfaction (Agreeing with statements about satisfaction with life, related to well-being, stress and resilience)	"In most ways my life is close to my ideal." "The conditions of my life are excellent." "I am satisfied with my life." "So far I have gotten the important things I want in my life." "If I could live my life over, I would change almost nothing."	1 = Disagree strongly to 6 = agree strongly
Social identity (Agreeing with statements about identification with others, well-being and resilience related)	"I identify with my fellow villagers." "I am glad to live in my village." "I feel strong ties with my fellow villagers."	1 = Disagree strongly to 6 = agree strongly

Well-being

Well-being was measured with the *Gießener Beschwerdebogen* (Brähler and Scheer 1983; Van Dick et al. 1999), a 7-item health complaints scale developed in Germany to measure somatic symptoms related to stress. Participants were asked about the frequency of health complaints on a 6-point Likert scale (1 = *rarely* to 6 = *very often*). Health complaints included problems such as "stomach pains", "palpitation of the heart" and "heartburn". The items for ill-health were inverted in order to account for well-being. Altogether, Cronbach's α is 0.73 for this study.

Life satisfaction

Life satisfaction was measured with the 5 item "Satisfaction with life scale (SWLS)" by Diener et al. (1985), translated by Janke and Glöckner-Rist (2012). It asks participants to assess their current life situation on a 6-point Likert scale by specifying whether they 1 = *disagree strongly* to 6 = *agree strongly*. Sample items are "In most ways my life is close to my ideal." and "I am satisfied with my life". The scale yielded a Cronbach's α of 0.91.

Social identification

Social Identification was measured with 3 items based on the 4 item scale of Doosje et al. (1995), translated by Van Dick (2004). On a 6-point Likert scale (1 = *disagree strongly* to 6 = *agree strongly*), participants assessed how much they agree with the following statements: "I identify with my fellow villagers", "I am glad to live in my village" and "I feel strong ties with my fellow villagers". Cronbach's α was 0.87.

Results

Preparation

All statistical analyses and graphs were done using R 4.0.3 (R Core Team 2020), including the packages psych (Revelle 2019), hash (Brown 2019), car (Fox and Weisberg 2019), dplyr (Wickham et al. 2020), rmisc (Hope 2013) and interactions (Long 2019). Using the package boot.pval (Thulin 2021) residuals were bootstrapped with a 95% confidence interval and 5000 iterations.

The data was screened for the requirements of the regression analysis and one-way ANOVA analysis, yielding acceptable results. No outliers were detected and participants with missing values were removed from the analyses. For accuracy of the computation, all predictor and criterion variables were centered to counter interpretation and multicollinearity issues (Aiken and West 1991; Dardas and Ahmad 2015; Hayes 2017). Multicollinearity between the criterion variables was not a problem. The variance inflation factor (VIF) for the criterion variables in the final regression models for both predictor variables were all below 1.13, with a VIF of 1

indicating no multicollinearity present. Moreover, for all variables we averaged the Likert scale values to proceed with the regression analysis.

The data file and questionnaires used to analyze the current study are available from the OSF repository (https://osf.io/vu47y/).

Manipulation check

Contrary to initial expectations, the ANOVA revealed no significant differences in threat perception ($F(2, 725)=0.20$, $p=0.82$) between the high threat condition ($n=66$, $M=4.35$, $SD=0.53$), the medium threat condition ($n=61$, $M=4.32$, $SD=0.59$) and the control condition ($n=55$, $M=4.29$, $SD=0.52$) (also see Table 2). As a result, we combined the three conditions into one single variable with which we then calculate threat perception in our regression models. Therefore, our hierarchical regression analyses only used the averaged Likert scales measuring threat perception, social identification, life satisfaction, and well-being to examine our hypotheses.

Correlations

Table 3 shows the intercorrelations, means, standard deviations, and reliabilities for all variables. The correlations were computed using the Spearman correlation method to meet the assumptions for correlation testing. As expected, results show a negative correlation between our independent and dependent variables, which is supported by threat perception being negatively associated with well-being ($r_s = -0.08$, $p=0.27$) and life satisfaction ($r_s = -0.09$, $p=0.24$). However, the relationship between threat perception and well-being as well as life satisfaction is not very strong which supports our assumption of contingency factors influencing the relations.

Social identification is positively and significantly related to life satisfaction ($r_s=0.47$, $p<0.01$), indicating a strong relationship which shows that individuals with high levels of life satisfaction also highly identify with their group. It also supports the robust finding that groups are good for individuals and that life satisfaction is related to our social lifestyle (Jetten et al. 2012).

However, contrary to our expectations, social identification is negatively ($r_s = -0.07$, $p=0.38$) but not significantly related to well-being (physical health). Hence, one can again only cautiously presume that high levels of social identification is connected to low levels of well-being as groups improve our overall well-being, which in turn might also relate to better physical conditions (Jetten et al.

