Helpful Abstraction, Barrier to Urgency, or Both? A Critical Examination of the Effects of Psychological Distance on Climate Change Perception

by

Elias Keller

A thesis submitted in partial fulfilment for the requirements for the degree of Doctor of Philosophy at the University of Central Lancashire

August 2023

RESEARCH STUDENT DECLARATION FORM

Type of Award **Doctor of Philosophy**
School **School of Psychology and Computer science**

1. Concurrent registration for two or more academic awards

I declare that while registered as a candidate for the research degree, I have not been a registered candidate or enrolled student for another award of the University or other academic or professional institution.

2. Material submitted for another award

I declare that no material contained in the thesis has been used in any other submission for an academic award and is solely my own work.

3. Collaboration

Where a candidate's research programme is part of a collaborative project, the thesis must indicate in addition clearly the candidate's individual contribution and the extent of the collaboration. Please state below:

Not applicable – the thesis has been produced by the student with support from the supervisory team only.

4. Use of a Proof-reader

No proof-reading service was used in the compilation of this thesis.

Signature of Candidate 

Print name: Elias Keller

Abstract

In recent years, there has been an increase in research activity around the psychological distance of climate change, often investigated through the lens of Construal Level Theory (CLT). However, recent commentaries and reviews have started to point out the inconsistent evidence produced by this research field and have questioned whether CLT is indeed the most appropriate approach for investigating distance and place in the climate change context. The aim of this thesis was to critically investigate research on psychological distance and, if necessary, to produce a more suitable way forward for research into distance-related climate perceptions. To achieve this aim, we first present a systematic review of studies around psychological distance of climate change, which documents the many different approaches and methodologies employed by researchers. We argue that CLT is indeed not effective in tackling relevant research questions because it is unable to address the complexity of climate change. Instead, we propose that researchers tackle distance-related research questions in a bottom-up manner, building a descriptive evidence base before selecting or building confirmatory theory. We apply this process to the location of climate change impacts, first collating existing knowledge from adjacent fields into a new framework of place affinity. In a cross-sectional study we find that place affinity towards places impacted by climate change predicts concern, but not worry about climate change. In an experimental study, we apply the framework of place affinity to media reports of extreme weather events and find that participants reading about a flooding in a high-affinity versus a low-affinity country differ in their emotional reactions, but not their resulting risk perception, policy support or behaviour. We discuss the implications of our findings for research on psychological distance, and more broadly, for investigations of place- and distance-related perceptions around climate change.

Table of Contents

Acknowledgements

Thank you to my supervisors, John, Beth and Linden, who supported me from start to finish in this fun, challenging and extremely valuable three-year effort!

Thank you also to all my friends who have suffered through many repeating conversations on psychological distance, climate change and online research. I'm not sure anyone escaped unscathed, but in particular I would like to thank 1) the UCLan postgraduate research society, without which this would have been a whole lot less fun; 2) Simon, for walks and chats; and 3) Priya, for picking apart my ideas, and your love and patience in life alongside a PhD project.

Tables

Figures

Publications

This thesis is based on the publications below. In all applicable chapters, the central text has been transferred from the published work, with changes to introductions and discussions to ensure the flow of the thesis.

Chapter 2 and 3.1-3.2:

Keller, E., Marsh, J. E., Richardson, B. H., & Ball, L. J. (2022). A systematic review of the psychological distance of climate change: Towards the development of an evidence-based construct. *Journal of Environmental Psychology*, *81*, 101822. https://doi.org/10.1016/j.jenvp.2022.101822

Chapter 3.3 and 4:

Keller, E., Richardson, B. H., Ball, L. J., & Marsh, J. E. (2022). *From psychological distance to place affinity: How people perceive and react to the location of climate change impacts* [Preprint]. Open Science Framework. https://doi.org/10.31219/osf.io/x4kpa

Chapter 5:

Keller, E., Marsh, J. E., Richardson, B. H., & Ball, L. J. (2023). *How Affinity with Places Affects the Indirect Experience of Extreme Weather Events (in press at Global Environmental Psychology)*. https://doi.org/10.23668/PSYCHARCHIVES.12693

Notes

This thesis is my own work and I take full responsibility for its contents. I will, however, use the first-person plural voice throughout for better narrative effect.

Supplementary materials to this thesis can be found under the following link:
Supplementary materials (https://osf.io/jk6x8/?view_only=632c297014b346919b55e93a45e06af0)

1 Introduction

Scientists agree that climate change is here and now (IPCC Working Group 1, 2021) and public concern and worry are steadily increasing in many countries (Lampert et al., 2021). Many structural and individual changes (e.g., energy systems, behaviour change) are available which would help to stop further harm to people and nature all over the world, yet, decisive climate action is far behind that recommended by scientists (IPCC Working Group 2, 2022).

There are structural, social and psychological barriers to climate action, many stemming from the complex and global nature of climate change. In recent years, the countries most severely affected by extreme weather events were Puerto Rico, Myanmar, Haiti, the Philippines and Mozambique (Eckstein et al., 2021) – places primarily in the Global South whose inhabitants are both least responsible for causing climate change (S. Evans, 2021), and least equipped to deal with its consequences (IPCC Working Group 2, 2022). At the same time, places which historically and currently have contributed most emissions, such as the United States, Germany and the United Kingdom (S. Evans, 2021), experience climate impacts less directly and severely (Eckstein et al., 2021). These countries are often known as WEIRD countries (Western, Educated, Industrialised, Rich, Democratic; Henrich et al., 2010). Unfortunately, these also often play a disproportionately large role in decisions on climate action, since they tend to have more negotiating power and presence in the political and economic systems that they often designed (Parks & Roberts, 2010). Individuals in these countries also have much larger annual emissions, such as 15t per capita CO_2 in the US, 8t in Germany and 5t in the UK, compared to 0.67t in Myanmar, 0.25t in Haiti, 1.27t in the Philippines and 0.22t in Mozambique (Ritchie et al., 2020). Even within WEIRD countries, there are large inequalities: for example, in the UK, the 10% highest earners use about three times as much energy as those in the bottom third, for example through transport such as flights and car journeys (Baltruszewicz et al., 2023). Engaging people in these countries, particularly those with a high socio-economic status, could therefore have potentially large impacts on reducing CO_2 emissions (Nielsen et al., 2021).

1.1 Psychological Distance of Climate Change

One often suggested reason for the lack of climate action in WEIRD populations is that manifestations of climate change (such as extreme weather events) feel too distant to be prioritised among other issues and need to be brought into the here and now (e.g., CRED, 2009; Van Lange & Huckelba, 2021). This idea is often discussed under the umbrella of *psychological distance* (PD), a concept within *Construal Level Theory* (CLT; Trope & Liberman, 2010). CLT is based on the idea that any object or event has a mental representation. This representation can have varying degrees of abstraction or concreteness and is linked to how psychologically distant or proximate the object is perceived to be. This distance can be spatial, social, temporal or hypothetical in nature. In the

example of a climate extreme weather event, this might translate into where the event took place, whom it affected, when it happened or is predicted to happen, and how much uncertainty exists around the event. The closer an object or event is perceived to be on each of those dimensions, the more concretely it is construed, which in turn influences which factors are considered in thinking and decision-making about the object or event. For example, someone thinking about an object in a concrete, proximal way would draw on immediate factors such as costs and benefits to make judgements and decisions. If they are thinking about it in a more abstract, distant way, more high-level aspects such as worldviews, values and ideologies would be considered more important (Trope & Liberman, 2010).

CLT would therefore suggest that a person's PD towards climate change influences how they construe the issue and which factors they consider when deciding whether to take up climate action (Brügger, Dessai, et al., 2015). On the other hand, the theory does not make any statements about whether a distant conception of climate change is more or less relevant or motivating (Brügger, 2020), which calls into question the recommendations to proximise climate change to promote climate action (CRED, 2009; Van Lange & Huckelba, 2021; Van Valkengoed et al., 2023). Moreover, experts in environmental social sciences continue to suggest that psychological distance interventions can be very effective (International Collaboration to Understand Climate Action, 2023).

In fact, evidence for the relationship between PD and climate change risk perception, policy support and action is mixed and does not currently support a clear pathway from proximising climate change to climate action (Brügger, 2020; Van Valkengoed et al., 2023; Wang et al., 2021). A review of recent opinion polls shows that many, if not most, people already perceive climate change as psychologically close (Van Valkengoed et al., 2023). Moreover, links between PD and relevant outcome variables are mixed: Some cross-sectional studies record links between PD and the intention to partake in climate action (e.g., Spence, Poortinga, & Pidgeon, 2012; Wang, Hurlstone, Leviston, Walker, & Lawrence, 2019), some do not (e.g., Chen, 2019; Rodríguez-Cruz & Niles, 2021); some experimental studies inducing low distance to climate change increase climate action and policy support (e. g., Jones, Hine, & Marks, 2017), others have the opposite effect (e.g., Halperin & Walton, 2018) or no effect at all (e.g., Mildenberger, Lubell, & Hummel, 2019).

This mixed evidence may be partially explained by limitations of CLT in the climate change context. For example, recent reviews have pointed out that CLT was originally formulated to describe relatively simple decision-making processes such as simple purchases, in which objects can be construed flexibly and it is relatively easy to manipulate an abstract or concrete construal of the same object or situation (Brügger, 2020; Wang et al., 2021). In contrast, research applying CLT to climate change often measures stable views, such as beliefs about where climate impacts take place.

Climate change is also a very complex topic, with many different aspects to which one can feel varying levels of distance. It is therefore possible that there appear to be many inconsistencies in PD studies because the studies investigate, intentionally or unintentionally, different aspects of climate change. This can translate into different research questions, but also different methods and operationalisations used to test the same questions, which could lead to inherently different results. It is also notable that the empirical basis of CLT has recently come under criticism; a team re-analysing a recent meta-analysis on CLT studies found strong evidence that effects and effects sizes are much less prominent, or even absent, when accounting for publication bias (Maier et al., 2022).

As a result of these criticisms, researchers have made different suggestions in how to advance knowledge around the distance of climate change. Wang and colleagues (2021) describe a range of situations in which certain PD dimensions may help understand climate perceptions. For example, the media often portray environmental issues as involving people who are very different from the readers themselves, such as celebrities, politicians or members of the general public who do not accurately represent diverse societies. This is theorised to increase social distance to climate change in general, and decrease engagement. Additionally, temporal and hypothetical distance can be used to understand the perception of climate mitigation targets. Many of these targets are far in the future (e.g., 2050) and abstract (e.g., 2°C warming). Such targets are not intuitively attractive and motivating, since people tend to prefer near-future benefits, even if they are smaller and especially if they are more certain than distant-future benefits (temporal and probability discounting; Kaplan et al., 2014). In this context, interactions between temporal and hypothetical distance dimensions can be useful for understanding why people struggle to prioritise climate action, which is often perceived to have short-term costs and long-term benefits (Wang et al., 2021; even though short-term wellbeing benefits are empirically documented, e.g., Capstick et al., 2022).

While Wang and colleagues (2021) give examples of suitable applications of CLT to the climate change context, Brügger (2020) suggests a range of different approaches altogether. For example, risk processing models may better explain the influence of distance-related information on risk perception; mental models may better explain conceptualisations of climate change involving risk in a bottom-up approach; Bayesian updating may help researchers investigate how distance-related beliefs change upon gaining new information; and finally, conceptual change models from the education literature may help to understand how education-based interventions can shape distance-related beliefs. Brügger's suggestions therefore call for a researcher to first examine which specific part of distance in climate change they want to study, and then to choose a theoretical or methodological approach which is suited to investigate this particular point. This helps researchers choose a parsimonious approach – using established theory where it already exists – while being able

to build on that theory's evidence base, and still conduct specific, targeted and applied climate change research.

In general, criticisms of CLT and PD and the different suggested ways of progressing within this research field indicate a need to reconsider how distance-related aspects of climate change can best be investigated and understood. Indeed, it is important to conduct these re-evaluations, especially in an applied and urgent context such as climate change wherein it is important that research is conducted in the most effective way possible. Currently, however, these proposals are based on narrative reviews (Brügger, 2020; Van Lange & Huckelba, 2021; Wang et al., 2021), which take into account a lot of the literature around psychological distance of climate change, but not in a systematic manner. Other reviews are systematic, but miss evidence from recent years (McDonald et al., 2015) or evaluate PD in relation to climate mitigation and adaptation behaviour only (Maiella et al., 2020), excluding risk perception or climate beliefs[1]. With current government and NGO communication guidelines overwhelmingly stating that proximising will help to motivate climate action (Van Valkengoed et al., 2023), it is necessary to conduct a robust review of the mixed evidence to be able to recommend whether such communication guidelines are effective, ineffective or even harmful.

In this thesis, we suggest that a systematic analysis of psychological distance research is necessary to develop the concept in the climate change context, or else to inform the choice of suitable alternative approaches. Using and analysing all presently available knowledge in the literature is important when aiming to further our understanding of climate change perceptions in the most effective and efficient way possible. Documenting theoretical assumptions, the methodological approaches and resulting patterns of evidence may help us understand why the evidence base in the psychological distance of climate change is so mixed, and which steps can be taken to build an empirically and theoretically well-founded understanding of distance-related aspects in climate change perceptions.

Below, we present a series of studies conducted during the PhD research programme. The first study takes the form of a systematic review of the psychological distance literature. This is then

[1] One systematic review on psychological distance and climate change beliefs and action was published very recently, in April 2023 (Van Valkengoed et al., 2023). This review was published two years after the systematic review in this thesis was completed (see Chapter 2), and almost one year after the systematic review in this thesis was published as a journal article. We have decided not to refer to this review in this paragraph to accurately depict the decision-making process at the beginning of the thesis. However, since Van Valkengoed et al. take a slightly different perspective, employing stricter exclusion criteria but additionally reviewing public opinion polls and communication guidelines, we include their insights throughout the thesis where it complements and adds to the evidence discussed within our own literature review.

followed by the presentation of empirical studies aimed at the development and evaluation of an alternative approach to understanding distance towards places affected by climate change consequences.

1.2 Aims and Contributions

The overarching aim of this thesis was to critically investigate research around psychological distance and based on this investigation, to suggest and evaluate a more efficient and effective approach to understanding distance-related climate perceptions.

A first step is to conduct a systematic review of psychological distance in climate change research. Chapter 2 presents this systematic review, which identifies, summarises and analyses 84 individual studies with a total number of 81,393 participants. These studies included investigations from across the world, but we were only able to include English language literature. Results indicate that many useful insights can be gained from this literature. At the same time, a wide range of methods are used to investigate a broad array of different climate change aspects, leading to inconsistent results. The review also identifies several ways in which central principles of CLT have been misapplied in the climate change literature. Based on these results, we discuss how the theory can be useful in investigating some aspects of distance in the climate change context, but also why researchers would benefit from taking a more bottom-up approach in choosing which theory and methodological approach to use in their studies.

In the third chapter, we reflect on this idea of a bottom-up approach by discussing meta-scientific arguments on theory development in psychology. We show how philosophy of science work can be used to describe the development of CLT and PD in climate change research and illustrate how premature and misapplied theory can lead to research lines in which said theory is incrementally changed, but no consistent theory is found. This then leads to a lack of a comparable research base upon which applied knowledge and recommendations can be produced. We demonstrate why philosophers of science often prioritise bottom-up research to counter such issues around theory development, how this approach has been discussed in environmental psychology in general and how it may be applied to distance-related research in particular. We then apply this approach to the context of climate change impact locations. We draw together and review various strands of the literature that may help understand people's relationship with places affected by climate change. We propose that this relationship can be thought of as one's *affinity with an affected place*, and propose a framework of place affinity which is determined by different place beliefs, including spatial distance and similarity with an affected place, social similarity and intimacy with its residents, and familiarity and caring about a place.

In Chapter 4, these proposed place beliefs are explored in a mixed-methods cross-sectional questionnaire study. UK participants were asked to freely name places that they thought were affected by climate change and to rate their affinity towards those places. Affinity towards places impacted by climate change in the present or immediate future was related to concern, but not frequent worry, about climate change. The qualitative part of the study additionally suggested that aspects of climate justice were highly relevant in understanding these place perceptions: participants stated that a place's vulnerability and responsibility for causing climate change influenced the extent to which they were concerned about it being impacted.

Based on the framework proposed in Chapter 3 and its cross-sectional exploration in Chapter 4, Chapter 5 presents an experimental study that tested the influence of the different place beliefs on the perception of extreme weather events. Participants were shown news reports of a flooding event attributed to climate change, taking place in either a high-affinity country (Germany) or a low-affinity country (Madagascar). An additional control condition consisted of a general article on flooding caused by climate change without place mentions. We found that emotional reactions were stronger in the high affinity compared to the control condition. However, other comparisons, as well as risk perception, policy support and pro-climate behaviour did not differ between conditions. We discuss these results with special consideration of the role of emotion regulation strategies, which many participants indicated using while reading the article.

Finally, Chapter 6 contains a general discussion of the contribution of the thesis. We synthesise the findings and discuss their implications 1) for research around psychological distance in general, and 2) for research applying the place affinity framework in particular. We close with implications for practitioners seeking to communicate climate change and extreme weather events around the world.

2 Systematic Literature Review

2.1 Aims

As outlined in the introduction, there is a growing awareness that research around psychological distance and climate change is producing a highly inconsistent evidence base. While various approaches have been suggested for how to tackle this challenge, including both modifications of the underlying Construal Level Theory and alternative theoretical approaches, there has been no systematic effort made to analyse this inconsistent evidence base in the first place. However, such an analysis is crucial if we aim to find the most effective and efficient way forward in researching distance-related effects around climate change.

The first step we took in this thesis was therefore to conduct a systematic review of the psychological distance literature across the world. The aim was to collate, record and document instances of empirical research on psychological distance when applied to climate change. Our focus was, in particular, on identifying differences in the methodologies and results across studies, in order to identify any patterns in the field and fruitful strategies for future research.

Guiding the analysis were the following research questions:

RQ 1: How is the concept of PD used to investigate cognition, affect and behaviour related to climate change, and what are the differences and similarities in its application?