Table 2 Descriptive statistics experimental conditions of manipulation check

Experimental condition		n	Mean	SD
High threat	Climate change	66	4.35	0.53
Medium threat:	Soil quality	61	4.32	0.59
Control condition:	Church architecture	55	4.29	0.52

Table 3 Descriptive statistics and correlation matrix for all variables ($N = 182$)

	Mean	SD	1	2	3	4
Gender						
Female ($n = 61$)						
Male ($n = 121$)						
Age	57.03	16.72				
Female ($n = 61$)	54.90	15.34				
Male ($n = 121$)	58.11	17.33				
Intercorrelations						
1. Life satisfaction	4.65	0.99	(0.91)			
2. Social identification	4.72	1.15	0.47**	(0.87)		
3. Threat perception	2.02	0.93	− 0.09	− 0.08	(0.70)	
4. Well-being	4.90	0.82	0.21**	− 0.07	− 0.08	(0.73)

Reliabilities (Cronbach's α) shown in parentheses along the diagonal. Significant correlations

$**p < 0.01$

$*p < 0.05$

2012). The relationship between social identification and threat perception is negative ($r_s = -0.08$, $p = 0.26$), but not significant. Finally, the dependent variables well-being and life satisfaction have a positive and significant association ($r_s = 0.21$, $p < 0.01$), which seems reasonable as being more satisfied with ones' life is likely to also be related to ones' physical and mental well-being.

Moderation analysis

Hierarchical regression analyses were performed to predict well-being from threat perception as well as social identification and life satisfaction of Krummhörn inhabitants and to show how exactly our model changes with respect to the coefficients. In addition, we controlled for age and gender by holding them constant in the hierarchical regression analyses. Controlling for age and gender removes their potential effect on the relationships between threat perception and well-being as well as life satisfaction, and the moderating effect of social identification of that relationship. For example, age could influence the relationship between threat perception and well-being as well as life satisfaction, because older individuals are generally more satisfied with their lives and seem to have higher levels of well-being (Baird et al. 2010). Also, older participants in our study are more likely to have experienced floods and therefore might feel less threatened. Further, gender differences could also be expected as numerous studies report gendered differences in risk perception related to floods (Lechowska 2018). Moreover, we tested if the effect of threat perception on well-being and life satisfaction was moderated by the inhabitant's social identification.

In order to test the robustness of our regression models, we used the bootstrapping method; the scaled and centered residuals were bootstrapped with a 95% confidence interval and 5000 iterations to estimate the $\widehat{\beta^*}$ coefficient.

Regression model with social identification as moderator and well-being as criterion

First, age ($\beta = -0.12$, $t(179) = -1.68$, $p = 0.09$) and gender ($\beta = 0.20$, $t(179) = 1.25$, $p = 0.21$) were added to the regression model (see Table 4). Overall, this model was not significant, therefore age and gender do not predict well-being in Krummhörn inhabitants ($F(2,179) = 2.01$, $p = 0.14$, $R^2 = 0.02$). After bootstrapping this model, the beta coefficient did not change for age ($\widehat{\beta^*} = -0.12$, 95% CI [$-0.27$, 0.02], $p = 0.09$). Gender remained similarly unchanged ($\widehat{\beta^*} = 0.20$, 95% CI [-0.11, 0.50], $p = 0.20$). Second, after controlling for age and gender, threat perception ($\beta = -0.20$, $t(178) = -2.72$, $p < 0.01$) was added to the model. There was a significant increase in explained variance ($F(1,178) = 7.42$, $p < 0.01$, $\Delta R^2 = 0.04^{**}$). Hence, participants with high levels of threat perception show lower levels of well-being. Bootstrapping this model revealed no changes for threat perception ($\widehat{\beta^*} = 0.20$, 95% CI [$-0.35, -0.06$], $p < 0.01$). Including social identity ($\beta = -0.01$, $t(177) = -0.14$, $p = 0.89$) as a predictor of well-being in the third step was not significant ($F(1,177) = 0.02$, $p = 0.89$, $\Delta R^2 = 0$). The bootstrapped model again indicates almost identical coefficients for this step ($\widehat{\beta^*} = -0.01$, 95% CI [$-0.15$, 0.13], $p = 0.88$). Fourth, the interaction term of threat perception and social identification ($\beta = 0.19$, $t(176) = 3.25$, $p < 0.01$) was added to the model. The addition of the interaction term returned a significant result when comparing models ($F(1,176) = 10.57$, $p < 0.01$, $\Delta R^2 = 0.05^{**}$). This significant interaction term with a negative beta coefficient, confirmed the expected moderation, such that highly identified people were less negatively affected by perceptions of threat, which in turn results in high levels

Table 4 Hierarchical regression analysis predicting well-being and life satisfaction	Well-being		Life satisfaction	
	ΔR^2	β	ΔR^2	β
Predictor				
Step 1	0.02		0.01	
Control variables				
Age		-0.12		0.10
Gender		0.20		0.12
Step 2	0.04**		0.01	
Threat		-0.20^{**}		-0.09
Step 3	0		0.29**	
Social identity		-0.01		0.55**
Step 4	0.05**		0.01	
Threat x				
Social identity		0.19**		0.08
Total R^2	0.11**		0.31**	
N	182		182	

$^{**}p < 0.01$

$^{*}p < 0.05$

of well-being (see Fig. 2). Bootstrapping this model yields the same results ($\hat{\beta}^*$ $=0.19$, 95% CI [0.08, 0.30], $p<0.001$).

Regression model with social identification as moderator and life satisfaction as criterion

Age ($\beta=0.10$, $t(179)=1.28$, $p=0.20$) and gender ($\beta=0.12$, $t(179)=0.76$, $p=0.45$) were added to the regression model (see Table 4). This model was not significant ($F(2,179)=1.21$, $p=0.30$, $R^2=0.01$), therefore age and gender also do not predict life satisfaction. Bootstrapping this model confirms the results for age ($\hat{\beta}^*$ $=0.10$, 95% CI [-0.05, 0.24], $p=0.21$) and gender ($\hat{\beta}^*=0.12$, 95% CI [-0.18, 0.43], $p=0.44$). Second, after controlling for age and gender, threat perception ($\beta=-0.09$, $t(178)=-1.19$, $p=0.24$) was added to the model, but was not significant ($F(1,178)=1.40$, $p=0.24$, $\Delta R^2=0.01$). Therefore, threat perception has no predictive value for life satisfaction. Again, bootstrapping this model does not change the results substantially ($\hat{\beta}^*=-0.09$, 95% CI [-0.25, 0.05], $p=0.23$). Third, social identification ($\beta=0.55$, $t(177)=8.59$, $p<0.001$) was added to the model and associated with a significant increase in explained variance ($F(1,177)=73.73$, $p<0.001$, $\Delta R^2=0.29^{***}$). Thus, participants with high levels of social identification have higher levels of life satisfaction. Bootstrapping this model also revealed no change of coefficients ($\hat{\beta}^*=0.55$, 95% CI [0.42, 0.67], $p<0.001$). Fourth, the interaction term of threat perception and social identity ($\beta=0.08$, $t(176)=1.59$, $p=0.12$) was added to the model, but was not significant ($F(1,176)=2.51$, $p=0.11$, $\Delta R^2=0.01$).
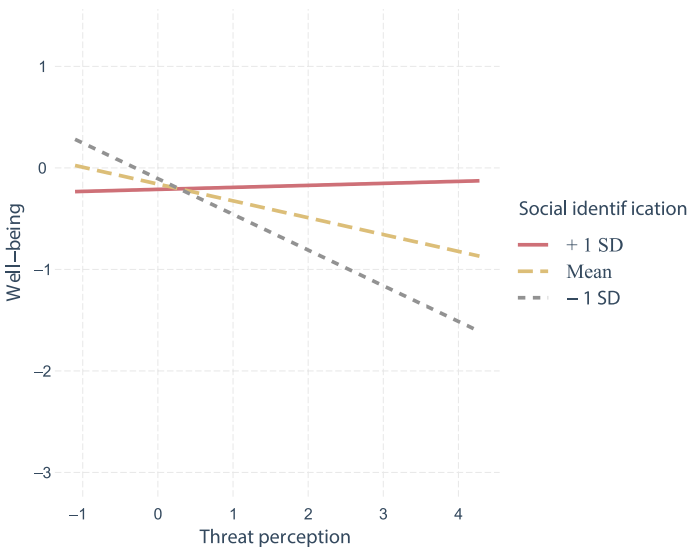
Fig. 2 Interaction plot for social identification. Simple slope results for low social identification (-1 SD) are $\beta=-0.35$, $SE=0.09$, $p=0.00$; For mean of social identification $\beta=-0.17$, $SE=0.07$, $p=0.03$; For high social identification ($+1$ SD) simple slope results are: $\beta=0.02$, $SE=0.10$, $p=0.85$

Therefore, contrary to our expectations, no moderation effect of social identification was found regarding the relationship of threat perception and life satisfaction. Finally, bootstrapping confirms the results of this model ($\widehat{\beta}\text{*}=0.08$, 95% CI [−0.02, 0.19], $p=0.11$).

Discussion

This study aimed at furthering the understanding of collective resilience processes related to populations living in flood-prone areas such as Krummhörn. Of specific interest was to explore the role of social identification in collective resilience processes and how it contributes to the physical and mental well-being in areas threatened by sea floods. With respect to our first hypothesis, the results of our empirical study show that threat perception is negatively and insignificantly correlated with well-being and life satisfaction. However, the moderation analysis based on our second hypothesis demonstrates that the aforementioned relationship is contingent on the level of participants' social identification. High levels of social identification strengthen populations in flood-prone areas by reducing threat perception and hence increase well-being. Moreover, highly identified participants seem less negatively affected by the continuous threat of floods than those who are weakly identified.

The findings of our study are in accordance with previous research on the *social cure effect*, verifying that social identification improves physical and mental well-being. However, contrary to our predictions, we did not find that social identification moderated the relationship of threat perception and life satisfaction, although social identification and life satisfaction are significantly correlated. This result, on the other hand, is not surprising as social identification fosters physical and mental well-being, which in turn, should then have positive effects on life satisfaction (see Jetten et al. 2012). Taken together, our results demonstrate that social identification is critical to collective resilience as it is the very fabric shaping every group's shared existence.