RQ 2: What overall patterns and general conclusions emerge from these different applications of the PD concept?

2.2 Method

2.2.1 Eligibility Criteria

Eligibility was defined by two main criteria. First, PD had to be investigated empirically, meaning that studies were excluded that reported no novel PD data. There were no restrictions regarding methodology. Second, studies had to investigate empirically cognitions, affect or behaviour specifically related to climate change. Only records from 2010 were considered, as this marks the start of research specifically investigating PD as a construct. Only results in English were included.

2.2.2 Search Strategy and Screening

The two terms “psychological distance” and “climate change” were combined (Boolean operator AND) along with their synonyms (operator OR) as described in Table 2.1 and searched for in interdisciplinary (Web of Science and Scopus) and psychology-focused (PsycInfo) databases. Additionally, the reference lists of eligible articles were searched to identify any missed records.

Table 2.1

Details of database searches in Web of Science, PsycInfo and Scopus

Database	Search terms	Results returned	Date of initial search
Web of Science	(TS=(("climate change" OR "global warming") AND ("psychological distance" OR “perceive* distan*” OR “fe?l* distan*” OR “temporal* distan*” OR “spatial* distan*” OR “geographical* distan*” OR “social* distan*” OR “hypothetical* distan*” OR "spatial* fram*" OR "temporal* fram*")))	459	02/11/2020
PsycInfo	("climate change" OR "global warming") AND ("psychological distance" OR “perceive* distan*” OR “fe?l* distan*” OR “temporal* distan*” OR “spatial* distan*” OR “geographical* distan*” OR “social* distan*” OR “hypothetical* distan*” OR "spatial* fram*" OR "temporal* fram*")	36	02/11/2020
Scopus	TITLE-ABS-KEY (("climate change" OR "global warming") AND ("psychological distance" OR “perceive* distan*” OR “fe?l* distan*” OR “temporal* distan*” OR “spatial* distan*” OR“geographical* distan*” OR “social* distan*” OR “hypothetical* distan*” OR "spatial* fram*" OR "temporal* fram*"))	375	02/11/2020

After removing duplicates, we screened titles and abstracts according to the eligibility criteria, followed by a full-text screening of the resulting selection. One study was included as both thesis and peer-reviewed article; we chose to keep the latter. Items from manual reference checks and personal correspondence were added to the final selection. Automatic search alerts using the aforementioned terms were established to highlight additional studies, which were added to the corpus when relevant and included in the analyses on a rolling basis. The final search was performed on 30th April 2021.

The main characteristics of each study were extracted, including the operationalisation of PD, its experimental manipulations (if applicable), other included variables and overall results. Multiple studies within the same paper were treated separately and if information was missing then authors were contacted directly (see notes in results tables). For the experimental studies, effect sizes of PD manipulation checks were also extracted or calculated as recommended by Lakens (2013).

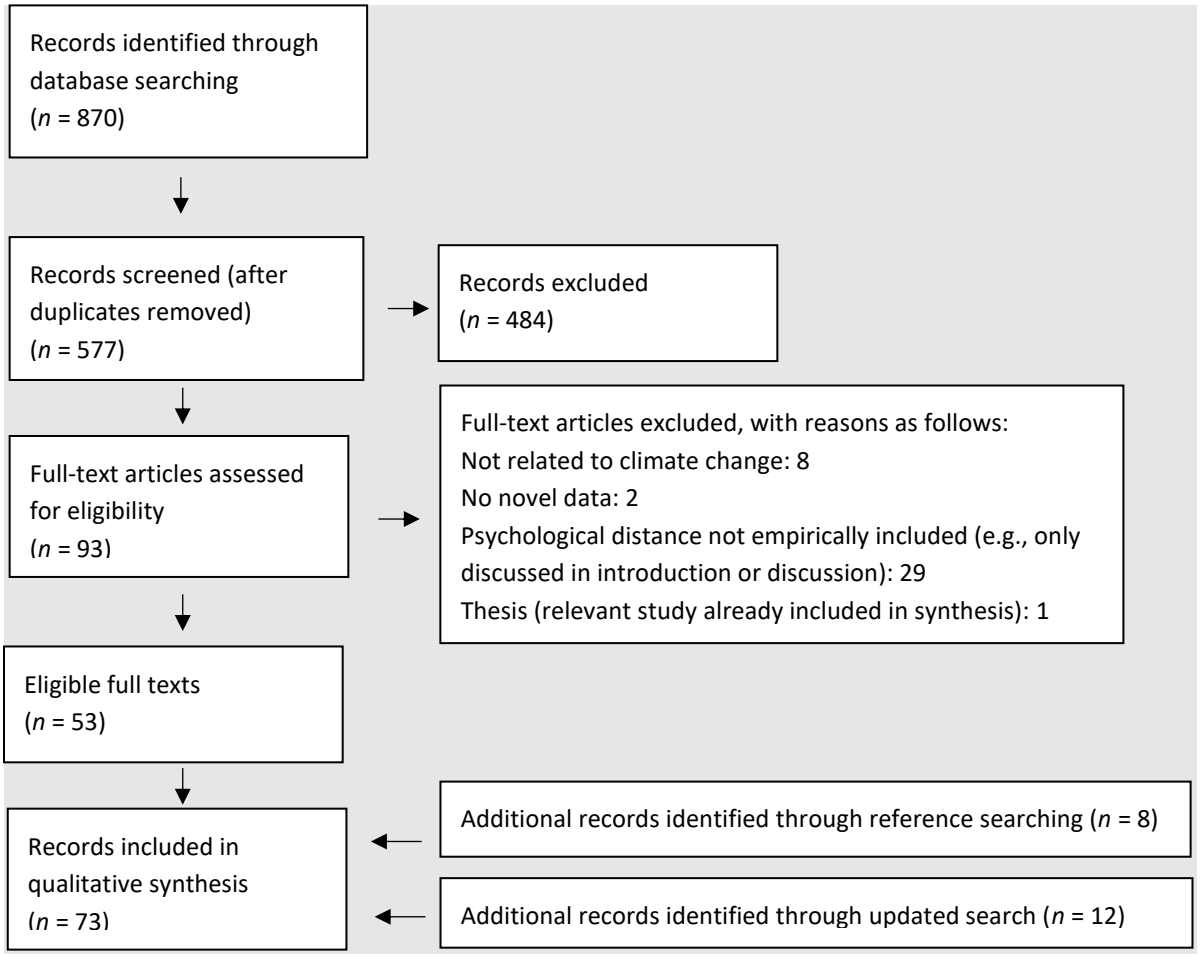
2.3 Results

Figure 2.1 shows a flowchart of the screening process, based on guidance from “Preferred Reporting Items for Systematic Reviews and Meta-Analyses" (PRISMA, Moher et al., 2009). This flowchart shows how many studies were excluded at different points. From 870 identified records,

53 were included after full-text screening. We included an additional eight records from reference searching and 12 records from updated searches, which resulted in a final corpus of 73 records.

Figure 2.1

Screening and selection process, adapted from PRISMA flowchart (Moher et al., 2009).



These 73 records contained 84 individual studies. We analysed studies within two main categories: (i) those that measured PD in a cross-sectional design (*n* = 33), with PD being measured at a given time-point; and (ii) those that manipulated PD in an experimental setup (*n* = 51). This distinction speaks to the conceptualisation of PD. Cross-sectional studies assume that PD is a relatively stable factor that can be related to other stable factors. Studies manipulating PD assume implicitly or explicitly that PD is a relatively temporary state, which can be altered during a laboratory session. We will therefore discuss and compare studies within these two categories, followed by a general discussion to collate findings

2.3.1 Cross-Sectional Studies

Of 33 cross-sectional studies, 25 employed quantitative questionnaires, seven a qualitative design and one a text analysis. We will first summarise and discuss the latter two groups followed by a more detailed discussion of the 25 correlational studies.

Qualitative studies and text analysis

The seven qualitative and one text analysis study are summarised in Table 2.2.

Table 2.2

Study characteristics of qualitative studies and text analysis

Study	Design	Sample	Conclusions regarding PD
Coulter et al. (2019)	Qualitative interviews	31 Canadian and Australian climate change communication experts	PD used by participants to distance themselves from negative consequences. Uncertainty applies to other dimensions.
de Guttry et al. (2017)	Free association statements	46 German and 46 Taiwanese students	PD prevalent concept, especially spatially. Climate change seen as relatively distant.
de Guttry et al. (2019)	Qualitative interviews	36 North German citizens	PD highly dynamic, with participants jumping between different dimensions and distances within dimensions. Uncertainty applies to other dimensions.
K. Lee & Barnett (2020)	Questions to experts	UK pupils from 25 classes aged 10-12 years, 820 questions	Many references to PD. Dimensions linked, e.g., large uncertainty for local impacts and small uncertainty for distant impacts.
Leviston et al. (2014) Study 2	Workshops on climate change imagery	52 Australian citizens and students	Climate change mostly associated with distant imagery. Local imagery sparked more emotions and discussions.
Michel-Guillou (2015)	Qualitative interviews	49 French water-management related experts	PD was prevalent, high contrast between concrete, proximal perception of water management and abstract, distant perception of climate change. Difficulties linking the two issues.
Poortvliet et al. (2020)	Text analysis (content analysis)	Intergovernmental Panel on Climate C (IPCC) summary for policy makers	Climate change mostly portrayed as abstract and distant in all dimensions, although there were references to concrete and proximal language, e.g., recent rising temperatures.
Schattman et al. (2021)	Qualitative interviews	24 US American farmers	Climate change impacts and necessary responses feel socially and temporally close to farmers. Consequences to socially distant persons are more abstract and uncertain.

Two studies analysed participants' free-form writing when asked to produce 10 statements about climate change (de Guttry et al., 2017) or, in a study with children, to pose questions about climate change to an expert panel (K. Lee & Barnett, 2020). In both studies, PD was a prevalent concept that was voluntarily mentioned, with many participants feeling very distant from climate change. Spatial distance was referred to most often, followed by temporal and social distance (de Guttry et al., 2017). The children's questions emphasised how interlinked the dimensions were (K. Lee & Barnett, 2020), with temporally current climate change impacts being seen as spatially further away than future impacts. This is a departure from the classic assumptions of CLT, which states that dimensions are positively correlated, where temporally close impacts are thought to be spatially

close. The language used by children indicated that some saw themselves as personally or collectively responsible for mitigating climate change, using pronouns such as “we” or “us” when speaking about society's response.

Four studies conducted expert interviews, consulting climate change communication specialists (Coulter et al., 2019), water-management experts (Michel-Guillou, 2015), residents of a flood-prone area (de Guttry et al., 2019) and farmers (Schattman et al., 2021). In all four, interviews were coded to identify mentions of PD. Despite the variety of domains, a common finding was that participants were certain about the fact of climate change, but less so about how, when and where its impacts were going to be felt. This could indicate that in the context of climate change, the dimension of hypotheticality (or uncertainty) may be seen as part of the other dimensions such that the spatial, temporal and social distances are uncertain in people's minds. For example, for farmers this meant that current climate change impacts to themselves were more certain than future impacts to socially-distant people, especially when participants were less receptive to others' experiences (Schattman et al., 2021). Participants often used PD dynamically, connecting local and global as well as present and future aspects of climate change within the same interview. Sometimes, distance was even used consciously to create space from overwhelming climate change consequences (de Guttry et al., 2019). This was contrasted with issues such as water management, which seemed more concrete and proximal than climate change, leading to difficulties in linking the two (Michel-Guillou, 2015).

Leviston et al. (2014, Study 2) analysed group discussions while sorting and ranking climate change images, finding that climate change was most strongly associated with distant, abstract imagery, although images of local events sparked stronger emotions. Similar abstract language was used in the IPCC summary for policy makers (Poortvliet et al., 2020), wherein climate change was often portrayed as distant on hypothetical-temporal and socio-spatial dimensions, with fewer concrete mentions to past evidence or adaptation measures.

These findings suggest that PD is important to people's mental representation of climate change, although its exact role is unclear. PD is used dynamically, with participants' feelings of distance changing across contexts. High uncertainty is associated with all dimensions. Often, dimensions are negatively correlated, contradicting classic CLT assumptions. Consequently, it might be difficult to assess, for example, only the spatial distance of climate change without specifying temporality. Finally, it is important to note the existence of bias towards WEIRD populations.

Correlational questionnaire studies

A correlational questionnaire design was employed by 25 studies, using samples from Europe, North America or Australia (*n* = 13), Africa (*n* = 2), the Middle East (*n* = 3), East Asia (*n* = 5) and Central or South America (*n* = 2). Most studies involved citizens (*n* = 14), students (*n* = 4) or a mix thereof (*n* = 2), but farmers (*n* = 3), policy influencers (*n* = 1) and school pupils (*n* = 1) were also included (see Table 2.3).

Table 2.3

Study characteristics of cross-sectional correlational studies

Study	Sample	Measurements: PD measurement style, *dimensions* (number of items; example item).	Descriptive levels of PD	Additional variables (related to PD with asterisk)[b]
Acharibasam & Anuga (2018)	180 Ghana farmers (convenience sample)	Two dimensions combined into index[a]. *Spatial* (2; My local area is likely to be affected by climate change), *social* (2; Climate change will mostly affect developing countries).	Spatially and socially very proximal.	Affective style (conceal, adjust and tolerate)*, experience of climate change consequences*, agricultural adaptation practices*
Azadi et al. (2019)	350 Iranian farmers (stratified random sample)	Four dimensions combined onto one latent variable, α = .87. *Spatial* (2; Climate change will mainly affect areas that are far away from here), *temporal* (3; It seems that climate change will affect future generations and has no effect on the current generation), social (2; Climate change is likely to have a big impact on farmers like me), hypothetical (2; It seems that there is no climate change).	On all dimensions, impacts were seen as quite distant.	Climate change risk perception, trust in government, belief in climate change, adaptation practices*
Berger et al. (2019)	972 German residents (weighted for representativeness of German population)	One dimension. *Socio-spatial* (3; To what extent will the following persons be affected by health risks as a result of climate change? Own person, German population, global population).	Distant: Own person seen as least likely to be impacted, global population as most likely.	NA
Brügger, Morton, et al. (2015)	309 Swiss, 612 UK residents (convenience sample)	One dimension (spatial) split into two categories/indices (α > .83). Pro*ximal risk perceptions* (7; Water shortages will occur where I live), *distant risk perceptions* (7; Worldwide water shortages will occur).	Distant: Global risk seen as higher than local risk for both samples.	Policy support* (especially distant risk), mitigation and adaptation intention*, climate change scepticism, attitude towards environmental protection* and nature*, affective risk perception (emotional reaction to climate change)*
Brügger et al. (2021)	1316 residents of Peru (random sample of three regions)	One dimension, items analysed independently. *Spatial* (12; How are the following places affected by consequences of climate change due to global warming, such as droughts, flooding, diseases, or mudslides	Both proximal and distant (impacts seen as severe for most places both local and global).	NA

		and avalanches? Your neighbourhood, your area, (…), rich countries, the whole world).		
Carmi & Bartal (2014)	361 Israeli residents and students (convenience sample)	Measured through correlation between Consideration of Future Consequences (CFC) score and risk perception: if person with high CFC is concerned, then threat is perceived as temporally distant.	Distant: Global warming risk only prioritised by those with high CFC.	
Carmi & Kimhi (2015)	305 Israeli students (convenience sample)	Three dimensions assessed for two types of threat and combined into two respective indices, environmental harm (α = .65) and climate change (α = .68). *Social* (1; To what degree would the realisation of the threat affect you personally), *temporal* (1; When is the threat expected to be realised), *hypothetical* (3; How likely is the threat to be realised?).	PD to climate change moderately distant; PD to harm to environment more proximal.	Risk perception*, emotions aroused by PEB*, willingness to sacrifice for environment*.
Chen (2019)	245 Taiwanese students and residents (convenience sample)	Seven items combined into one index (α = .82). *Spatial* (2; Climate change is occurring in other countries and elsewhere), *temporal* (1; Climate change will occur in the distant future), *hypothetical* (3; Climate change's existence is uncertain).	Moderately proximal.	PEB intentions, climate change risk perception*, media coverage*
Chen (2020)	733 Taiwanese residents (random sample)	Four dimensions combined into index (α = .75). Nine items adopted from Spence et al., 2012)[a].	Moderately proximal.	PEB (self-reported), values, ecological worldview*, concern about environmental problems*
Fang et al. (2016)	851 Taiwanese env. science students (convenience sample)	Three dimensions combined into latent variable (α = .88). *Spatial, social, temporal*, items not given[a.]	Not stated.	Attachment to environment*, natural constraints (limit of natural resources), social norms, environmental attitude, conservation commitment*, PEB intentions*
Fesenfeld & Rinscheid (2021)	4225 German residents and 4877 US residents (representative samples from panels)	One dimension recoded into factor variable with levels low urgency, high urgency, climate sceptic. *Temporal* (2; Climate change is already today a serious problem; Climate change will be a problem for future generations).	Proximal for both samples.	Policy support for general climate change mitigation*, policy support for policies targeting high-cost behaviours (meat consumption and fossil-fuel cars), feelings of dread