Interestingly, we observe that people in Krummhörn are well aware of the risk of being flooded, which might be related to the fact that participants live approximately 6 km away from the main dyke. This finding is evidenced by the results of our manipulation check, assessing the effectiveness of our experimental design. As can be seen in Table 2, the mean score of each experimental condition is relatively high with regard to the Likert scale value range. Participants have answered the manipulation check questions with an approximate average of 4, which translates to perceiving a possible flood in the present and the near future as a "relatively high" risk of happening. Hence, given that inhabitants of this area are conscious of the risk, the worst-case scenario for such populations would then be growing inner conflict, deepening their mental and physical health problems, which in turn would have compounding detrimental effects on their well-being as individuals and as a group.

Consequently, such a scenario would also impact levels of collective resilience and make it much harder to collectively bounce back quickly after a flood event. Haslam and Reicher (2006) found that with reduced social identification, the group becomes disorganized, and experiences lower levels of social support,

communication, and trust. Collective efficacy also suffers greatly under such circumstances and the group risks falling apart, evidenced by the observation of higher levels of withdrawal in group members (Haslam and Reicher 2006). Thus, the survival and functioning—in our case the continuation of coastal populations—depends on their levels of social identification and shows that the environmental impact (de Vries et al. 2021) on the relationship between well-being and resilience can also be attributed to the groups or communities of which we are members.

The present-day benefit of social identification in groups collectively navigating floods is further supported by the archeological context of Krummhörn. The harsh environment and living conditions fostered collective action, which in turn is based on immense agreement by group members and tremendous group effort, which resulted in the construction of multiple settlements built on an artificially elevated pieces of land. Moreover, due to its form, size, and dense living conditions, *Terps* may have encouraged and simultaneously strengthened a *shared social identity* and, in turn, well-being across many generations. Hence, combating the threat of floods on a long-term basis required the two-way interaction of ecologies shaping behavior and behavior shaping ecologies (Uskul and Oishi 2020). Therefore, the outcomes of living on *Terps* for the East Frisian population were twofold—it secured the survival of the group in a harsh environment prone to floods, and ensured the present and future functioning of the population living in Krummhörn by keeping up their well-being.

Terp building and living were not the only activities fostering and maintaining high levels of a *shared social identity* in Krummhörn. The highly ambitious dyke building projects in this area also helped to bring inhabitants closer together to collectively defy the life-threatening conditions created by floods. Together with the evidence from human remains of the East Frisian population we have further support for a *social cure effect*, as a short glimpse into Krummhörn living conditions and their impact on physical and mental health in the sixteenth century shows that the groups persisted in spite of high mortality rates. Combining these archeological data with recent psychological results, we can assume that only those populations with high levels of social identification, which increases levels of social support and collective efficacy (Avanzi et al. 2015; Frisch et al. 2014; Junker et al. 2019; Van Dick et al. 2017) as well as decreases cortisol levels (Häusser et al. 2012), were resilient and continued to function throughout these relentless times. On the basis of our results, we believe that the strong connection between present-day inhabitants of Krummhörn, whose ancestry can be traced back three or more generations, reflects the collective resilience and identification with their social and environmental surroundings in the past. In other words, despite the threat from floods, people still reside in Krummhörn with relative high levels of satisfaction and well-being.

Importantly, the long-term viewpoint contributed by our archeological perspective allows for conjectures about collective resilience processes over time. Accordingly, we suggest that if social identity is nourished and strengthened at its core, it will sustain for generations, maybe even over centuries. Therefore, combined with our empirical findings, we would like to take the opportunity here to propose social identification as a collective resilience factor.

Henceforth, we think the social identity approach has huge potential for supporting communities and, subsequently, the individuals within. Especially in regions where people do not want to leave their homes due to financial reasons or the cherished shared social support available to them (Mallick and Mallick 2021). Thus, communities at risk of floods, can be supported by group interventions, such as the *Groups 4 Health* program, with the potential benefit of enhancing collective resilience, and thus, cohesion as well as physical and mental health. The *Groups 4 Health program is* an intervention developed by Catherine Haslam and colleagues (Haslam et al. 2016) aimed specifically at improving the mental health and well-being of groups. Those who participated in their five-module program increased their well-being, mental health, social connectedness, as well as developed and strengthen their social identification within their chosen groups (Haslam et al. 2016). Moreover, *Groups 4 Health* is a flexible program that can be used for multiple purposes, e.g., water resource management (Ananga et al. 2021) or different age groups (Islam 2020), as it is adaptable to unique environmental circumstances that require unique ways of strengthening cohesion and collective resilience.

Limitations

Although both the empirical study and archeological perspective of this paper are in support of the *social cure effect* and promoting social identity as a collective resilience factor, our study is not without limitations. Highly identified residents of Krummhörn were more likely to respond, as questionnaires were distributed by the respective head of each village. We acknowledge that they were mainly able to hand them out to those who generally participated in village activities. However, to counter possible biases in our data related to our sampling method we used the bootstrapping method to corroborate our findings. Further, the causal relation of our assumptions is theory-driven and should be further corroborated by using experimental or longitudinal design. In addition, our research design did not include a control group and hence, we were not able to compare the Krummhörn results with other regional municipalities along the North Sea coast that exhibit the same settlement pattern or populations at risk of floods in other areas of the world. We have also not looked at how populations without such settlement structures cope with living on the North Sea coast. Therefore, although we can account for high external validity, our presented results are, to some extent, one-sided. Future research exploring social identification as a collective resilience factor in representative and diverse populations facing other environmental stressors is needed.

Moreover, within the last twenty years, no life-threatening flood or storm event took place in Krummhörn. Consequently, many of our participants could not relate to any recent event. Although the threat conditions were developed with the unique Krummhörn context in mind, this study is limited by relying on self-reported perceptions of climate events as opposed to behaviors following lived experiences. Self-report data also have the potential to introduce issues with common method variance. However, given that the hypothesized models included interaction effects and were tested with regression analyses (including bootstrapping), common method

variance is likely less problematic (Evans 1985; McClelland and Judd 1993). Additionally, the theoretical translation of current psychological findings such as the *social cure effect* to behaviors of past populations is not without challenges. However, we believe it to be a strength to strive for an interdisciplinary approach when developing stimulating ideas and solutions to ameliorate risks to physical and mental well-being in populations facing climate change-related environmental events. Finally, as the literature on social identity as a collective resilience factor develops, future research should also test programs that promote social identity, such as *Groups 4 Health* (Haslam et al. 2016), in populations facing flooding and other environmental and climate-related stressors.

Conclusion

High levels of social identification enable the survival and functioning of the group by strengthening their physical and mental well-being. We found that threat perception (of floods) is negatively related to well-being, but that this relationship is buffered by high levels of social identification. However, other mechanisms need to be explored to investigate the relationship between threat perception and life satisfaction as social identification does not moderate this assumed association. Future studies on collective resilience should address social identification as a major collective resilience factor as it enables collective action, cohesion, collective self-efficacy, and shared social support, even in emergency situations. Particularly, with regard to todays' looming climate change-related events such as sea level rise and its consequences, future research should concentrate on communities with indications of low social identification and no financial means to leave as they would suffer the most by such devastating prospects. Moreover, we show that fostering and strengthening social identification needs time and intervention studies require longitudinal designs to achieve improved physical and mental well-being in participants. Finally, our archeological perspective should encourage future studies to investigate and pay tribute to past strategies of collective coping as they might impact collective resilience over centuries and surely are culturally very diverse.

Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

References

Aiken LS, West SG (1991) Multiple regression: Testing and interpreting interactions. Sage Publications Inc, Thousand Oaks, CA, US

Ananga EO, Naiga R, Agong' SG, Njoh AJ, Vickers HP (2021) Examining the contribution of community participation in water resource production and management: perspectives from developing countries. SN Social Sciences 1(1):37. https://doi.org/10.1007/s43545-020-00050-0

Avanzi L, Albertini S, Fraccaroli F, Sarchielli G, De Plato G, van Dick R (2018a) Exploring identity dynamics from a combined social exchange and social identity perspective. Int Public Manag J 21(4):677–702. https://doi.org/10.1080/10967494.2015.1115450

Avanzi L, Fraccaroli F, Castelli L, Marcionetti J, Crescentini A, Balducci C, van Dick R (2018b) How to mobilize social support against workload and burnout: the role of organizational identification. Teach Teach Educ 69:154–167. https://doi.org/10.1016/j.tate.2017.10.001

Avanzi L, Schuh SC, Fraccaroli F, van Dick R (2015) Why does organizational identification relate to reduced employee burnout? The mediating influence of social support and collective efficacy. Work Stress 29(1):1–10. https://doi.org/10.1080/02678373.2015.1004225

Baird BM, Lucas RE, Donnellan MB (2010) Life satisfaction across the lifespan: findings from two nationally representative panel studies. Soc Indic Res 99(2):183–203. https://doi.org/10.1007/s11205-010-9584-9

Bärenfänger R (2006) Fundbericht 307 Rysum OL-Nr. 2608/1:14, Gde. Krummhörn, Ldkr. Aurich, ehem. Reg. Bez.W-E. Fundchronik Niedersachsen 2006/2007. Nachrichten Aus Niedersachsens Urgeschichte 12:205–206

Benight C (2004) Collective efficacy following a series of natural disasters. Anxiety Stress Coping 17:401–420. https://doi.org/10.1080/10615800512331328768

Biggs A, Brough P, Drummond S (2017) Lazarus and Folkman's psychological stress and coping theory. In: Cooper C, Quick JC (eds) The Handbook of Stress and Health: A Guide to Research and Practice. John Wiley and Sons Incorporated, Newark, United States, pp 351–364

Brähler E, Scheer JW (1983) Der Gießener Beschwerdebogen (GBB). Huber, Bern

Brinckerhoff Jackson J (1984) Discovering the vernacular landscape. Yale University Press, New Haven and London