Gubler et al. (2019)	587 Swiss pupils (convenience sample)	Four dimensions combined into an index each (.50 < α > .68). *Spatial* (3; Climate change is mostly affecting the area where I live), *social* (3; Climate change will particularly affect me, my family and my friends), *temporal* (3; The impacts of climate change will be mostly felt far in the future), *hypothetical* (3; I wonder if climate change is a serious threat at all).	Spatially and socially distant, temporally and hypothetically proximal.	NA
Katz et al. (2020)	524 US American engineering students (stratified random sample)	One dimension, items analysed independently. One question combining *socio-spatial* and *temporal* distance: Global warming will have impact on [whom, e.g., me personally, (…), the natural environment)] [when, e.g., now, (…), never)].	Temporally proximal for impact on nature, distant for impact on themselves.	NA
Klinsky et al. (2012)	25 Canadian residents (convenience sample)	NA	NA	Tasked with assigning climate change mitigation and adaptation funds to countries. Distance more important for adaptation scenarios, mixed evidence for direction of effects.
Rodríguez-Cruz & Niles (2021)	405 Puerto Rican Farmers (random sample)	Four dimensions combined into one index α = .74. *Spatial* (2; Climate change does not present more risk than benefits to agriculture in Puerto Rico), *social* (2; Farmers like me are not likely to be affected negatively by climate change), *temporal* (1; The effects of climate change are not being felt today), *hypothetical* (3; There is scientific uncertainty about the causes of climate change).	Impacts seen as severe both proximally and distant.	Reported experience of extreme weather event, reported damages, perceived self-capacity to adapt*, perceived vulnerability*, motivation to adapt, adaptation behaviour
Sacchi et al. (2016) Study 1	80 Italian residents and students (convenience sample)	Three dimensions combined into index (α = .81). *Temporal* (1; Think about climate change and its consequences. Are they close in time?), *spatial* (1; Are they close in space?), *hypothetical* (1; Are they likely to occur?).	Moderately proximal.	Concern*, cognitive mindset (holistic (vs analytical thinking) *, attitude towards environment
Singh et al. (2017)	653 US American residents (quota sampling of online panel)	Four dimensions, items used independently. *Hypothetical* (1; How likely are climate change impacts to occur), *spatial* (1; Are/will impacts be primarily experienced near where you live or far away?), *social* (1; Are/will climate change impacts be primarily experienced by people similar to you or by other, dissimilar people?), *temporal* (1; Are/will climate change impacts be primarily felt now or in the distant future?).	Not reported.	Concern*, policy support*, response efficacy

Spence et al. (2012)	1822 UK residents (quota sample representative of UK)	Four dimensions, social/spatial distance items analysed independently, hypothetical combined (α = 0.71). *Spatial* (2; My local area is likely to be affected by climate change), *social* (2; Climate change will mostly affect developing countries), *temporal* (1; When, if at all, do you think Britain will start feeling the effects of climate change?), *hypothetical* (4; I am uncertain that climate change is really happening).	Spatially, temporally, hypothetically proximal. Socially mixed evidence.	Concern*, PEB intentions*
Steynor et al. (2020)	40 policy influencers from Malawi, Zimbabwe, Botswana (purposive sampling)	Four dimensions, items used independently. *Hypothetical* (1; Which of the following statements regarding climate change do you believe? Caused by human activities, (…), is not happening), *temporal* (1; When, if at all, do you think your city will start feeling the effects of climate change?), *spatial* (1; How much of a threat do you think climate change is to your city?), *social* (1; How much of a threat do you think climate change is to you personally?).	Proximal on all dimensions.	
Verplanken et al. (2020)	306 US American and European residents (online panel and convenience)	Four dimensions assessed with 16 items from Spence et al., 2012. Combined into three factors after exploratory factor analysis: *proximal* consequences (6; Global warming is likely to have a big impact on people like me), *distant* consequences (3; Other countries are more vulnerable to negative effects of global warming than we are), *scepticism* (4; The seriousness of climate change is somewhat exaggerated).	Not reported.	Habitual worry about global warming*, New Environmental Paradigm*, pro-environmental values*, past PEB*, green self-identity*, positive affect negative affect scale*
Wang et al. (2019) Study 1	218 Australian residents (online panel, approximately representative of Australian population)	Four dimensions assessed with two measures: PD1 adapted from Spence et al. (2012), α = 0.93. PD2: from McDonalds et al., 2013, α = 0.76. Both used as latent variables. PD1: *Spatial* (4; I feel geographically far from the effects of climate change), *social* (4; I don't see myself as someone who will be affected by climate change), *temporal* (3; Climate change is happening now), *hypothetical* (3; Climate change is virtually certain to affect the world), *temporal/spatial* (1; The region where I live is already experiencing serious effects of climate change), *temporal/social* (1; Climate change will not change my life, or my family's lives anytime soon), *hypothetical/spatial* (1; My local area is very unlikely to be affected by	PD1: proximal PD2: temporally and hypothetically proximal, socially and spatially distant.	Behaviour Identification Form, Response Category Width, political identification, perceived behavioural control, scepticism*, Consideration of Future Consequences*, place attachment*, environmental worldview*, PEB at individual level* and community level

		climate change), *hypothetical/social* (1; It is virtually certain that my family will be safe from the effects of climate change) PD2: Continuous sliding scales. *Temporal* (1; When will climate change impacts occur?), *spatial* (1)[a], *hypothetical* (1)[a], *social* (2; one item measuring intimacy, one similarity).		
Wang et al. (2019) Study 2	216 Australian residents (online panel, approximately representative of Australian population)	As above.	As above.	Construal level (amended to relate to environment)*, response category width, PEB at individual level and community level, scepticism*, time perspective*
Xu et al. (2020)	234 Chinese residents (convenience sample from three cities)	Four dimensions combined into one index (α = .97). *Spatial* (1; I feel that the place where I live has been negatively affected by environmental changes), *social* (1; I feel that the lives of people around me are negatively affected by environmental changes); *temporal* (1; I think in recent years my life has been more negatively affected by environmental changes), *hypothetical* (1; am more and more confident about the negative results brought about by environmental changes).	Moderate.	PEB intentions*, psychological response to others' PEB*, perception of enforceability of just environmental policies, appraisal of others who engage in PEB (see paper for more details on measures)
Yu et al. (2017)	1640 Taiwanese students with training in climate change (random sample)	Three dimensions combined into one index (α = .92). *Spatial* (1; Climate change will mostly affect areas that are far away from Taiwan), *temporal* (1; When, if at all, do you think Taiwan will start feeling the effects of climate change?), *hypothetical* (2; Climate change is likely to have a big impact on people).	Similar scores on all dimensions, distance unclear[a].	Environmental ethics*, social responsibility for environmental issues*, own responsibility*, green purchase intentions*, consumer loyalty to green brands*
Zwickle (2015) Chapter 3 Study 2	364 residents of Ohio, USA (online panel)	Three dimensions combined into one index (α = .72). *Temporal* (1; When, if at all, will humans begin to experience negative consequences of climate change?), *spatial* (1; Which of the following, if any, are or will be most at risk to the negative consequences of climate change? My community in Columbus, (…), other countries), *social* (1; Which of the following groups of people, if any, are or will be	Temporally proximal, spatially far, socially moderate.	Personal relevance*, concern about health effects of climate change*

							most at risk to the negative consequences of climate change? Myself and my family, (…), people who are unlike me).

Note. [a]Insufficient information given by authors. [b]Given the large variety in measurement styles present in PD items (see analysis of studies) but also in the associated variables, we do not see studies as easily comparable. For this reason, we do not give effect sizes, but rather focus on giving a broader overview over what variables may be related to different aspects of PD, with the aim of showing general patterns and helping researchers find studies relevant to their research questions. For a more nuanced look at the associated variables, please see individual studies. PEB = pro-environmental behaviour.

Operationalisation of Psychological Distance. In almost all studies, participants were asked about their perceived distance towards climate change consequences, that is, the likelihood, location and timing of impacts and those potentially affected by them. Almost half of the studies measured all four PD dimensions, eight measured a combination of two or three dimensions, and four studies measured only spatial (Brügger et al., 2021; Brügger, Morton, & Dessai, 2015), social-spatial (Berger et al., 2019) or temporal distance (Fesenfeld & Rinscheid, 2021). More than half combined multiple dimensions into one PD index for analysis, with good resulting internal consistencies (Cronbach's α = 0.68 to 0.97). Others used single items (Berger et al., 2019) or analysed dimensions independently (Singh et al., 2017; Spence et al., 2012; Steynor et al., 2020).

Phrasing of PD items differed between studies. Temporal distance sometimes referred to a concrete (though not uniform) number of years (Azadi et al., 2019; Zwickle, 2015), whereas other studies used relative frames, such as “distant future” (Chen, 2019) or “close in time” (Sacchi et al., 2016). Some items were ambiguous, for example, participants rating whether impacts were felt mostly close or mostly far away (Acharibasam & Anuga, 2018; Azadi et al., 2019; Chen, 2020; Gubler et al., 2019; Singh et al., 2017). A person who perceives impacts to occur at home feels very close to them – but what if they think impacts are felt both at home and far away? Arguably, this would indicate closeness, as impacts are still felt close to home, yet they might disagree with the statement ‘that impacts are felt mostly at home’. Similarly, spatial distance sometimes referred to risk for distant countries (e.g., Acharibasam & Anuga, 2018; Chen, 2020; Katz et al., 2020) and at other times to a global risk (e.g., Berger et al., 2019), which would include the self and could thus be perceived differently. Alternative phrasing (e.g., how close are impacts in space; Sacchi et al., 2016) can avoid this issue, but these ambiguities indicate that current PD measures reference a variety of different aspects and situations.

One recent study models an approach to simplifying measurements (Fesenfeld & Rinscheid, 2021). Participants were categorised as high urgency (judging both future and current impacts as serious) versus low urgency (judging only future impacts as serious). In addition to determining participants’ temporal distance more accurately, this operationalisation enabled the identification of climate sceptics, and therefore offers a concise measuring tool. Similarly, two studies combined PD items from multiple PD dimensions into two independent factors: proximal risk (whether impacts are perceived as close to home/now), and distant risk, (whether impacts are perceived as far away/in the future) (Brügger, Morton, & Dessai, 2015; Verplanken et al., 2020). Results showed that this distinction helped explain other variables such as emotions, behavioural intentions or policy support. How these approaches can be integrated into PD measurements will be discussed below.

Katz et al. (2020) are noted for their unique operationalisation of PD. Participants rated the risk to people of varying similarity (e.g., me, family, in developing countries …) within multiple timeframes, thus addressing interlinking PD dimensions. Although combining dimensions effectively, the measure is complex as it requires myriad items to capture different combinations of socio-spatial and temporal distances. It may be less feasible than a metric index, which is easier to analyse statistically. Wang et al. (2019) compared two scales: one involving the often-used items by Spence et al. (2012) with additional items combining dimensions (see Table 2.3); the other, a sliding-scale measure by McDonald et al. (2013). The former was found to be more reliable and of better explanatory value. However, neither was strongly related to construal levels, suggesting that distance in the context of climate change may be more independent from construal levels than in other contexts. Finally, as an indicator of PD, Carmi and Bartal (2014) assessed the extent to which future consequences are considered in decision-making (Strathman, Gleicher, Boninger, & Edwards, 1994), assuming that if a person with high consideration of future consequences shows higher concern than one with lower consideration, then the threat is a distant one. In this context, it was shown that the risk of climate change was only prioritised alongside other risks by those with a more future-oriented perspective, indicating that it is seen as a distant threat. These approaches demonstrate the variety of methodologies employed in PD research, each with benefits and drawbacks. In future research it may be desirable to standardise measurements within specific contexts, depending on which aspect of PD is being investigated.

Descriptive Levels of Psychological Distance. *S*tudies describe a wide range of perceived distance towards climate change. Those in relatively vulnerable countries of the Global South reported participants feeling very close to climate change impacts (Acharibasam & Anuga, 2018; Brügger et al., 2021; Rodríguez-Cruz & Niles, 2021; Steynor et al., 2020). Others, in Europe (Berger et al., 2019; Brügger, Morton, & Dessai, 2015), Iran (Azadi et al., 2019) and Israel (Carmi & Kimhi, 2015), reported participants feeling more distant. When the four dimensions were analysed independently, PD frequently differed between them. Concordant with qualitative findings, hypothetical distance (or uncertainty) was generally small, especially regarding whether climate change was happening (e.g., Gubler et al., 2019; Wang et al., 2019; Yu et al., 2017). Participants often felt more distant spatially than temporally and sometimes socially (Wang et al., 2019; Zwickle, 2015). It does appear that CLT dimensions often combine with high reliability into measurement indices, which suggests that they co-vary systematically.

Care should be taken as to the direction of the relationships between the different PD dimensions. For example, Katz et al. (2020) found an inverse relationship between temporal and socio-spatial distance, such that US students thought themselves to be the last to experience adverse consequences despite feeling socio-spatially close to those consequences. This is contra the CLT

assumption that dimensions are *positively* related. In order not to bias responses, it would be helpful to either assess all dimensions or to specify all dimensions that are not being assessed (e.g., by specifying a time scale). Otherwise, there could be a risk for participants to assume different reference frames (e.g., thinking about impacts at different points in time), which could influence their responses without the researcher's knowledge.

Associations of Psychological Distance with Other Concepts. In addition to the descriptions here, individual studies with significantly associated constructs are marked in Table 2.3 with an asterisk.

Pro-environmental behaviour and policy support. Several studies found that increased PD was related to lower willingness to engage in mitigating (Brügger, Morton, & Dessai, 2015; Carmi & Kimhi, 2015; Spence et al., 2012; Verplanken et al., 2020; Wang et al., 2019, Study 1; Xu et al., 2020) or adaptive behaviours (Azadi et al., 2019; Brügger, Morton, & Dessai, 2015). Others found no direct relationship (Chen, 2019; Wang et al., 2019, Study 2) or a full or partial mediation by concern (Chen, 2020; Spence et al., 2012), environmental attachment and conservation commitment (Fang et al., 2016), environmental ethics and perceived responsibility (Yu et al., 2017) or perceived self-capacity and vulnerability (Rodríguez-Cruz & Niles, 2021). Similarly, regarding policy support, some studies found that other variables were more important predictors than PD (Brügger, Morton, & Dessai, 2015; Wang et al., 2019), or suggest a mediation by concern (Singh et al., 2017). How detailed these policies are may be important: Fesenfeld and Rinscheid (2021) found that participants perceiving climate change as temporally close were more supportive of a general mitigation policy, but not of personally high-cost policies targeting meat consumption and fossil-fuel cars.

A final study illustrates the complex effects that PD can have on policy scenarios (Klinsky et al., 2012). When participants were asked to allocate climate change funds, some chose to give more money to socio-spatially closer countries that they identified with; others allocated more to the country furthest away, which may seem more vulnerable. In both cases, distance may have influenced the decision, but the meaning associated with that distance (identity, vulnerability) may have led to opposing results. These findings demonstrate that PD can sometimes be directly related to behaviour and policy support, but that it is often likely to function within complex mechanisms involving other variables. These are explored in the next section.

Moderators, mediators, and predictors of psychological distance. Several studies found reduced PD was associated with higher concern (e.g., Chen, 2020; Sacchi et al., 2016; Spence et al., 2012). Occasionally, this relationship differed for different dimensions. Gubler et al. (2019) found concern was predicted by hypothetical and social distance, but not spatial distance, whereas Singh et al. (2017) found concern fully mediated temporal distance and policy support relationships, but only partially for other dimensions.

Decreased distance was also related to a higher perceived risk of climate change (Carmi & Kimhi, 2015), increased habitual worry (Verplanken et al., 2020) and stronger affective reactions (Brügger, Morton, & Dessai, 2015; Carmi & Kimhi, 2015; Verplanken et al., 2020), the latter mirroring qualitative findings (Leviston et al., 2014). However, these effects may differ between dimensions, as feelings of dread have been found to rise with decreased socio-spatial distance, but not with decreased temporal distance (Fesenfeld & Rinscheid, 2021). This indicates that in some contexts, PD dimensions operate independently from each other, causing information to be lost in indices combining dimensions.

The concept of "personal relevance", often named in relation to PD, is typically thought to increase with reduced PD, even though theories such as CLT can account for personally relevant risks that are both proximal and distant from the self (Brügger, Dessai, et al., 2015). One study directly included personal relevance (Zwickle, 2015), wherein it was found to be separate from PD in an exploratory factor analysis, supporting the notion that it should not be conflated with proximity. PD acted as a moderator: increasing personal relevance was always related to increasing concern, but this increase was larger for participants feeling more distant towards climate change.

Looking at participants' worldviews, studies suggest that scepticism towards climate change is closely related to increased PD (Brügger, Morton, & Dessai, 2015; Wang et al., 2019). This is expected as hypothetical distance items commonly measure how certain participants feel about climate change taking place (e.g., Verplanken et al., 2020). Feeling uncertain about climate change will therefore be captured as both high scepticism and large hypothetical distance. Further, pro-environmental attitudes towards nature and environmental protection (Brügger, Morton, & Dessai, 2015), conservation commitment and environmental attachment (Fang et al., 2016), environmental ethics (Yu et al., 2017), the new ecological paradigm (Chen, 2020; Verplanken et al., 2020), the belief in a fragile environment (Wang et al., 2019) and a green self-identity (Verplanken et al., 2020), were all related to decreased PD. These relationships with stable characteristics support a conceptualisation of PD of climate change as relatively stable too.

Finally, studies suggest that some cognitive styles change participants' susceptibility to PD. One study investigated whether holistic mindsets would influence the PD and pro-environmental behaviour relationship (Sacchi et al., 2016). Participants with a strong holistic mindset (seeing things as interconnected and part of a larger whole) were less influenced by PD in their concern about climate change than those with a more analytic mindset (in which objects are thought of as more independent). Similarly, Wang et al. (2019) found participants with a weaker consideration of future consequences (i.e., the extent to which future outcomes to current behaviour are considered), also felt more distant towards climate change. However, links with individual construal level tendencies,

assessed with the behaviour identification form (BIF; Vallacher & Wegner, 1989) and response category width (RCW; Krüger, Fiedler, Koch, & Alves, 2014), were inconsistent. Both BIF and RCW measure how much a person thinks on an abstract versus concrete level, for example, sorting objects into fewer bigger groups (abstract thinking) or more smaller groups (concrete thinking). These studies found RCW to be unrelated to PD towards climate change, and BIF only to be related if it included environment-specific items. This indicates that while PD towards climate change may be unrelated to general construal level tendencies, there are other individual cognitive styles that may influence the effect of PD on people's climate cognitions.