Brown C (2019) Hash: full feature implementation of hash/associated arrays/dictionaries. https://CRAN.R-project.org/package=hash

Brown PJ (2021) Tangible and intangible impacts of the storms of 1287 and 1288. In: Gerrard CM, Forlin P, Brown PJ (eds) Waiting for the end of the world?: new perspectives on natural disasters in medieval Europe. The Society for Medieval Archaeology Monographs Abingdon Routledge

Burkhardt A (1998) Wer lebte und starb im ostfriesischen Kloster Barthe? Archäologie in Niedersachsen 1:94–96

Burkhardt A (2009) Anthropologische Betrachtung einer Doppelbestattung aus Jemgumkloster. Archäologie in Niedersachsen 12:99–103

Carfrae MJ, Kesser BW (2008) Malignant Otitis Externa. Otolaryngol Clin North Am 41(3):537–549. https://doi.org/10.1016/j.otc.2008.01.004

CRED, and UNDRR (2020) The Non-COVID Year in Disasters. *Brussels: CRED (Centre for Research on the Epidemiology of Disasters)*(62), 1–2. Retrieved from https://emdat.be/sites/default/files/adsr_2020.pdf

Cruwys T, South EI, Greenaway KH, Haslam SA (2014) social identity reduces depression by fostering positive attributions. Social Psychological and Personality Science 6(1):65–74. https://doi.org/10.1177/1948550614543309

Dardas LA, Ahmad MM (2015) Coping strategies as mediators and moderators between stress and quality of life among parents of children with autistic disorder. Stress Health 31(1):5–12. https://doi.org/10.1002/smi.2513

De Dominicis S, Fornara F, Ganucci Cancellieri U, Twigger-Ross C, Bonaiuto M (2015) We are at risk, and so what? Place attachment, environmental risk perceptions and preventive coping behaviours. J Environ Psychol 43:66–78. https://doi.org/10.1016/j.jenvp.2015.05.010

de Vries LP, Baselmans BML, Luykx JJ, de Zeeuw EL, Minică CC, de Geus EJC, Bartels M (2021) Genetic evidence for a large overlap and potential bidirectional causal effects between resilience and well-being. Neurobiology of Stress 14:100315. https://doi.org/10.1016/j.ynstr.2021.100315

De Weerd M, Klandermans B (1999) Group identification and political protest: farmers' protest in the Netherlands. Eur J Soc Psychol 29(8):1073–1095. https://doi.org/10.1002/(SICI)1099-0992(199912)29:8%3c1073::AID-EJSP986%3e3.0.CO;2-K

DeMarco TC, Newheiser A-K (2019) When groups do not cure: Group esteem moderates the social cure effect. Eur J Soc Psychol 49(7):1421–1438. https://doi.org/10.1002/ejsp.2594

Diehl M, Hay EL, Chui H (2012) Personal risk and resilience factors in the context of daily stress. Annu Rev Gerontol Geriatr 32(1):251–274. https://doi.org/10.1891/0198-8794.32.251

Diener E, Emmons RA, Larsen RJ, Griffin S (1985) The satisfaction with life scale. J Personality Assessment 49(1):71–75. https://doi.org/10.1207/s15327752jpa4901_13

Doosje B, Ellemers N, Spears R (1995) Perceived intragroup variability as a function of group status and identification. J Exp Soc Psychol 31(5):410–436. https://doi.org/10.1006/jesp.1995.1018

Drury J (2018) The role of social identity processes in mass emergency behaviour: An integrative review. Eur Rev Soc Psychol 29(1):38–81. https://doi.org/10.1080/10463283.2018.1471948

Drury J, Carter H, Cocking C, Ntontis E, Tekin Guven S, Amlôt R (2019) Facilitating collective psychosocial resilience in the public in emergencies: twelve recommendations based on the social identity approach. Front Public Health. https://doi.org/10.3389/fpubh.2019.00141

Drury J, Cocking C, Reicher S (2009) The nature of collective resilience: survivor reactions to the 2005 London Bombings. Int J Mass Emerg Disasters 27:66–95

Erickson VO (2018) Pewsum – Vom Heim des Pewe zum Zentrum der Krummhörn. Budrich UniPress Ltd, Opladen, Berlin and Toronto

Evans MG (1985) A Monte Carlo study of the effects of correlated method variance in moderated multiple regression analysis. Organ Behav Hum Decis Process 36(3):305–323. https://doi.org/10.1016/0749-5978(85)90002-0

Fox J, Weisberg S (2019) An {R} companion to applied regression. Sage, Thousand Oaks CA. https://socialsciences.mcmaster.ca/jfox/Books/Companion/

Frisch J, Häusser J, Dick R, Mojzisch A (2014) Making support work: the interplay between social support and social identity. J Exp Soc Psychol. https://doi.org/10.1016/j.jesp.2014.06.009

Gallagher S, Meaney S, Muldoon OT (2014) Social identity influences stress appraisals and cardiovascular reactions to acute stress exposure. Br J Health Psychol 19(3):566–579. https://doi.org/10.1111/bjhp.12056