Discussion of cross-sectional studies

Qualitative studies suggest that PD is important to people's mental representation of climate change, but that it is dynamic and multidimensional. Correlational studies often link decreased PD with increased mitigation and adaptation intentions, sometimes directly, sometimes mediated by pro-environmental attitudes or concern. This suggests that PD is worth investigating. However, methods employed, particularly in quantitative measures, are very diverse. Some studies focus on PD towards very specific aspects (e.g., location of a specific extreme weather event, identification with activists, timing of a mitigation project…), some on PD towards a general threat of climate change; some combine multiple PD dimensions into one index, some assess them separately; others use proximal (vs. distant) risk perceptions as indicators. Additionally, items are inconsistent in what they describe to be distant or close, further complicating comparisons between studies.

Despite these inconsistencies, we can learn several lessons from cross-sectional studies. Qualitative accounts indicate that PD of climate change is as multifaceted as climate change itself, leading to different levels of distance in different contexts. Dimensions also appear to be interlinked in complex ways. In CLT, it is assumed that dimensions are positively related. In the climate change context, it does seem like relationships between dimensions exist and that dimensions often co-vary systematically; however, contra to CLT assumptions, these relationships are sometimes inverse. For example, temporally close impacts can be perceived to be further away than temporally distant impacts (by Western participants). Some qualitative findings suggest that uncertainty can be thought of as applying to the other dimensions (e.g., in that people are uncertain about the spatial distance or proximity), as opposed to manifesting as a parallel dimension. These observations represent departures from PD as conceptualised in CLT, indicating that alternative measures may better describe distance in the context of climate change.

Informed by these findings, we make a few suggestions for alternative measures. First, it might be beneficial to focus on specific aspects of climate change (e.g., location of a specific extreme weather event, identification with activists, timing of a mitigation project) rather than the broad

phenomenon of climate change. This will focus measurement, as it might be overwhelming for participants to think of climate change generally without referring to personal and potentially changing reference points. Second, in terms of representing interlinked dimensions in a single measure, one option would be to combine multiple dimensions in items as described above (Katz et al., 2020), whereas another option would be to specify items explicitly, for example, setting a timeframe for spatial items. Another option might be to approach combining dimensions differently than the typical averaging. Findings indicate that participants not only specify different levels of PD on different dimensions, but also that these dimensions may have different effects on dependent variables. Consequently, it is possible that averaging dimensions into an index may lose some valuable information. Studies which restructure dimensions into the perception of proximal consequences and the perception of distant consequences offer an alternative approach (Brügger, Morton, & Dessai, 2015; Spence et al., 2012; Verplanken et al., 2020). In this operationalisation, a person can perceive consequences as simultaneously close and distant, for example, perceiving consequences to take place both far away and close to home. These studies suggest that the presence of proximal risks is more influential in determining risk perception than distant risks, meaning that information about proximity should be retained. One way to achieve this may be through addition. Scores could be added so that a high score constitutes proximity on all dimensions, a medium score constitutes PD on some dimensions and a low score constitutes distance on all dimensions. This would assume that all distance dimensions are similarly influential, as is the case when using an averaging index. In both cases, this equal-weighting assumption should be tested to ensure accurate information regarding general climate change perception.

Results are unclear as to whether PD can be thought of as a stable or a transient construct. On the one hand, qualitative accounts indicate that PD beliefs are dynamic and associated with high uncertainty, suggesting they may be updated following new information. On the other hand, PD is related to several stable factors such as identity, worldview and cognitive style. In this latter case, it is likely that its experimental manipulations increase the saliency of PD rather than change it permanently. Such different mechanisms may impact the effectiveness of interventions, and would therefore be important to study through further research. It is also possible that these different conceptualisations merely reflect different components of PD, some of which may be more malleable than others. In the General Discussion, we propose how research can investigate these potential components in more detail, while also addressing the other measurement issues.

Finally, the descriptive levels of PD show the importance of diverse samples, with smaller PD generally found in more vulnerable countries. It may also be useful to include other socio-demographic factors such as education, that are established as important predictors of climate change beliefs (T. M. Lee, Markowitz, Howe, Ko, & Leiserowitz, 2015). This would help to build a

picture of the determinants of PD and to investigate how much explanatory power PD can add, as well as inform the generalisability of studies.

2.3.2 Experimental Studies

In discussing experimental studies, we first describe and evaluate the main approaches to manipulating PD before discussing the effects of these manipulations on other variables. The 51 studies (Table 2.4) are mostly located in Western countries (*n* = 45), followed by 6 East Asian samples. Consequently, results will be generalisable primarily to these populations.

Table 2.4

Study characteristics of experimental studies

Study	Sample	Manipulation	Design	Manipulation check	Additional variables[c]
Bashir et al. (2014) Study 1	65 Canadian students (convenience sample)	Distance to same impact. Temporal	2 (distant vs. proximal) x 2 (mildly or very pessimistic about impacts) + control between subjects design	PD temporal, successful, η_p^2 = .09	PEB intentions*, pessimistic framing
Bashir et al. (2014) Study 2	182 Canadian students (convenience sample)	Distance to same impact. Temporal	3 condition between subjects designs: proximal vs. distant vs. control	PD temporal, successful, η^2 = .05, Hedge's g_s = .43[a] for close vs. distant/control. Close vs. distant n.s.	PEB*, outcome efficacy beliefs*
Brügger et al. (2016) Study 1	80 UK students (convenience sample)	Contrasting impacts (text). Socio-spatial	2 condition between subjects design: Global vs. local frame	Construal level, not successful.	Policy support, PEB intentions, risk perception, fear*, scepticism*
Brügger et al. (2016) Study 2 and Brügger (2013) Chapter 5[e]	330 UK residents (convenience sample)	Contrasting impacts (text). All 4	2 (manipulation order) x 2 (low/high levels of fear) x 2 (local vs. global frame) between subjects design	PD, partially successful, (p < .08), r = .10, Hedges g_s = .20[a]	Policy support, PEB intentions, risk perception*, liking*, group-efficacy, fear
Brügger & Pidgeon (2018)	32 Swiss residents (convenience sample)	Contrasting impacts (text). All 4	2 condition between subjects design: global vs. local frame	NA (qualitative interviews)	Multiple associations with different PD frames, switching, adjusting for prior beliefs
Busse & Menzel (2014)	938 German pupils (cluster sample)	In measurement of variables. Spatial	2 condition between subjects design: proximal vs. distant frame	NA (PD manipulated in measurement)	PEB intentions, other-oriented awareness of consequences*, self-oriented awareness of consequences*, perceived behavioural control*, helplessness*
Chu & Yang (2018)	1098 US residents (online panel)	Contrasting impacts (videos). Spatial	2 (distant or proximal) x 2 (novel or familiar climate impact) + control between subject design	Only in additional variables	Policy support*, concern*, affect, political ideology*, cultural worldview, environmental values, novelty framing
Chu & Yang (2019)	429 US residents (online panel)	Contrasting impacts (text). Spatial, social	2 condition between subjects design: distant vs. proximal condition	PD, partially successful, (social, but not spatial). p = .08, η^2 = .01[a]	Policy support, PEB intentions, concrete* and abstract* emotions, trait empathy*

Chu & Yang (2020a)	1282 US residents (quota sample from online panel)	Contrasting impacts and solutions (text). Spatial	2 (solution vs. impact frame) x 2 (proximal vs. distant) between subjects design	PD, successful, spatial η^2_p = .004, social η^2_p = .003, temporal/hypothetical n.s.	Policy support, PEB intentions*
Chu & Yang (2020b)	950 US residents (online panel)	Contrasting impacts (videos). Spatial	2 (distant vs. proximal) x 2 (health vs. economy impacts) between subjects design	Only in additional variables	Risk perception, policy support, economy vs. health frame*, ideology*, environmental value*, belief in climate science*
Duan et al. (2019)	450 US residents (online panel)	Contrasting impacts (images). All 4	2 condition between subjects design: abstract vs. concrete	PD, partially successful, (spatial Cohen's d_s = .30, Hedges d_2 = 28[a]. Other three dimensions n.s.)	Media use*, ideology
Ejelöv et al. (2018)	139 Swedes (convenience sample)	Contrasting impacts (text). Spatial	2 (proximal vs. distant) x 2 (concrete vs. abstract description) between subjects design	PD spatial, not successful, (but only addressed part of manipulation)	Emotion regulation strategy, willingness to self-change and repair, self-conscious emotions*, basic emotions
Evans et al. (2014)	147 NZ residents (cluster sample)	In measurement of variables. Temporal, spatial, social	2 condition between subjects design: proximal vs. control	NA (PD manipulated in measurement)	PEB intentions*, support for mitigation, belief in climate change
Fesenfeld & Rinscheid (2021) Study 2	4225 German residents and 4877 US residents (representative samples from panels)	Contrasting impacts (text). Temporal	2 (distant vs. proximal) x 2 (high-cost behaviour information vs. no information) + control between subjects design	Only in additional variables	Policy support for general climate change mitigation, policy support for policies targeting high-cost behaviours (meat consumption and fossil-fuel cars), feelings of dread, prior levels of urgency (temporal distance)
Fox et al. (2020)	190 US students (convenience sample)	Contrasting impacts (game). Temporal, spatial	2 (distant vs. proximal) x 2 (contingent on participant behaviour vs. non-contingent) between subjects design	PD (general "near/distant"), successful, R^2 = 3%	PEB intentions, policy support, risk perception*, self-efficacy
Guillard et al. (2019)	325 French residents (purposive sample)	Contrasting impacts (quasi-experiment). All 4	Quasi-experiment: recruiting people from area with and area without regular flooding	Successful, (PD of four dimensions to flooding), η^2 = .08[a]	Risk perception*, place attachment, PD of climate change*

Guillard et al. (2021)	286 French residents (convenience sample)	Contrasting impacts (videos). All 4	2 (distant vs. proximal) x 4 (spatial vs. social vs. temporal vs. hypothetical) + control between subjects design	PD, successful; combined PD index $\eta_p^2 = 0.07$, spatial $\eta_p^2 = .05$, hypothetical $\eta_p^2 = .09$, socio-temporal n.s.	Coping strategy*
Halperin & Walton (2018)	655 California residents (online panel)	Contrasting impacts and behaviour (text). Spatial, social	3 condition between subject design: local vs. global vs. control	Only in additional variables	Intention to mitigate*, to adapt*, policy support*, place attachment, climate change beliefs*
Hart et al. (2015)	556 New York property owners (random sample)	Policy frame. Spatial	2 condition between subject experiment: proximal vs. distant project	NA (PD manipulated in measurement)	Support for mitigation projects, affect related to climate change, affect related to mitigation project*, ecological beliefs
Johanssen et al. (2018)	109 Minnesota students (convenience sample)	Contrasting impacts (maps) and distance to same impact. Spatial	2 (proximal vs. distant extreme weather) x 2 (local vs. national map) within subjects design	Only in additional variables	Concern*
Jones et al. (2017)	333 Australian residents (convenience and online panel)	Contrasting impacts (videos). All 4	2 condition between subjects design: proximal vs. distant	PD, partially successful, (all but temporal). Spatial $\eta^2 = .03^a$, social $\eta^2 = .05^a$, hypothetical $\eta^2 = .02^a$. Temporal $\eta^2 = .01^a$, p = .08	Concern*, PEB intentions*
Kim & Ahn (2019)	193 South Korean and US students (purposive sample)	Contrasting impacts (text and images). Temporal	2 condition between subjects design: proximal vs. distant	PD (temporal, in pretest), successful, Hedges $g_s = 0.68^a$ for US participants, Hedges $g_s = 0.62^a$ for South Korean participants	PEB intentions, cultural understanding of time*, perceived relevance of manipulation*, attitude towards PEB
Kyselá, Tvinnereim et al. (2019)	1714 Norwegian residents (random sample)	Policy frame. Temporal, spatial	2 (temporal distance) x 2 (spatial distance) x 2 (air pollution vs. climate change) between subjects design	NA (PD manipulated in measurement)	Policy support*, ideology
Loy & Spence (2020)	508 UK residents (quota sample)	Contrasting impacts (text). Spatial, social	2 (proximal vs. distant) x 2 (global identity vs. control) between subjects design	PD, spatial and social, successful. Social d = .47, $\eta^2_p = .05^a$, spatial d = .87, $\eta^2_p = .16^a$.	Theoretical PEB (investment in information, budget allocation), PEB intentions, relevance*

Manning et al. (2017) Study 1	161 Minnesota residents (sampling unknown)	Contrasting impacts (text). Spatial, social	2 (Minnesota vs. Kenya) x 2 (people vs. birds) between subjects design	PD, spatial and social, partially successful: no main effects of social or spatial manipulations, but interaction $\eta^2_p = .16^a$	Willingness to donate
Manning et al. (2017) Study 2	67 Minnesota residents (sampling unknown)	Contrasting impacts (text). Spatial, temporal	3 condition between subjects designs: distant, proximal, control	PD (general: far/near) measured with Go/No-go Association Test, not successful	Climate change beliefs
Manning et al. (2017) Study 3	207 US residents (online panel)	Contrasting impacts (text). Social	3 (human, moose, tree) x 2 (empathy vs. objectivity) between subjects design	Only in additional variables	PEB intentions, personal distress, climate change beliefs
Mildenberger et al. (2019)	2201 San Francisco Bay area residents (online panel)	Contrasting impacts (map). Social, temporal	3 condition between subject design: control, local map of sea level rise, local map of sea level rise + storm	Only in additional variables	Concern*, willingness to pay, belief in climate change
Ngo et al. (2020)	348 Vietnamese pupils (purposive sample)	Contrasting impacts and actions (text). All 4	2 (information vs. action) x 2 (abstract/distant vs. concrete/proximal) between subjects design	Only in additional variables	Perceived responsibility*, PEB*, perceived severity of climate change*, perceived susceptibility to climate change*, self-efficacy*, response efficacy*, previous PEB*
Rickard et al. (2016)	Singapore (183) and US (193) students (convenience samples)	Contrasting impacts (text). Temporal	2 (New York vs. Singapore) x 3 (2020, 2047, 2066) + control between subjects design	PD temporal, successful, (temporal $\eta^2_p = .06^a$; spatial not measured)	Policy support, ideology*
Rinscheid et al. (2020)	1520 US residents (representative sample from online panel)	Policy frame. Temporal	Conjoint analysis (temporal levels: 2020, 2030, 2040, 2050)	NA (PD manipulated in measurement)	Policy support*, ideology
Romero-Canyas et al. (2019)	806 South Dakota residents (purposive sample)	Contrasting impacts (quasi-experiment). Spatial	2 condition quasi-experiment: recruited participants who saw (proximal) climate change campaign vs. not	Only in additional variables	Belief in climate change*, concern*, acceptance of scientific consensus*, openness to changing opinion*, policy support*, ideology

Sacchi et al. (2016) Study 2	170 Italian students (convenience sample)	PD measured, cognitive style manipulated. Spatial, temporal, hypothetical	2 condition between subject design: holistic vs. analytical frame	NA (PD not manipulated)	Cognitive style*, attitude towards environmentalism*, Commitment to the environment*, PEB intentions*
Scannell & Gifford (2013)	327 Canadian residents (random sample)	Contrasting impacts (text and images). Spatial	3 condition between subjects design: local vs. global vs. control	Only in additional variables	Engagement with climate change*, engagement with message*, place attachment
Schoenefeld & McCauley (2016)	99 US residents (convenience sample)	Contrasting impacts (text). Spatial	3 condition between subjects design: local vs. global vs. control	Only in additional variables	Climate change importance, PEB intentions, policy support, values*
Schuldt et al. (2018) Study 1	240 US residents (online panel)	Distance to same impact. Spatial, social	2 condition between subjects design: proximal vs. distant	PD spatial, successful, Cohen's d_s = .45, Hedges d_2 = 45[a]	NA
Schuldt et al. (2018) Study 2	251 US residents (online panel)	Distance to same impact. Spatial, social	2 condition between subjects design: proximal vs. distant	PD spatial, successful, Cohen's d_s = .33[b], Hedges d_2 = 33[a]	Policy support, construal level*
Shrum (2021)	1879 US residents (online panel)	Distance to same impact. Social, temporal	3 condition between subjects design: letter to future generation vs. essay about climate change impacts vs. control	PD temporal, successful[d]	Donation to climate mitigation organisation*, legacy motives*, climate change concern*, climate change baseline concern, political orientation
Shwom et al. (2008)	316 US residents (random sample)	Contrasting impacts (text). Spatial	2 condition between subjects design: regional vs. national	Only in additional variables	Policy support
Singh et al. (2016) Chapter 4	420 US residents (quota sample from panel)	Policy frame. Temporal	2 conditions between subjects experiment: proximal vs. distant policy	NA (PD manipulated in measurement)	Policy support*, policy impact*, prior PD towards climate change*
Soliman et al. (2018)	147 Canadian students (convenience sample)	Distance to same impact. Temporal	2 (distant vs. proximal) x 2 (norms vs. control) between subjects design	PD temporal, successful, Hedges d_2 = 0.36[a]	PEB intentions, previous PEB, social norms manipulation*
Sparkman et al. (2021)	3587 Japanese residents (stratified random sample)	Policy frame. Spatial, temporal	Conjoint analysis of policy proposals	NA (PD manipulated in measurement)	Policy support*, area of policy

Spence & Pidgeon (2010)	161 UK students (convenience sample)	Contrasting impacts (text, images, map). Spatial	2 (gain vs. loss) x 2 (proximal vs. distant) between subjects design	Only in additional variables	Attitudes to mitigation, severity of climate change*, recall of information, outcome manipulation, fear emotions, personal relevance, positive or negative implications
Stanley et al. (2021) Study 1	535 US residents (online panel)	Contrasting impacts (images). Temporal	2 condition between subjects design: past- versus future-oriented	Only in additional variables	Willingness to sacrifice, policy support, behaviour, political views, social dominance orientation, Zimbardo time perspective, nostalgia, certainty of changes portrayed in manipulation*, climate change belief
Stanley et al. (2021) Study 2	1102 US residents (online panel)	Contrasting impacts (images). Temporal	2 condition between subjects design: past- versus future-oriented	Only in additional variables	As above, but certainty only significantly related to condition interaction with political orientation
Tvinnereim et al. (2020)	22 011 residents of 9 countries (quota samples from online panels)	In measurement of additional variables. Spatial, social	5 condition between subject experiment: four distances + control	NA (PD manipulated in measurement)	Concern*
Wang et al. (2019) Study 3	320 Australian students (convenience sample)	Contrasting impacts (videos). Temporal	2 (concrete vs. abstract) x 3 (distant past vs. recent past/immediate future vs. distant future) + control between subjects design	Only in additional variables	PEB (donations), PEB intentions, construal level, time perspective*
Wharton (2020)	152 UK residents (convenience sample)	Contrasting impacts (text and images). Spatial, social, temporal	2 condition between subjects experiment: proximal vs. distant	PD spatial, social and temporal, successful. $\eta_p^2 = .17$, Hedges $g_s = -0.90^a$	PEB Intentions*, belief in climate change*
Wiest et al. (2015)	198 US residents and students (convenience sample)	Contrasting impacts (videos). Spatial	2 (local vs. global) x 2 (loss vs. loss and benefit) between subjects design	Only in additional variables	PEB intentions*, policy support*, perceived severity*
Yang et al. (2020)	175, 226 Singaporean students (2	Distance to same impact. Spatial, social	2 condition between subjects experiment: proximal vs. distant	PD spatial, successful. Cohens $d_s = .43$ Hedges $g_s = -0.42^a$ (sample	Risk perception, affective response*, policy support*, PEB intention*, construal level, ideology*, issue salience, environmental

	convenience samples)			1) and Cohen's d_s = .35, Hedges g_s = 0.35[a] (sample 2)	attitudes, perceived spatial ability, familiarity with Maldives
Zwickle (2015) Chapter 3 Study 1	364 Ohio residents (online panel)	Policy frame. Temporal	2 condition between subjects design: proximal vs. distant	NA (PD manipulated in measurement)	Policy Support, relevance of policy*, relevance of climate change, risk perception

Note. [a]Calculated from information in the text. [b]Private correspondence with authors; effect size corrected from the article. [c]Significant associations are marked with *. As in Table 2.3, we do not give effect sizes for dependent and associated variables as we do not want to suggest that studies are comparable. Instead, we want to provide readers with the opportunity to gain a quick overview over what variables were analysed and are associated with PD so that they can identify studies useful to their own research questions. [d]Effect size not given in the article or correspondence. [e]Both based on the same study, but as peer-reviewed article (Brügger et al., 2016) only presents some of the effects discussed, both references are given.

Presenting proximal and distant impacts

In the most common manipulation method, participants were given a description of distant or close impacts, for example, a report on impacts in the US versus Indonesia (Chu & Yang, 2018) or now versus in the future (Kim & Ahn, 2019). The description was frequently framed as news or a report and presented as a text scenario (*n* = 15), a video (*n* = 6), imagery (*n* = 3), maps (*n* = 2), a video game (*n* = 1) or a mix thereof (*n* = 4). This is a practically relevant application of PD to pro-environmental communication: every communication of impacts must reference a time, place, group of people and level of uncertainty. Comparing the effects of such different reference frames can therefore document unintended and intended effects of this messaging.

Twenty-three studies compared post-manipulation PD or construal level measures, 13 of which found a significant difference between experimental conditions in all targeted dimensions, with a further seven reporting partial success. These results indicate that some aspects of PD can be manipulated, but further research needs to establish how effective these manipulations are, since the measurement issues discussed for the correlational studies apply to these manipulation checks as well. For example, some studies used a PD towards climate change in general as a manipulation check (Loy & Spence, 2020), others measured distance towards the specific presented date (Rickard et al., 2016) or scenario (Fox et al., 2020). This not only makes the effectiveness difficult to compare, but also shows that the manipulation targets of studies ranged from very specific to very broad.

Two further observations about this experimental approach which may be helpful for future research. First, the places and times of reference used in the manipulations should receive attention, as these differed between studies. For example: (i) large spatial distance sometimes referred to a far-away country (e.g., Chu & Yang, 2020b) and sometimes to global impacts (e.g., Halperin & Walton, 2018); (ii) small spatial distance sometimes referred to the close community (e.g., Mildenberger et al., 2019), region (e.g., Halperin & Walton, 2018) or country (e.g., Chu & Yang, 2020a); and (iii) distant future sometimes constituted the next 10 years (Singh, 2016), 30 years (e.g., Fox et al., 2020) or the end of the century (Kim & Ahn, 2019). These differences may lead to variability in effectiveness of manipulations or engage different underpinning mechanisms. Future research should systematically determine which reference frame is relevant to a specific research context. Such decisions might rely on theoretical assumptions or be driven by applied goals, such as investigating common types of climate reporting.

Second, participants' prior PD beliefs may influence how materials are processed and therefore inform the effectiveness of manipulations. Supporting research comes from Brügger and Pidgeon (2018) who interviewed participants qualitatively after the experimental manipulation and found

that participants switched between spatial levels in patterns that suggested they were trying to accommodate their own prior beliefs. Another study incorporated prior PD beliefs as an additional predictor variable (Singh, 2016) and found that participants with higher PD were less likely to support near-future climate change policies. Contra to this, Fesenfeld and Rinscheid (2021) found prior PD beliefs to be unrelated to the experimental manipulation or policy support. Nevertheless, future research may benefit from measuring prior distance beliefs to judge the effectiveness of manipulations more successfully.

Changing perception of a fixed point in time or space

A further eight studies presented all experimental groups with the same scenario in time or space but manipulated the perceived distance towards that point. Three studies (Bashir et al., 2014, Studies 1 and 2; Soliman et al., 2018) had participants place a marker for the current year on a timeline. In the proximal condition, that timeline was very long (e.g., until year 2085), so that the distance from the current year to the placed year felt very short. In the distant condition, the timeline was very short (e.g., 2025), so that the distance between the two years seemed larger. In all three studies, participants in the proximal condition stated that the year felt significantly closer to the present than it did for participants in the distant condition.

Other studies manipulated perceived spatial distance by asking participants to scroll from their home, USA, to the Maldives on a computer (Schuldt et al., 2018 Studies 1 and 2; Yang et al., 2020). In the proximal condition, the map was zoomed out, so that the distance to the Maldives seemed small; in the distant condition, the map was zoomed in, so that the distance to the Maldives seemed large. The manipulation was successful with effect sizes ranging from d = .27 to d = .45. In comparison to the approach of presenting proximal versus distant impacts, manipulation checks were more standardised here, as PD was measured towards a specific year or place.

The final two studies used slightly different methodologies. One showed local and remote impacts either on a small-scale or large-scale map and found the scale to cause no difference in concern about climate change (PD not measured; Johannsen et al., 2018). This design used a within-participants, non-interactive manipulation, differing from the other designs, potentially explaining the different results. The other study used participant-generated narratives to change perception of the year 2050 (Shrum, 2021). Participants were asked to engage with future climate change impacts either by writing a letter to the future generation or by writing an essay, whilst the control group produced an unrelated essay. The letter task was found to decrease PD significantly compared to the other two tasks, suggesting this interactive approach may be another tool in decreasing distance towards climate change.

The above studies show that visual tools can be used to change the perceived distance towards a certain time or place. This could suggest that varying the presentations of impacts, for example, by varying the scale of maps or graphs, can influence participants' engagement with the materials and their resulting motivation to act. A recommendation for future research is therefore to test the extent to which these manipulations, as well the participant-generated narratives, can be replicated in applied settings.

Policy frames

In a third approach, studies manipulated PD towards policies rather than impacts. Four studies measured the support for policies implemented now versus in the future (Kyselá, Tvinnereim, et al., 2019; Singh, 2016; Zwickle, 2015) or where participants lived versus elsewhere (Hart et al., 2015; Kyselá, Tvinnereim, et al., 2019). No study tested PD towards the policies, and findings regarding policy support were inconsistent, with two studies finding no influence of PD on policy support (Hart et al., 2015; Zwickle, 2015) and one finding more support for policies taking place further into the future (Kyselá, Tvinnereim, et al., 2019). Lastly, it was found that participants who indicated feeling close to climate change supported future and present policies, whereas participants feeling more distant only supported future policies (Singh, 2016).

Further insights can be gained from two studies employing conjoint analysis (Rinscheid et al., 2020; Sparkman et al., 2021). Participants were asked to choose their preferred policy from pairings varying in attributes such as implementation date or location. Analysing these choices, researchers can ascertain the influence of different attributes on preferences. Rinscheid et al. (2020) showed that participants feeling close to climate change preferred policies which phase out fossil fuel cars in the near future to those with later implementation dates. In comparison, policy preferences of those feeling more distant towards climate change were not influenced by the implementation dates. Sparkman et al. (2021) presented participants with abstract policies with myriad attributes such as geographical area, expected time of benefit and the issues they were addressing (e.g., environmental quality, health care). Temporally and spatially distant policies received less support than proximate ones. Results also suggested that temporal and spatial distance added to one another in their effect on policy support, lending support to the additive PD measure proposed in our earlier discussion.

These findings support the idea that preference for policies may vary with their timing and location and that PD offers an interesting lens through which to investigate policy support. However, further research is needed to untangle mechanisms such as the role of prior PD level, which seems to be an important moderating variable.

Effects of manipulations on other variables

Below, we discuss the effects of manipulations of PD on key variables of interest, including: (i) outcome measures of behaviour and policy support; (ii) holistic thinking styles; and (iii) other mediators and moderators such as concern, efficacy beliefs and affect. We group these across all methods of manipulation to provide an overview of interesting patterns (significant relationships are highlighted in Table 2.4).

Mitigation and Adaptation Behaviour and Policy Support. Findings regarding direct relationships between PD and behaviour and policy support were mixed. Of those testing direct links, some found pro-environmental behavioural intentions to be higher in proximal conditions, although only three of those had manipulated PD successfully (Bashir et al., 2014; Jones et al., 2017; Wharton, 2020). Others did not record any differences in intentions or behaviour (e.g., Brügger et al., 2016; Busse & Menzel, 2014; Schoenefeld & McCauley, 2016; Stanley et al., 2021; Wang et al., 2019). Similarly, multiple studies found no differences in policy support (e.g., Brügger et al., 2016; Chu & Yang, 2019, 2020b; Fesenfeld & Rinscheid, 2021; Stanley et al., 2021), and those that did provided mixed evidence, some finding more support in distant conditions (Fox et al., 2020; Kyselá, Tvinnereim, et al., 2019) and some in proximal conditions (Chu & Yang, 2018; Wiest et al., 2015). Overall, results were inconsistent, both between and within the different approaches to manipulations.

Holistic Thinking Styles. Among the individual and cultural influences were several variables that describe some form of holistic thinking, with key variables being political ideology, cultural understanding of time, global identity, holistic mindset and trait empathy.

Political ideology was frequently included in US studies. Results showed that when presented with proximal information, most participants were willing to support policy or behaviour regardless of ideology (Chu & Yang, 2018; 2020a). In distant conditions, however, conservatives were likely to show less support (Rickard et al., 2016; Wiest et al., 2015; Yang et al., 2020). While these previous studies used comparisons of a near or far-away future in their manipulations, another study took a different approach by comparing climate impacts of the past with those of the future, finding inconsistent influences of political ideology (Stanley et al., 2021). Additionally, participant-generated narratives about the future were unrelated to voting choices, suggesting political identities are less prominent when presented with personalised information (Shrum, 2021). Variables such as self-enhancing personal values may also be related, with one study finding that this curtailed willingness to act when presented with proximal information (Schoenefeld & McCauley, 2016).

Kim and Ahn (2019) included cultural differences in the understanding of time between South Koreans and US Americans (Kim & Ahn, 2019). South Koreans generally perceived the future to be closer than Western cultures and were less impacted by distance framing than US Americans, so that they felt closer, more relevance and a higher behavioural intention in the distant condition than their Western counterparts. These effects are reminiscent of consideration for future consequences, which was suggested to have a similar effect in correlational studies (Wang et al., 2019). Further, stimulating global identity (by showing a video of a man dancing all over the world; Loy & Spence, 2020) or holistic mindset (Sacchi et al., 2016) decreased any difference between proximal and distant conditions. The latter was implemented with a Navon task, participants were presented with a large letter constructed of many smaller letters, and then asked to focus either on the large or small letters, stimulating a local or global focus. Adding a social dimension, participants with low trait empathy were more receptive to the social distance stimulation, showing a larger difference in social PD in response to proximal information (Chu & Yang, 2019).

All these variables are examples of large-scale, holistic thinking. Results, therefore, suggest that individuals or cultures with a more holistic thinking style may be more resistant to any demotivating effects of distant information. Besides controlling for these variables in manipulations, it may also help practitioners to consider their target group for communication measures. For example, a distant frame may be more harmful to Western, conservative individuals than to Southeast Asian or liberal groups. However, results also suggest that holistic thinking and global identity can be encouraged to prevent such effects, which may be helpful in climate communication.

Other Moderators and Mediators. In correlational studies, concern and risk perception were often associated with PD. Experimental studies provide mixed evidence towards these relationships. Some find risk perception (e.g., Guillard et al., 2019) or concern (e.g., Hart et al., 2015) to be higher in proximal than distant conditions. However, effects are sometimes inconsistent across conditions (Mildenberger et al., 2019; Romero-Canyas et al., 2019; Wiest et al., 2015), based on quasi-experimental designs (Guillard et al., 2019; Romero-Canyas et al., 2019) or on studies without manipulation checks (Chu & Yang, 2018). Other studies found no differences, although also without checking the manipulation of PD (Brügger et al., 2016; Chu & Yang, 2020a). In some instances, concern acted as a mediator between PD and behavioural intentions (Brügger et al., 2016; Fox et al., 2020; Jones et al., 2017), or was a stronger predictor of donations when PD was reduced (Shrum, 2021). Brügger (2013) showed the complex processes involved, whereby proximal information increased risk perception and willingness to act, but at the same time, through disliking of the information, decreased risk perception and willingness to act.

Emotional responses to climate change or the manipulation itself were included in several studies. In line with qualitative accounts, distant information was sometimes associated with weaker affect (Chu & Yang, 2018), although personal distress (Manning et al., 2017) and feelings of dread (Fesenfeld & Rinscheid, 2021) were found to be unrelated to PD in other studies. One study (Chu & Yang, 2019) separated concrete emotions (e.g., anger, fear, sadness and guilt) from abstract emotions (hope, anxiety and shame), finding that concrete emotions were stronger in proximal conditions. Another study found that participants in the local condition relied more on fear and those in the global condition relied more on scepticism in determining pro-environmental behaviour (Brügger et al., 2016). This suggests that different types of emotions may be associated with different levels of PD or otherwise impact decision-making processes and should be included in research.

Finally, PD manipulations sometimes acted as a moderator. For example, Chu and Yang (2020a) analysed the effect of presenting either economic or health risks of climate change, in reference to either participants' home country or a far-away country (Chu & Yang, 2020a). For those in the distant conditions, economic risks increased risk perception and policy support more effectively. For those in the proximal conditions, however, health risks outperformed economic risks in increasing policy support (though not risk perception). In further studies, distant conditions made an impact frame more effective than a solution frame (Ngo et al., 2020) and an abstract description increased abstract self-conscious emotions and willingness to act (Ejelöv et al., 2018). Other factors were more influential in proximal than in distant conditions, such as personal relevance (Zwickle, 2015), social norms (Soliman et al., 2018) and affect related to the manipulation (Hart et al., 2015). The notion that some factors may be more influential in distant frames, and others more influential in proximal frames, is supported by CLT (Brügger, Dessai, et al., 2015; Trope & Liberman, 2010). Here it is stated that in proximal frames, people tend to refer to concrete information for decision-making, which might include factors such as health risks, personal relevance, others' actions and opinions as well as immediate affective reactions. In distant frames, people would be more likely to refer to abstract information and emotions, which might include the focus on impacts (and not solutions) and (impersonal) economic risks. The exact mechanisms are yet to be established, but these results indicate the variables that might impact PD manipulations.

Discussion of experimental studies

Three main approaches have been used to manipulate PD: presenting proximal versus distant impacts, changing the perception towards a point in time or space or probing support towards policies with various levels of distance. The first two approaches both target impacts but differ in their application to climate change communication. In the first, it is assumed that portraying various locations or timings of climate change impacts can alter PD, which then impacts other variables. If

effective, this approach could be applied in information campaigns aiming to increase mitigation or adaptation behaviour. Results so far are mixed, potentially resulting from inconsistencies within studies that future research should aim to disentangle. In this process, research should determine to what extent these general PD beliefs are changeable within an experimental manipulation.

The second approach shows how different presentations of the same climate impacts may determine how distant those impacts feel, which in turn may influence general risk perceptions and policy support. Here, general PD is not manipulated, but PD towards a specific year or place. Results suggest that these different forms of presentation may effectively manipulate PD, but further research is needed to determine their influence on other variables and their effectiveness in applied settings. These results also suggest that PD towards a specific aspect of climate change may be easier to manipulate than general PD beliefs, although the latter may be a valuable control variable in the form of prior PD beliefs.

The third approach involves studies showing that temporal and spatial attributes of policies affect their associated support, and moreover, that this may be influenced by participants' prior PD beliefs. These results are informative for policy makers both in understanding how different attributes may influence policy acceptance, but also in understanding how this acceptance may differ for varying PD levels.

In all approaches, results indicate that links to behaviour and policy support may not be direct but are influenced by many other variables. For example, various forms of holistic thinking were shown to increase resistance to negative effects of increasing PD. This holistic thinking style could be experimentally induced (e.g., via the Navon task), an individual characteristic (e.g., considering future consequences of current behaviour) or a cultural tendency (e.g., East Asian cultures feeling a closer connection to the future then Western cultures). Additionally, some variables, such as economic framing, were shown to be more important in distant conditions; others, such as social norms, were more influential for decision-making in proximal conditions. These results indicate the different mechanisms resulting from distance manipulations. However, the current variety in manipulation and measurement styles results in difficulties in comparing studies, even when they are aiming to manipulate the same variables. In the next section we suggest how to address these inconsistencies and further develop the field of PD research.