Greenaway KH, Cruwys T, Haslam SA, Jetten J (2016) Social identities promote well-being because they satisfy global psychological needs. Eur J Soc Psychol 46(3):294–307. https://doi.org/10.1002/ejsp.2169

Harms PD, Brady L, Wood D, Silard A (2018) Resilience and well-being. In: Diener E, Oishi S, Tay L (eds) Handbook of well-being. DEF Publishers, Salt Lake City UT

Haslam C, Cruwys T, Haslam S, Dingle G, Chang MX (2016) Groups 4 Health: Evidence that a social-identity intervention that builds and strengthens social group membership improves mental health. J Affect Disord. https://doi.org/10.1016/j.jad.2016.01.010

Haslam C, Jetten J, Cruwys T, Dingle G, Haslam S (2018) The New Psychology of Health. Routledge, London

Haslam SA, Reicher S (2006) Stressing the group: social identity and the unfolding dynamics of responses to stress. J Appl Psychol 91(5):1037–1052. https://doi.org/10.1037/0021-9010.91.5.1037

Häusser JA, Junker NM, van Dick R (2020) The how and the when of the social cure: a conceptual model of group- and individual-level mechanisms linking social identity to health and well-being. Eur J Soc Psychol 50(4):721–732. https://doi.org/10.1002/ejsp.2668

Häusser JA, Kattenstroth M, van Dick R, Mojzisch A (2012) "We" are not stressed: Social identity in groups buffers neuroendocrine stress reactions. J Exp Soc Psychol 48(4):973–977. https://doi.org/10.1016/j.jesp.2012.02.020

Hayes AF (2017) Introduction to mediation, moderation, and conditional process analysis, Second Edition : A Regression-Based Approach. Guilford Publications, New York, UNITED STATES. http://ebookcentral.proquest.com/lib/senc/detail.action?docID=5109647

Hetherington E, McDonald S, Wu M, Tough S (2018) Risk and protective factors for mental health and community cohesion after the 2013 calgary flood. Disaster Med Public Health Prep 12(4):470–477. https://doi.org/10.1017/dmp.2017.91

Hope RM (2013) Rmisc: Rmisc: Ryan Miscellaneous. https://CRAN.R-project.org/package=Rmisc

Hu T, Zhang D, Wang J (2015) A meta-analysis of the trait resilience and mental health. Personality Individ Differ 76:18–27. https://doi.org/10.1016/j.paid.2014.11.039

Islam MR (2020) Environment and disaster education in the secondary school curriculum in Bangladesh. SN Social Sciences 1(1):23. https://doi.org/10.1007/s43545-020-00025-1

Janke S, Glöckner-Rist A (2012) Deutsche Version der Satisfaction with Life Scale (SWLS). In: Zusammenstellung sozialwissenschaftlicher Items und Skalen (ZIS)

Jetten JE, Haslam CE, Haslam AE (2012) The Social Cure: Identity, Health and Well-Being. Psychology Press, London

Junker NM, van Dick R, Avanzi L, Häusser JA, Mojzisch A (2019) Exploring the mechanisms underlying the social identity–ill-health link: Longitudinal and experimental evidence. Br J Soc Psychol 58(4):991–1007. https://doi.org/10.1111/bjso.12308

Kaniasty K (2012) Predicting social psychological well-being following trauma: the role of postdisaster social support. Psychol Trauma Theory Res Pract Policy 4:22–33. https://doi.org/10.1037/a0021412

Kaniasty K, Norris F (2008) Longitudinal linkages between perceived social support and posttraumatic stress symptoms: sequential roles of social causation and social selection. J Trauma Stress 21:274–281. https://doi.org/10.1002/jts.20334

Lazarus RS, Folkman S (1984) Stress, appraisal, and coping. Springer, New York, NY

Lechowska E (2018) What determines flood risk perception? A review of factors of flood risk perception and relations between its basic elements. Nat Hazards 94(3):1341–1366. https://doi.org/10.1007/s11069-018-3480-z

Long JA (2019) Interactions: comprehensive, user-friendly toolkit for probing interactions. https://cran.r-project.org/package=interactions

Lyons A, Fletcher G, Bariola E (2016) Assessing the well-being benefits of belonging to resilient groups and communities: development and testing of the fletcher-lyons collective resilience scale (FLCRS). Group Dyn Theory Res Pract 20(2):65–77. https://doi.org/10.1037/gdn0000041

Mallick A, Mallick B (2021) Staying despite riverbank erosion: evidence of coastal Bangladesh. SN Social Sciences 1(6):155. https://doi.org/10.1007/s43545-021-00104-x

Masson T, Bamberg S, Stricker M, Heidenreich A (2019) "We can help ourselves": does community resilience buffer against the negative impact of flooding on mental health? Nat Hazard 19:2371–2384. https://doi.org/10.5194/nhess-19-2371-2019

McClelland GH, Judd CM (1993) Statistical difficulties of detecting interactions and moderator effects. Psychol Bull 114(2):376–390. https://doi.org/10.1037/0033-2909.114.2.376