2.4 General Discussion and Recommendations for Future Research

We have discussed 84 studies from 73 records, which empirically investigate PD in relation to climate change. Twenty-five studies employed a cross-sectional correlational design, eight a cross-sectional qualitative design and 51 an experimental design. Overall, there was high diversity in

findings, and broad range of approaches to measuring and manipulating PD. Studies investigated different topics (e.g., policies, impacts, mitigation), using different measurement styles (specific or broad aspects of climate change, analysing dimensions separately or together) and employing different reference frames (e.g., different timescales, global vs. distant effects). Results indicated that PD has been able to shed substantial light onto the perception of climate change, bringing attention to the different dimensions of distance that may influence people's beliefs. However, it has also been shown to be a complex construct, with interlinked dimensions and a dynamic understanding of PD depending on contexts. For example, lower distance was sometimes, but not always, associated with mitigation and adaptation intentions; experiments, if successful in manipulating PD, rarely showed direct effects on behaviour and policy support, but sometimes effects were mediated through variables such as risk perception and concern. Recognising the variety in foci and methods behind these studies, it is not surprising that the results are inconsistent when trying to integrate research. To develop research, an important question is therefore: can we unify all important aspects of PD in a single construct or theory, and if so, what *is* a useful conceptualisation and operationalisation of PD?

The reviewed studies suggest that CLT is not a suitable unifying theory. Specifically, this review identified three instances in which aspects of PD do not conform with CLT assumptions in the climate change context. First, our analysis supports observations by Brügger (2020) who suggested that PD is often used as a stable construct in climate change research, related to other stable characteristics such as values or ecological worldviews (e.g., Chen, 2020). Within classic CLT, PD is seen as a temporary attitude, and easily changeable (Trope & Liberman, 2010). While the reviewed experiments may have increased the saliency of PD, there are other approaches that may be more suitable to investigating stable distance beliefs and how to change them (Brügger, 2020). This review has been able to shed light on two additional points of mismatch between classic CLT and its application to climate change. CLT is classically applied to relatively simple decision-making situations (Trope & Liberman, 2010). Some of the reviewed studies use specific situations such as the distance towards a presented year (Soliman et al., 2018), but many others apply PD to climate change very broadly (e.g., Jones et al., 2017). In these cases, associations with factors such as emotions and identities can be assumed to be much more complex than accommodated for within CLT (Wang et al., 2021). Additionally, it is possible that in the broad applications, participants refer consciously or subconsciously to their own more specific reference frames to be able to respond to the items, which could make their responses less comparable. These different levels of measurement (very specific vs. very broad) and their implications may be partly responsible for the inconsistencies, with broad applications tending to show higher inconsistency than specific ones. Third, contra to the CLT assumption that PD dimensions are positively correlated (higher spatial distance should co-occur

with higher temporal distance), evidence has shown that PD dimensions regarding climate change are interlinked in more complex and often inverse ways, for example, with current impacts thought to be far away, but future impacts thought to be close.

CLT has thus been unable to provide a holistic explanation of these complex mechanisms, and it is unlikely that other unifying theories would succeed in its stead. Because the word "distance" has many subtly distinct meanings (e.g., physical distance, emotional distance, distant time), it may be impossible for a unifying theory to accommodate them all within a climate change context Brügger (2020) acknowledged this by proposing several other theories that might be useful in further investigating PD. However, there remains a challenge in trying to identify suitable approaches to investigating the role of distance in various aspects of climate change, without prematurely limiting research within a certain (potentially restrictive) theoretical paradigm. In Chapter 3, we discuss in more detail how the present literature review, combined with a meta-scientific perspective, may help us identify the most effective and efficient way forward in understanding distance-related aspects of climate change.

2.4.2 Components of Perceived or Psychological Distance

In addition to reflecting on alternative theoretical approaches, researchers might also benefit from thinking about different components into which PD can be divided. We believe there is value in distinguishing between objective distance and perceived distance in the climate change domain. In CLT, psychological distance is named as such because it is a subjective sense of distance that can be reconstrued, not an inherent property of an object (Trope & Liberman, 2010). Typical experiments manipulating PD within this paradigm include having participants focus on different parts of the same landscape (Bar-Anan et al., 2007), using different language to talk about the same persons (Stephan et al., 2010), or testing implicit associations between high-distance words (theirs, stranger) and low-distance words (ours, friend) (Bar-Anan et al., 2006). In the context of climate change, it might be helpful to acknowledge that, unlike in the CLT scenarios, there is an objective distance component which can be differentiated from the susceptibility to that distance, both of which might come together to make up perceived or psychological distance. For example, when people express where and when they believe impacts to be happening, this speaks to an objective distance belief. How they then perceive those places and time periods will determine how those objective distances are perceived.

While this distinction between objective distance and a person's susceptibility to this distance is a novel contribution of this analysis, neither of these components themselves are new: for example, Spence et al. (2012) investigate the location of impacts by asking whether participants' local areas will be affected; Schuldt et al. (2018) investigate the perception of a single location by

changing their presentation; and other studies investigate something in between, such as participants' first thoughts about impacts (Jones et al., 2017) or whether they perceive impacts in certain locations as a threat or concern (Fesenfeld & Rinscheid, 2021; Steynor et al., 2020). Understanding that these different approaches may tap into different components of distance might help more fully understand the phenomena involved.

Distinguishing between objective distance and susceptibility to distance would facilitate the integration of other theoretical knowledge, providing similar benefits to the distinction between the contexts described above. For example, the objective distance component might be explained (and changed) with mental models or Bayesian updating paradigms, which describe what information people hold about impacts. Susceptibility might be better analysed, however, with individual characteristics such as consideration of future consequences and identification with all humanity, as well as people's general attitudes towards specific places such as whether they constitute objects of care (Wang et al., 2018). It is possible that this distinction could separate stable components of distance from more transient aspects. This could be investigated by analysing the different components for longitudinal changes or successful manipulations.

2.4.3 Other Methodological Considerations

The studies in this review showed that there are some general methodological considerations that require attention in future research. One clear example is the inclusion of diverse samples. The correlational studies clearly demonstrate that people across the world will have different perceptions of distance. It is likely that this is due not only to cultural variations, but also to differences in the actual distance towards climate impacts and in how climate change is reported on and construed socially. Qualitative and experimental studies are currently focused on Western countries and should be diversified in the future, as well as looking at other demographic variables. For example, younger people might feel more connected with the global world, not least due to familiarity with technological advances. It would be fruitful to see if other demographic variables are related to differences in distance beliefs. Finally, the analysis and discussions of cross-sectional measurements and experimental manipulations included several suggestions on how to improve research around distance constructs. Individual research questions and designs will determine which of these considerations are relevant and we encourage researchers to consider these sections (Chapters 2.3.1 and 2.3.2) in their application of distance research.

2.4.4 Limitations and Risk of Biases

This review included many studies, focusing on emerging trends in the evidence rather than assessing and summarising individual records. Consequently, the studies comprised numerous methodologies and variables, making it less meaningful to apply the overarching quality criteria

recommended for systematic reviews of standardised studies such as randomised control trials (Moher et al., 2009). We therefore integrated considerations regarding the quality of evidence within the discussion of study categories themselves. This way, indicators associated with different research designs could be treated within context, whereby their impact on evidence patterns was directly integrated into conclusions. For correlational studies, we extracted and discussed the sample origin, research design and operationalisation of variables, the latter with a strong focus on the operationalisation of PD measurements. For experimental studies, we additionally described the experimental designs and methods of manipulation, emphasising manipulation checks.

There are additional limitations to this literature review that should be noted when interpreting findings. First, the search strategy focused on scientific databases. Because of the considerable number of relevant studies this produced, we did not additionally search for and include other grey literature. It is possible that this led to a bias towards significant results. However, since the presented evidence is inconsistent and includes findings of varying significance, we do not expect that any studies with unpublished, non-significant data would contradict the conclusions provided in this chapter.

Second, our quality assessment of studies was targeted at criteria relevant for understanding the evidence regarding PD of climate change. This meant that assessment was focused on operationalisation and manipulations of PD. Other criteria focusing on individual studies were outside the scope of this review. We recommend that future research use the index of studies provided here to examine those studies relevant to their specific research questions.

Third, there are several concepts in the literature that may be related to the PD of climate change. Examples include temporal discounting, values such as self-transcendence (Brosch et al., 2018), and tools such as episodic future thinking (Bø & Wolff, 2020; P.-S. Lee et al., 2020). These concepts, and lessons learned from their applications, should be considered during the development of future research.

2.5 Conclusion

The PD of climate change is an important concept that has been increasingly studied in recent years. In this review, we provide an index of studies empirically investigating PD in this context, including ones that used qualitative, correlational and experimental designs. Evidence shows that PD is a multifaceted construct when related to the highly complex issue of climate change. There are links between PD and climate perception and action, but these are inconsistent in size and often moderated or mediated by other variables. Additionally, the substantial variety in areas of application and approaches to measurement make it difficult to compare or attempt to unify the

studies under one theory such as CLT. We propose that it might be more effective to research different aspects of distance of climate change in a bottom-up manner, investigating specific applied contexts such as the location of impacts, acceptance of policies or the distance between behaviour and outcome. By using these bottom-up, context-driven research approaches, it may be easier to describe the observed phenomena, draw together relevant theoretical explanations from other areas and in time explain or utilise knowledge about the role of distance in climate change. Additionally, we suggest increased clarity is required in relation to different potential components of distance, such as objective beliefs about the location and timing of climate impacts, as well as the perception of those places and time periods. Understanding these different components could not only help researchers comprehend inconsistent effects around the distance of climate change, but disentangle stable and transient aspects, to understand how to best utilise them in climate communication.

3 The Way Forward: Identifying Effective and Efficient Approaches to Understanding Distance in Climate Change

3.1 Using Meta-Scientific Perspectives to Understand Theoretical Challenges for Psychological Distance

In Chapter 2, we presented a systematic review of studies applying CLT and psychological distance to climate change perceptions and action. The review showed that the evidence produced by this literature is often inconsistent. Associations between higher distance and concern or behaviour are not always present, and manipulating psychological distance has produced mixed effects on people's climate perceptions and their action intentions (Brügger, 2020; Brügger, Dessai, et al., 2015; Maiella et al., 2020; Wang et al., 2021). What makes these inconsistencies less surprising is recognising the wide range of contexts that are researched under this umbrella of psychological distance. Within this field, studies: investigate perceptions of climate change (Aslam & Rana, 2022); measure support for policy proposals (Sparkman et al., 2021) or mitigation projects (Galati et al., 2021); test for the effects of different frames of information (Altinay, 2017) or different presentations of the same timeline or map (Bashir et al., 2014); and examine abstract or concrete climate change imagery (Duan et al., 2019). Additionally, we have shown the wide variety of research methods that have been employed in studies, including many different operationalisations of psychological distance itself.

In principle, testing a theory through a variety of research methods (e.g., study designs, measurement instruments, manipulation materials) and against various contexts is usually a good approach. Such an approach can provide substantial supporting evidence to corroborate a theory. However, problems arise when this confirmatory research tests a theory that is not grounded in a solid descriptive basis. In psychological research, it is essential to establish concepts or phenomena before trying to explain their causes or finer mechanisms through confirmatory testing (Eronen & Bringmann, 2021; Haig, 2013; Scheel et al., 2020). In cases where researchers apply a theory that is premature or inappropriate to explain their research questions, the field can run into problems. For example, when multiple researchers continue to adapt a theory to their inconsistent results, this can lead to degenerative research lines – in which the theory is continually changed, but without significantly improving its predictions (Scheel et al., 2020). The end result can be a multitude of theories that overlap slightly in their constructs but are not falsified (Eronen & Bringmann, 2021). Such a multitude of premature theories, the (confirmatory) applications of which often result in inconsistent findings, makes it difficult for both researchers and practitioners to reliably interpret and utilise the resulting knowledge.

We propose that such a process may have taken place in the area of CLT and climate change perceptions. Since the concept of psychological distance is intuitive and addresses issues that are clearly relevant in climate change perceptions, researchers have applied it to a wide variety of climate contexts. This is especially understandable in an area such as climate change research, which requires urgent action and in which researchers may be reluctant to take the time to conduct explorative and descriptive research if there is the promise of an intuitive theory (Van Valkengoed et al., 2023). However, reviewing the CLT and climate change studies so far, as we have done in Chapter 2, raises the question of whether these different contexts and dimensions really do have the same underlying phenomena and can be usefully described by a single theory. Our review suggests that, while a large number of studies are reportedly based on the same theory of CLT, the variety in research methods and contexts described in the literature review reflects how much the interpretation of this theory varies.

The point of this argument is not to discount past research. Previous studies provide valuable insights into effects relating to distance around climate change, to be built upon in future work. However, there is rising recognition of the fact that past approaches in the area of psychological distance – primarily via CLT – may be not the most fruitful way to engage with the topic of climate change (Brügger, 2020). Additionally, studies and communication strategies inappropriately employing CLT may even cause harm: first by recommending ineffective strategies to policy makers and thereby slowing climate research and action; and second, by inadvertently upholding the narrative that most people perceive climate change as distant and unimportant (Van Valkengoed et al., 2023). The challenge is therefore to identify an effective way forward within this field. Based on the reasoning laid out above, we believe that looking for alternative theories might run the same risk as previous research: as there is no descriptive basis describing the phenomenon of climate change perceptions, any theory chosen to apply to this context will likely be slightly misfitting and premature. We also suggest that the problem is deeper than this: climate change is such a large and complex topic that it will be extremely difficult to describe any universal underlying phenomena of climate change perceptions and actions. Therefore, identifying or building universal theories to describe these areas will either be impossible or, at the very least, highly unlikely. Instead, it seems more likely that different climate change contexts, with their complex spatial, social, temporal and hypothetical dimensions, will require different methodological and theoretical approaches in order to be adequately understood.

There has already been some work suggesting alternative theories which could be fruitfully applied to certain aspects of distance in climate change perceptions (Brügger, 2020). However, the risk of applying such theories prematurely still applies. Below, we outline a strategy that can help

researchers decide whether their research context: requires more exploratory, descriptive research; allows the application of existing theory or theories; or is at a state which allows them to build new theory. We propose that the key to these decisions is not in investigating climate change perceptions or climate action as a general phenomenon, but instead to focus on phenomena in specific contexts.

3.2 Bottom-up Research in Action: Understanding Different Types of Distances by Context

Working from a context-based starting point, rather than a theoretical one, has multiple benefits: it allows researchers to examine the existing evidence more holistically; it helps them to identify whether a descriptive basis already exists; it helps them to conduct explorative research to build this descriptive basis if required; and it helps them choose appropriate methodology. Below, we will use several examples to show how these benefits may apply in different distance-related contexts.

A common topic in CLT climate change research is the location of climate impacts and how such locations relate to climate action. This line of questioning is not exclusive to CLT, as for example place-based research has long investigated how people's relationships with their own places influences their reactions to climate impacts (e.g., Scannell & Gifford, 2013). However, researchers who are working in a theory-confirmation mindset may be less likely to utilise this already available evidence. On the other hand, a context-based perspective helps researchers utilise already existing findings and therefore improves and accelerates the acquisition of knowledge. For example, people's beliefs about where climate impacts occur may be influenced by their mental models of climate change (Bostrom, 2017) and their sources of climate information and willingness to consider new information (e.g., through Bayesian updating; Cook & Lewandowsky, 2016). Their feelings about those locations may be affected by the physical distance between the locations and themselves (often used as PD), as well as their familiarity with the locations (Yang et al., 2020), whether they care about them (Objects of Care; Wang et al., 2018), whether they identify with the affected people (global identity, e.g., Loy, Reese et al.'s, 2021; Social Identity Approach; see also Mackay et al., 2021), and personal characteristics such as empathy (e.g., Chu & Yang, 2019) or cognitive style (e.g., holistic versus analytical thinking; Sacchi et al., 2016). As shown in Chapter 2 (the systematic literature review), people's feelings about locations are also linked to the timeframe given or assumed in which climate impacts take place. Specifying or measuring this timeframe is therefore important when studying the spatial dimension of climate impacts.

In the context of policy, there are also several factors that can influence support for action on climate change. Examples include the targeted location and the timeline of benefits (Sparkman et al., 2021), as well as variables such as climate justice and fairness (Bergquist et al., 2022). Other contexts that have received less attention include the role of distance in behaviour, such as the gap between one's actions and their outcomes, or the social distance towards those negotiating or protesting about the climate crisis (Wang, 2021).

The theoretical frameworks mentioned above are not exhaustive, and there may be many other fields that can provide relevant insights when studying specific research questions. Our goal in discussing these frameworks is to demonstrate that by focusing on applied contexts rather than limiting ourselves to a particular theory or concept, it may be easier to identify the various components that contribute to different aspects of distance. This can help us bring together relevant knowledge to better understand complex situations.

There is also a methodological benefit to context-based research: it may help to more accurately identify the causal relationships associated with aspects of distance. One challenge in psychology, which is also the case in CLT and climate change research, is that interventions often try to manipulate psychological causes such as PD. However, it can be difficult to change just one psychological variable without inadvertently affecting other variables, making it hard to conclude that changes in the dependent variable (such as concern) are due to the psychological variable (such as PD) (Eronen, 2020). The systematic literature review suggested that this might have been an issue when manipulating PD: unsuccessful and inconsistent manipulation checks indicated that the target variable of a manipulation is not always clearly identified. In contrast, when non-psychological variables are manipulated (such as the location of climate impacts or the starting point of policy), the effects can be more clearly attributed to these non-psychological characteristics. By being explicit about the applied context being studied, researchers can more clearly identify what they are measuring or manipulating and gain a better understanding of which phenomena occur in which contexts, rather than continuing to face the challenge of manipulating hypothesized psychological causes.

The above examples are situations in which PD is only one of the possible factors influencing a particular context. However, researchers should also be aware of other research areas that use the term distance or distancing as part of alternative theories. For example, a strategy of distancing oneself is seen as a common emotion regulation tool when faced with overwhelming climate consequences (Pihkala, 2022a). It is critical to be aware of these related research areas, both to ensure that terminology is appropriately defined in one’s own research and to relate or contrast concepts with similar terminology, to be able make use of relevant evidence.

The remainder of the thesis will apply this understanding and focus on one specific aspect of climate change perceptions: the location of climate change impacts. As climate change accelerates around the globe, the frequency of observable impacts will increase greatly. However, impacts will remain unequally distributed across the globe both in terms of type and severity (IPCC Working Group 2, 2022). It is therefore more important than ever to understand how people's perceptions to these impacts around the world varies depending on their location. In the following chapter, we will apply the reasoning laid out above to this particular context of climate change impact locations, reviewing and introducing a framework of place affinity to better describe people's relationships with such affected places.

3.3 Introducing Place Affinity and Place Beliefs

In the previous chapter, we explained why focusing on specific contexts within climate change perceptions is important to build robust knowledge around perceptions of distance. As described above, we will now apply these principles to the context of climate change impacts and the places where they occur. We will demonstrate that people's personal relationships with affected places are not restricted to (psychological) distance. In fact, research has already established a number of further constructs relating to people-place relationships in the context of climate change, such as social identification (e.g., Fielding & Hornsey, 2016) and more recent concepts such as objects of care (Wang et al., 2018). We integrate these constructs in a framework of place affinity. In this framework, place affinity is a broad concept determined by the various factors (termed place beliefs) that are relevant to people-place relationships in this context. We propose that this broad concept of place affinity is useful and necessary to capture the diverse aspects relevant to people-place relationships in the context of climate change impact. As shown in the previous chapter, bottom-up research allows us to collate knowledge that has already been acquired on a particular subject from a variety of perspectives, thus providing a solid evidence base on which to build further research. Place affinity allows us to do just that in the context of climate change impact locations, utilising a framework in which any established or emerging constructs influencing the perception of those locations can be included as a place belief. As such, it is different from concepts such as place identity or place attachment (Droseltis & Vignoles, 2010; Manzo, 2003; Scannell & Gifford, 2013), which also speak to people-place relationships but are narrower theories established to answer specific research questions, and thus unable to integrate research from a variety of perspectives.

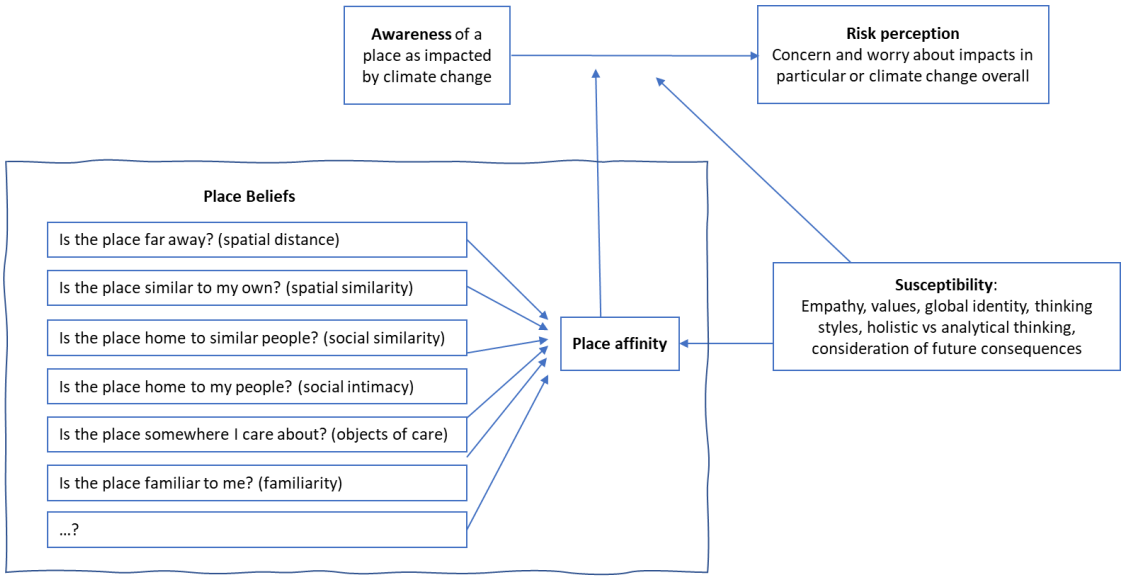
In this chapter, we will review literature surrounding the process of people's perception of climate impact locations, including: (a) the places that people think of as being impacted by climate

change; (b) the place affinity framework, including place beliefs relevant to place affinity and how these may influence how these impacts are perceived; and (c) people's susceptibility to place affinity, measured through individual characteristics such as empathy, which may determine the intensity of these place beliefs and their effects on climate change perceptions.

In Figure 3.1, we present a visual summary of the different processes that relate to the perception of climate impacts. This place affinity framework is portrayed in the smaller box. In this chapter we will review both the surrounding processes as well as various place beliefs. The literature reviewed in this chapter has been drawn from the systematic review presented in the previous chapter as well as additional reading on related concepts to include a wide range of place beliefs.

Figure 3.1

Processes around the effects of place affinity



Note. Depicted are the processes reviewed in this chapter. The place affinity framework refers to the place affinity as predicted by several place beliefs, as shown inside the "Place Affinity Framework" box. In the list of place beliefs, the bottom box containing a question mark signals that the framework is open to more place beliefs being added as research develops.

3.3.1 Place Awareness: Which Places Come to Mind When Asking People About Climate Impacts?

Place awareness, in the context of this study, is defined as which places people are aware of as being impacted by climate change. Considerable insight into these perceived locations comes from the literature on spatial psychological distance (PD), which is a concept from Construal Level Theory (CLT; Trope & Liberman, 2010). Psychological distance describes how spatial, social, temporal and hypothetical distance between the self and another object influences our thinking and decision-making processes. Consequently, many cross-sectional studies of psychological distance have measured how far away people feel from climate impacts. In some studies, participants indicated that the impacts of climate change take place far away spatially (e.g., Katz et al., 2020; K. Lee & Barnett, 2022; van Valkengoed et al., 2021); in other studies, impacts were seen as close by (e.g., Acharibasam & Anuga, 2018; Rodríguez-Cruz & Niles, 2021; Spence et al., 2012). Additionally, a recent review of opinion polls indicates that the majority of people in many countries perceive climate change to be psychologically close (Van Valkengoed et al., 2023). These differences could be partly due to the geographical locations of impacts, which often take place in the global south.

Consequently, for example, Puerto Ricans (Rodríguez-Cruz & Niles, 2021) reported lower levels of distance to climate change impacts than those in Western countries such as the Netherlands and USA (van Valkengoed et al., 2021). However, the methodology of many empirical studies and opinion polls may also mean these findings may not necessarily reflect everyday thought processes about place awareness correctly. For instance, the above studies asked participants to agree with whether climate impacts are happening in a certain location such as their home country. They may well agree with this statement in principle and at the same time, in everyday life, more frequently associate other places with climate change impacts (e.g., because of iconic imagery such as droughts, glacial landscapes or polar ice caps, which have long been presented in the UK media; O'Neill & Smith, 2014). It is therefore important to investigate specifically which places people are freely recalling as impacted by climate change (rather than just recognising), because their relationships with these spontaneously recalled places may be the more salient one in their considerations of climate change in general.

3.3.2 Place Affinity: How Do People Relate to Places Impacted by Climate Change?

Once we understand which places are salient to people as locations that are impacted by climate change it is then important to understand how people feel towards these places. We adopt the term place beliefs to describe the beliefs that people have about a place. We further propose that there is a set of place beliefs that together make up the notion of place affinity, which can explain people's various reactions to places under threat from climate change. In the following we review the literature that concerns place beliefs relating to risk perception in the context of climate change.

Spatial Distance and Spatial Similarity

One aspect of place beliefs frequently proposed to be related to risk perception is that of *spatial distance* and *spatial similarity*. Perceiving climate change as threatening places that are close to one's location has sometimes been found to be related to higher concern about climate change (Sacchi et al., 2016; Spence et al., 2012), and higher intentions to mitigate (Brügger, Morton, et al., 2015; Spence et al., 2012; Wang et al., 2019) or adapt (Azadi et al., 2019; Brügger, Morton, et al., 2015). At other times, however, no such relationships have been found (e.g., Gubler et al., 2019) and the systematic review presented in Chapter 2 – as well as other recent systematic reviews – indicate that there is little overall evidence for these pathways (Van Valkengoed et al., 2023). Additionally, disentangling the role of spatial distance from related concepts is currently difficult. Most of the previous studies investigate spatial distance in combination with social, temporal or hypothetical distance, which are then challenging to tease apart (Carmi & Kimhi, 2015; Verplanken et al., 2020). People also typically exhibit spatial optimism, believing that things are better in their own location

than in other places (Gifford et al., 2009), which might lead to a different assessment of impacts in places that are close to one's own location or far away from it. It is thus not clear how exactly spatial proximity relates to risk perception, or to what extent different levels of spatial distance have an impact on risk perception. Moreover, studies sometimes combine spatial distance and similarity, for example, formulating some items on spatial distance (e.g., "my local area will be affected"), others on the types of places under consideration or their similarity (e.g., "mostly developing countries"; both Spence et al., 2012). These two aspects could work in different ways despite being clearly related. Spatial distance, on the one hand, might speak more to whether one is personally likely to be affected by climate change. Global climate patterns are difficult to understand, but if a drought or storm is physically close to a person, it is more likely that it will reach and affect them directly. Spatial similarity, on the other hand, could work more like a heuristic: if a person thinks that places similar to their own are affected, this may increase their perception of their vulnerability (since similar types of landscapes are recognised to be vulnerable) and their perception of adaptation strategies (since a similar place will require similar measures). Even if spatial distance and spatial similarity have the same effect, it is conceivable that they can differ in their descriptive levels. For example, regions such as the north of the USA and northern Europe may engender perceptions that their climates and natural landscapes are more similar to each other than they are to places that would be spatially much closer to them, such as Central America or Southern Europe. Measuring similarity and distance combined, then, would obscure these differences, making separate measures preferable.

Social Similarity and Intimacy

Of course, a large part of our relationships with places relates to the people living there. In previous research, people's social attitudes toward places have often been referred to as relating to *social distance*. As outlined by Wang et al. (2019), social distance can encompass both social similarity (the perceived similarity between the self and those in an affected place) and social intimacy (the degree of personal connection with those in affected places, such as family and friends). Operationalisations of social distance target either, or both, of these aspects, asking participants variously whether climate impacts will affect them personally, people around them, their family, people similar to them, people in their country or people in developing countries (Gubler et al., 2019; Rubio Juan & Revilla, 2021; Spence et al., 2012; Xu et al., 2020).

An examination of relevant research helps to untangle these effects. Social intimacy is relatively straightforward; if a person, their family or their friends are affected, we can expect this to have a different impact than if only strangers are affected (Wang et al., 2018). Regarding social similarity, there is more variety in its operationalisation and key underpinning assumptions. Some items ask whether people in their community, their country or in different countries are affected,

assuming that participants feel similar or dissimilar to those groups (Aslam & Rana, 2022). Others ask about social or professional groups such as "farmers like me" (Azadi et al., 2019; Rodríguez-Cruz & Niles, 2021). From the social identity literature, we know that an identification with all these types of groups – profession-based, society-based or interest-based – is possible (Fielding & Hornsey, 2016), but we also know that these identities are fluid, and change depending on context and saliency (Mackay et al., 2021). In an explicit link to other place beliefs, Swim and Bloodhart (2018) additionally suggest that social group membership can be grounded in both spatial distance (e.g., living in the same place) and spatial similarity (e.g., living in a similar landscape). In future research, it would therefore be helpful explicitly to prioritise establishing the current extent of identification or similarity (as one aspect of identification) with affected groups. This is important, since we generally expect a person to work towards protecting their own social group or category (Masson & Fritsche, 2021) if they are threatened.

Descriptively, evidence suggests that participants in the Global South feel relatively close or similar to people living in affected places or feel directly affected by climate impacts themselves (Acharibasam & Anuga, 2018; Rodríguez-Cruz & Niles, 2021; Steynor et al., 2020). In contrast, participants in Western countries feel relatively dissimilar to or far removed from those living in affected places (Berger et al., 2019; Gubler et al., 2019; Wang et al., 2019). The effects of such differences in social similarity and intimacy are not yet clear. For example, Spence et al. (2012) found that for British participants, believing similar people to be affected was related to larger concern and willingness to mitigate. However, a higher perceived threat to developing countries, while not related to concern, was associated with a higher willingness to act. Similarly, Shackley (2021) found that for a US sample, a perceived threat to developing countries was related to higher pro-environmental intentions; much more so than believing in personal harm. Based on this evidence, it would be worthwhile to assess directly whether people feel similar to, are intimate (related or friendly) with, or identify with those in affected places. Such aspects of social relations seem to play an important role in climate perceptions such that bringing together the different strands of research may help understand these complex effects in more detail.

Place Attachment and Identity

Place identity and *place attachment* are two closely related concepts that have been conceptualised and measured in various different ways throughout their existence in environmental psychology, but are generally defined to mean a personal, emotional and cognitive connection with a place, or place-based community (Droseltis & Vignoles, 2010; Manzo, 2003; Scannell & Gifford, 2013). This connection can relate to local places, but also at a larger level to one's own country or even the world (Lewicka, 2011). In the context of place beliefs, it could be argued that identifying

with or feeling attached to a particular place may influence how one would react to that place being threatened by climate change. However, in a recent meta-analysis, links between place identity and pro-environmental intentions or behaviour were not found to be as strong as other forms of identity (Vesely et al., 2021). Additionally, studies which presented participants with information about global or local climate impacts and measured attachment to these places found that while place attachment was linked to climate engagement overall, it was not helpful in explaining responses to the local versus global conditions (Altinay, 2017; Halperin & Walton, 2018; Scannell & Gifford, 2013). It is possible that place attachment, in the context of climate change impacts, suffers from similar problems as the concept of psychological distance: that it is defined very broadly and intuitively encapsulated a number of different aspects of a connection with a place, which are investigated to varying degrees in theory and research (Manzo, 2003). We therefore focus on the other place beliefs, which make up more specific, primary beliefs about a place which can then be aggregated more comprehensively into the concept of place affinity.

Objects of Care

The concept of *objects of care* was developed by Wang and colleagues (2018) to explore why people do or do not feel emotions about climate change. Specifically, they propose that caring about climate change does not mean caring about the abstract issue itself, but about objects, people, ways of life, places and any other things that it may damage, effectively addressing concepts such as social intimacy, identity and place attachment. Consequently, measuring whether people care about an affected place should be informative in terms of their perceptions of the risk to that place.

Wang and colleagues (2018) support this notion in two studies, showing that scientists and participants from the general population primarily referred to objects of care such as nature or future generations when describing their emotions about climate change. These objects of care were less prominent in a student sample, who generally indicated fewer and less intense emotions. No further research has been conducted on this concept, but it is possible that the level of caring towards a place could influence people's reaction to it being threatened, and thus their perception and response to climate change overall.

Familiarity

A final factor that may influence people's perception of places is that of *familiarity*, including their knowledge or understanding of a place. Familiarity may be related to the above beliefs, but it is equally conceivable that one might be familiar with places that are far away, dissimilar from one's own or that one is not personally attached to. Such familiarity could, for example, stem from media reports, from films or from traveling, with the latter having been shown to promote a global identity

following contact with local people (Loy, Tröger, et al., 2021). Whether one is familiar with a place might help in understanding climate impacts to local systems and could influence the reaction to such reports. Empirical support so far is lacking, barring a study which used familiarity with the Maldives as a covariate when manipulating the spatial distance towards the islands, with no covariate effects (Yang et al., 2020). Nevertheless, familiarity may be yet another component of place beliefs that could help in advancing an understanding of people's perception of and reaction to places that are impacted by climate change.

3.3.3 Susceptibility: What Shapes Place Affinity and its Effect on Risk Perception?

In the systematic review presented in the previous chapter, we identified several individual characteristics that influence people's perception of the distance of climate impacts and how this distance affects their decision-making (Chapter 2.3.1 and 2.3.2). These variables have been shown to act as moderators between psychological distance and various outcome variables, and may therefore help to explain processes surrounding place affinity and the perception of climate impacts. Here, we summarise these characteristics, which we term "susceptibility variables" and which we predict may influence the nature and effect of place beliefs.

The first set of susceptibility variables addresses individual characteristics that speak to how easily one can build human connections, that is: *trait empathy*, *self-transcendent values* and *global identity*. A person with high trait empathy (i.e., the "ability and tendency to traverse social distance and take another person's perspective"; Davis, 1980) might be more able to identify with people in impacted places by recognizing similarities that may be less obvious to people with lower trait empathy. Similarly, self-transcendent values, a stable belief and concern for the well-being of all other people and nature (Schwartz, 2012), and global identity, an identification and self-investment in the global community (Reese et al., 2015), might speak to a similar notion of valuing, identifying with and protecting people around the world.

It is therefore possible that these characteristics influence the extent of affinity created for a particular place, but also, offer an insight as to whether affinity is required to generate concern. These mechanisms are not yet established in research, but there are indications of their importance in the literature. For example, in a study which showed news stories of local or distant climate impacts, only individuals with low trait empathy were affected by the difference in location, whereas those with high trait empathy felt consistently close to both local and distant places (Chu & Yang, 2019). Another study found that participants with lower trait empathy were more likely to use abstract terms to think of spatially and temporally distant climate change impacts than those with

higher trait empathy (Chu, 2022). However, other results indicate a lack or even the opposite of such effects: increasing global identity via a video did not impact participants' likelihood to engage in climate action, although it did lead them to judge distant climate impacts to be more relevant (Loy & Spence, 2020). Furthermore, individuals with strong self-enhancing values (valuing one's own well-being more than that of others, which is theorised to be the opposite of having self-transcendent values), expressed lower importance to and acceptance of climate action when shown local impacts, compared to a global frame (Schoenefeld & McCauley, 2016), which is possibly a defensive reaction to a strong personal threat. The strength and direction of these potential moderators can therefore not yet be established, but evidence does suggest that they may be helpful in explaining different reactions to threats to different places.