Molenaar C, Blessin M, Erfurth LM, Imhoff R (2021) Were we stressed or was it just me – and does it even matter? Efforts to disentangle individual and collective resilience within real and imagined stressors. Br J Soc Psychol. https://doi.org/10.1111/bjso.12475

Nicolay JAW (2014) Terp Excavation in the Netherlands. In: Smith C (ed) Encyclopedia of Global Archaeology. New York NY Springer, New York, pp 7271–7273

NOAA (05/20/20) What is storm surge? Retrieved from https://oceanservice.noaa.gov/facts/stormsurge-stormtide.html

Norris FH, Stevens SP, Pfefferbaum B, Wyche KF, Pfefferbaum RL (2008) Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. Am J Community Psychol 41(1–2):127–150. https://doi.org/10.1007/s10464-007-9156-6

Ntontis E, Drury J, Amlôt R, Rubin GJ, Williams R (2019) What lies beyond social capital? The role of social psychology in building community resilience to climate change. Traumatology 26(3):253–265. https://doi.org/10.1037/trm0000221

Palinkas LA, Wong M (2020) Global climate change and mental health. Curr Opin Psychol 32:12–16. https://doi.org/10.1016/j.copsyc.2019.06.023

R Core Team (2020) R: a language and environment for statistical computing. Vienna, Austria. https://www.R-project.org/

Reicher SD, Haslam SA, Platow MJ (2018) Shared social identity in leadership. Curr Opin Psychol 23:129–133. https://doi.org/10.1016/j.copsyc.2018.08.006

Revelle W (2019) Psych: Procedures for personality and psychological research. Northwestern University, Evanston, Illinois, USA. https://CRAN.R-project.org/package=psych

Rochford EB, Blocker TJ (1991) coping with "natural" hazards as stressors: the predictors of activism in a flood disaster. Environ Behav 23(2):171–194. https://doi.org/10.1177/0013916591232003

Southwick SM, Bonanno GA, Masten AS, Panter-Brick C, Yehuda R (2014) Resilience definitions, theory, and challenges: interdisciplinary perspectives. European Journal of Psychotraumatolog. https://doi.org/10.3402/ejpt.v5.25338

Steffens NK, Haslam SA, Kerschreiter R, Schuh SC, van Dick R (2014) Leaders enhance group members' work engagement and reduce their burnout by crafting social identity. German Journal of Human Resource Management 28(1–2):173–194. https://doi.org/10.1177/239700222140280011 0

Swierczynski T, Lauterbach S, Dulski P, Brauer A (2013) Late neolithic mondsee culture in austria: living on lakes and living with flood risk? Climate of the past 9(4):1601–1612. https://doi.org/10.5194/cp-9-1601-2013

Tajfel H, Turner JC (1979) An integrative theory of intergroup conflict. Brooks/Cole, Monterey CA

Tapsell SM, Tunstall SM (2008) "I wish I'd never heard of Banbury": The relationship between 'place' and the health impacts from flooding. Health Place 14(2):133–154. https://doi.org/10.1016/j.healthplace.2007.05.006

Thulin M (2021) Boot.pval: Bootstrap p-Values. R package version 0.1.0. Retrieved from https://CRAN.R-project.org/package=boot.pval

Turner JC (2010) Towards a cognitive redefinition of the social group. In: Postmes T, Branscombe NR (eds) Rediscovering Social Identity. Psychology Press, New York, NY, US, pp 209–224

Turner JC, Hogg MA, Oakes PJ, Reicher SD, Wetherell MS (1987) Rediscovering the social group: A self-categorization theory. Blackwell, Oxford

Uskul AK, Oishi S (2020) Editorial overview: What is socio-ecological psychology? Curr Opin Psychol 32:181–184. https://doi.org/10.1016/j.copsyc.2020.01.001

Van Dick R (2004) Commitment und Identifikation mit Organisationen. Hogrefe, Göttingen

Van Dick R, Ketturat C, Häusser JA, Mojzisch A (2017) Two sides of the same coin and two routes for improvement: Integrating resilience and the social identity approach to well-being and ill-health. Health Psychology Open 4(2):1–6. https://doi.org/10.1177/2055102917719564

Van Dick R, Wagner U, Petzel T, Lenke S, Sommer G (1999) Arbeitsbelastung und Soziale Unterstützung: Erste Ergebnisse einer Untersuchung von Lehrerinnen und Lehrern. Psychol Erzieh Unterr 46(1):55–64

Wickham H, François R, Henry L, Müller K (2020) Dplyr: a grammar of data manipulation. https://CRAN.R-project.org/package=dplyr

Williams R, Drury J (2009) Psychosocial resilience and its influence on managing mass emergencies and disasters. Psychiatry 8(8):293–296. https://doi.org/10.1016/j.mppsy.2009.04.019

Wu G, Feder A, Cohen H, Kim JJ, Calderon S, Charney DS, Mathé AA (2013) Understanding resilience. Front Behav Neurosci 7:1–15. https://doi.org/10.3389/fnbeh.2013.00010

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