A second set of susceptibility variables addresses individual differences in thinking styles. For example, engaging in *actively open-minded thinking* has been linked to stronger belief in anthropogenic climate change (Pennycook et al., 2020) and coherence between prior beliefs and judging new arguments (Bago et al., 2023). These findings suggest that differences in reasoning styles, such as *actively open-minded thinking* versus *closed-minded thinking*, and *effortful* thinking versus *intuitive thinking* (Newton et al., in press), may influence how a threat to particular places is processed, especially in relation to prior beliefs on climate impacts. Relatedly, participants with strong levels of *holistic thinking*, that is, seeing an object or event as one piece of a whole (Choi et al., 2007), respond similarly to both distant and local information-frames (Sacchi et al., 2016).

Finally, a third set of susceptibility variables encompasses two less directly connected, but nonetheless potentially relevant variables. First, since temporal dimensions are clearly woven into the perception and communication of climate change, it is possible that a higher *consideration of future consequences* (CFC) influences how we perceive impacted places. CFC, the "extent to which individuals consider potential distant outcomes of current behaviours and the extent they are influenced by potential outcomes" (Strathman et al., 1994, p. 743), has been linked to spatial, social and hypothetical dimensions of the climate crisis (Wang et al., 2019). For example, it is feasible that someone who considers future consequences to a lesser extent will be more strongly influenced by their current place affinities, since future developments of climate patterns may be less prominent in their reasoning.

Second, whether someone feels *agency*, that is in control over their own future (Lalot et al., 2020), might influence their reaction to meaningful places that are being threatened. A higher sense of threat has consistently been linked to a higher level of efficacy (Hornsey et al., 2021), possibly as a coping mechanism to manage distress. Agency, although a stable trait rather than a coping response,

may affect the influence of risk and threat in a similar way, determining how someone responds to personally meaningful places that are being impacted.

3.3.4 Summary and Outlook

In the above literature review, we have explored research concerning the processes around the awareness of climate impacts and our relationships with those impacted places. We proposed that there are certain place beliefs (spatial similarity and distance, social similarity and intimacy, familiarity and identification with a place and level of caring towards a place), which together form one's affinity towards a place. We propose that understanding this affinity and its associated place beliefs can help advance a theoretical understanding of people's reactions to those places being affected, and thus their responses to climate change overall. We have additionally suggested that there may be several susceptibility variables, such as values, empathy and thinking styles, which may influence how people form these place beliefs and moderate the influence they have on decision-making. While the place beliefs and susceptibility variables are selected from previous research, we contribute to the literature by integrating these factors into a framework of place affinity and the processes surrounding it. This allows researchers to investigate a more holistic picture of the perception of climate change impact locations. These propositions have not been previously investigated empirically. In the next chapter, we therefore present a study that explores place beliefs, place affinity and susceptibility variables as well as their interconnections and their influence on risk perceptions relating to climate change.

4 Exploring Place Beliefs Cross-Sectionally

4.1 Introduction and Aims

In Chapter 3, we proposed the theoretical framework of place affinity, including a selection of place beliefs which may shape people's relationships with places impacted by climate change. In order to assess whether this framework is of theoretical and practical value, we must determine whether place affinity is related to the perception of extreme weather events and climate change overall. To this end, we conducted an exploratory study that measured place affinity and the surrounding processes as summarised in Figure 3.1, that is: (i) awareness of impacted places; (ii) place beliefs and affinity; (iii) susceptibility variables; and (iv) relationships with risk perception. The purpose of this study was to measure each of these components and explore their relationships with each other, as a first test of the place affinity framework and its role in the perception of climate impact locations. We set out to explore these in two studies. Study 1 (consisting of a primarily quantitative questionnaire) aimed to provide a quantitative exploration of the framework in a larger sample; Study 2, consisting of a primarily qualitative questionnaire, aimed to give a smaller sample of participants the opportunity to express themselves as freely as possible in regard to the different research questions, which we hoped would uncover any major points that we may have missed in the literature reviews. In the following, we will first report Study 1, followed by Study 2.

4.2 Study 1

A cross-sectional questionnaire study was conducted to measure the place affinity framework and the surrounding processes within the context of climate impact locations. This general aim was translated into four research questions, which are presented in Table 4.1. We aimed to measure which places people think of as being impacted by climate change (RQ1), how people relate to those places as measured by their place beliefs (RQ2), how these place beliefs and the resulting place affinity relate to people's risk perceptions (RQ3) and finally, whether these relationships are shaped by people's susceptibility to place affinity (RQ4).

Table 4.1 presents an overview of these four components, including what we know about each from the literature that has been reviewed in Chapters 2 and 3, how we aim to expand upon this knowledge and how each of the aims is operationalised, with more detail below. For each component, we selected and measured the variables introduced in the previous Chapter 3, with further details on measurement in the methods below.

The focus of the study was on the location of climate impacts. As shown in the systematic literature review in Chapter 2, such perceptions of locations are often dependent on time frames. For example, asking someone to name which locations are impacted by climate change currently versus

in the future will likely yield different responses. We chose to reduce noise by holding stable the time frames that participants responded to. Specifically, we asked participants first about their relationships with locations impacted by climate change in the present and immediate future, and then about their relationships with locations predicted to be impacted by climate change in the distant future.

Table 4.1

Empirical investigation of research questions

Research question	Lessons from literature reviews (chapters 2 and 3)	Aims for empirical study	Addressed constructs and operationalisation for Study 1[a]. Constructs selected based on previous literature review, see Chapter 3.
RQ1 Place awareness: Which locations come to mind when asking people about climate impacts?	Generally, places come to mind that are further away from the self, but places and their category and scale are often prespecified in quantitative measures (i.e., developing countries, close to home) and most research is done using WEIRD[b] samples.	To use an unbiased measure that allows people to express freely which place (or which type of place) is salient in terms of being impacted by climate change.	*Impacted places* Name the places where climate change does/will have serious and negative consequences. Do you live in one of those places? If yes, which: ____ (Asked twice, once for now/immediate future, once for distant future).
RQ2 Place affinity: How do people relate to places impacted by climate change?	Possibly influenced by factors such as spatial distance and similarity, social similarity and intimacy, place identity and attachment, objects of care and familiarity.	To measure people's beliefs toward salient impacted places (RQ1) as a means to determine their affinity for impacted places.	*Spatial distance, spatial similarity, social similarity, familiarity, objects of care* Naming: Which of those places you have just identified are you most familiar with/feels most similar to where you live/the people feel most similar to you/you care most about? ____ Score: How similar/familiar does it feel/how much do you care about this place?
RQ3 Risk perception: How does place affinity influence risk perception?	Some empirical evidence from different research areas, but patterns are currently inconsistent.	To measure risk perception towards climate change and assess its association with place affinity.	*Climate change perceptions*: belief, human causes, valence of consequences (van Valkengoed et al., 2021). *Risk perception*: extent of concern, frequency of worry, affect, threat to natural environment (van der Linden, 2015).
RQ4 Susceptibility variables: What influences and shapes place affinity and its effect on risk perception?	Possibly influenced by factors such as trait empathy, values, global identity, thinking styles, holistic thinking and consideration for future consequences. Some evidence towards these factors influencing perceptions of distance and risk perception.	To measure susceptibility variables and explore their relation to place affinity and risk perception.	*Trait empathy:* Interpersonal Reactivity Index – Perspective taking (Davis, 1980). *Values*: Personal Value Questionnaire – Power and Universalism (Schwartz et al., 2001). *Global identity*: Identification with All Humanity (Reese et al., 2015). *Thinking styles:* Comprehensive Thinking Styles Questionnaire (Newton et al., 2021). *Holistic thinking*: Analysis-Holism Scale – Locus of Attention (Choi et al., 2007). *Consideration of Future Consequences* (Joireman et al., 2012). *Agency*: Future Consciousness – Agency Beliefs (Lalot et al., 2020).

Note .[a]Full items are available below. [b]WEIRD = Western, Educated, Industrialised, Rich, Developed

4.2.1 Method

Participants and Sampling

In determining a sample size for our study, we follow Kraemer et al. (2015), who describe the goal of exploratory studies as proposing reasonable and important hypotheses, which requires collecting enough data to observe interesting patterns, but not enough to test these inferentially (as this is a task for a latter study designed for this purpose). In the context of the present study, we sampled UK residents to ensure comparable climate change experiences, drawing on participants of various backgrounds, ages and political leanings. These sample characteristics were achieved by recruiting participants from Prolific Academic, a panel provider that has been shown to afford higher participant diversity and better data quality than other, similar panels (Peer et al., 2017). Participants were paid the equivalent of an hourly rate of £7.50. Ethical approval was obtained from the ethics board at the authors' institution.

We recruited 180 participants, all of which were UK residents. Participants were 34 years old on average (*SD* = 9.68, range 18 to 63), with 76% identifying as female (2% preferred not to say), 62% in full-time employment and 12% in education. More than half (56%) of participants said that they had personally experienced flooding at least once, and 84% said that they had personally experienced other types of extreme weather.

Materials

Participants were first asked to respond to the susceptibility items and then the climate change items, which included questions concerning impacted places, place beliefs and risk perceptions. Descriptive statistics for all items and scales can be found in supplementary materials.

Impacted Locations and Place Beliefs. To measure the locations that participants spontaneously associated with impacts, we first asked participants to think about severe and negative consequences associated with climate change impacts occurring now or in the near future. We then asked them to write down "where, if at all, you believe these consequences are/will be taking place right now or in the near future. You can name specific regions, countries, continents or other types of places". We then measured spatial similarity to the named places in two steps: First, we asked participants which of the previously named places was the *most* similar to their own (i.e., their residence), and second, we asked them to rate *how* similar the place was to theirs (*1 = not similar at all* to *5 = extremely similar*). The same two steps were then repeated for familiarity with the place (*1 = not familiar at all* to *5 = extremely familiar*), similarity with the inhabitants of the place and levels of care (*1 = not at all* to *5 = very strongly*). We chose this operationalisation based on the reasoning that there are likely many places which are thought of as being impacted (e.g., Spence et al., 2012), due to the global

nature of the climate crisis. However, the literature on objects of care (Wang et al., 2021), suggests that the largest influence on risk perceptions will be exerted by places or objects that are cared for most, and possibly also be ones that are most familiar and most similar, so it is these places that we focus on in our measure. We did ask participants whether they lived in one of the affected places, and if so, did not ask them to rate how similar to place is to their own, since the two places would be identical and pilot testers found the item to be confusing. However, the other place beliefs were still assessed for these participants, since one's identification with the inhabitants, as well as one's familiarity and care for one's own place can still differ.

In terms of the place beliefs that were reviewed above, we therefore included in our study measures of spatial distance, spatial similarity, social similarity, familiarity and objects of care. We excluded place attachment, social identity and social intimacy as these are partially covered by the other variables. Integrating them with more comprehensive instruments was beyond the scope of this study but could be part of future investigations.

This block (impacted locations and place beliefs) was then repeated as we expected that people's perception of impacted locations would vary across time. This time, we asked participants to consider places expected to be impacted in the distant future. We also included a measure to gauge what approximate time frames participants were thinking of for each of the blocks ("What time scale are you thinking of when thinking about the near future? From now up to _____ years").

Risk and Climate Change Perceptions. Items concerning the perception of climate change were taken from a recently developed and validated climate change perception scale (van Valkengoed et al., 2021). Participants were asked to rate their agreement on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*) to a number of statements measuring belief in climate change ("I believe that climate change is real", "Climate change is NOT occurring" (-)), belief in anthropogenic causes of climate change ("Humans are a major cause of climate change", "Climate change is mostly caused by human activity", "The main cause of climate change are human activities") and beliefs about the valence of climate change consequences (i.e., positive or negative; "Overall, climate change will bring more negative than positive consequences to the world", "Climate change will bring about serious negative consequences", "The consequences of climate change will be very serious"). Items were combined via averaging into indices with good internal reliabilities (Spearman-Brown r_{kk} = .78; Cronbach's α = .95, Cronbach's α = .84 respectively).

Risk perception was measured using items from the climate change risk perception model (van der Linden, 2015). Participants were first asked "How concerned are you about climate

change?" on a scale from 1 (*not concerned at all*) to 7 (*very concerned*) and "How often do you worry about the potentially negative consequences of climate change?" on a scale from 1 (*very rarely*) to 7 (*very frequently*) to measure climate change concern and worry respectively. They were then asked about their affect towards climate change by rating the statement "I see climate change as something that is…" on three scales from 1 to 7 with the endpoints of *pleasant/unpleasant*, *favourable/unfavourable* and *positive/negative* respectively. This subscale was averaged into a climate change affect index with good internal reliability, Cronbach's α = .82. Three items from the same model additionally measured perceived threat to nature ("Lastly, how serious of a threat do you think that climate change is to the natural environment?" on a scale from 1 = *not serious at all* to 7 = *very serious*), personal experience of extreme weather events ("Considering roughly the last 5 years, how often have you personally experienced flooding in your local area? (Only taking into account your time in the United Kingdom)" with responses from *never* to *three or more times* or *can't remember*) and whether they lived in a flood-prone area ("Do you live or have recently lived in an area that is liable to flooding?" with responses of *no*, *yes* and *not sure*).

Susceptibility Variables. We measured a selection of potential susceptibility variables as introduced in the previous Chapter 3, based on their potential interaction with the place affinity framework. All susceptibility items were based on established instruments. All items are presented in Table 4.2 below, with descriptive statistics for each item and scale in the supplementary materials. Some instruments were shortened for conciseness, so that holistic thinking was assessed with two items of the Locus of Attention subscale of the Analysis-Holism Scale (Choi et al., 2007) and agency was assessed with two items from the Agency Beliefs subscale of the Future Consciousness instrument (Lalot et al., 2020). We also added an item to the Consideration of Future Consequences scale to include other-focused considerations, to reflect the pro-social context of the climate crisis ("When I make a decision, I think about how it might affect others in the future").

Table 4.2

Susceptibility variables – items and internal reliabilities

Construct and Scale	Items	Internal reliability
Actively open-minded thinking (from Comprehensive Thinking Styles Questionnaire; Newton et al., 2021) 1 strongly disagree 2 disagree 3 tend to disagree 4 tend to agree 5 agree 6 strongly agree *Note*: higher value means less open-minded thinking	It is important to be loyal to your beliefs even when evidence is brought to bear against them. Whether something feels true is more important than evidence. Just because evidence conflicts with my current beliefs does not mean my beliefs are wrong. There may be evidence that goes against what you believe but that does not mean you have to change your beliefs. Even if there is concrete evidence against what you believe to be true, it is OK to maintain cherished beliefs. Regardless of the topic, what you believe to be true is more important than evidence against your beliefs	Cronbach's α = .86
Close-minded thinking (from Comprehensive Thinking Styles Questionnaire) 1 strongly disagree 2 disagree 3 tend to disagree 4 tend to agree 5 agree 6 strongly agree	I think there are many wrong ways, but only one right way, to almost anything. In my experience, the truth is often black and white. Truth is never relative. The truth does not change. Either something is true or it is false; there is nothing in-between. There is no middle ground between what is true and what is false.	Cronbach's α = .78
Preference for intuitive thinking (from Comprehensive Thinking Styles Questionnaire) 1 strongly disagree 2 disagree 3 tend to disagree 4 tend to agree 5 agree 6 strongly agree	I like to rely on my intuitive impressions. I believe in trusting my hunches. When I make decisions, I tend to rely on my intuition. Using my "gut-feelings" usually works well for me in figuring out problems in my life. Intuition is the best guide in making decisions. I often go by my instincts when deciding on a course of action.	Cronbach's α = .89
Preference for effortful thinking (from Comprehensive Thinking Styles Questionnaire) 1 strongly disagree 2 disagree 3 tend to disagree	I'm not that good at figuring out complicated problems. Thinking is not my idea of an enjoyable activity. I try to avoid situations that require thinking in depth about something. I am not a very analytical thinker. Reasoning things out carefully is not one of my strong points.	Cronbach's α = .80

4 tend to agree 5 agree 6 strongly agree Note: higher value means less effortful thinking.	Thinking hard and for a long time about something gives me little satisfaction.	
Perspective taking (from Interpersonal Reactivity Index; Davis, 1980) 1 does not describe me well 2 3 4 5 describes me very well	Before criticizing somebody, I try to imagine how I would feel if I were in their place. If I'm sure I'm right about something, I don't waste much time listening to other people's arguments. (-) I sometimes try to understand my friends better by imagining how things look from their perspective. I believe that there are two sides to every question and try to look at them both. I sometimes find it difficult to see things from the "other guy's" point of view. (-) I try to look at everybody's side of a disagreement before I make a decision. When I'm upset at someone, I usually try to "put myself in his shoes" for a while.	Cronbach's α = .73
Locus of Attention (from Analysis-Holism Scale; Choi et al., 2007) 1 strongly disagree 2 disagree 3 somewhat disagree 4 neither agree nor disagree 5 somewhat agree 6 agree 7 strongly agree	It is more important to pay attention to the whole context rather than the details. We should consider the situation a person is faced with, as well as his/her personality, in order to understand one's behavior.	Spearman-Brown coefficient: .34. Items used separately due to low internal reliability.
Power (from Personal Value Questionnaire; Schwartz et al., 2001) 1 not like me at all 2 not like me 3 a little like me 4 somewhat like me 5 like me 6 very much like me	It is important to them to be rich. They want to have a lot of money and expensive things. It is important to them to be in charge and tell others what to do. They want people to do what they say. They always want to be the one who makes the decisions. They like to be the leader.	First item dropped: Cronbach's α = .82 (with all items: Cronbach's α = .72)
Universalism (from Personal Value Questionnaire) 1 not like me at all 2 not like me 3 a little like me 4 somewhat like me	They think it is important that every person in the world be treated equally. They believe everyone should have equal opportunities in life. It is important to them to listen to people who are different. Even when they disagree with them, they still want to understand them.	Cronbach's α = .85

5 like me 6 very much like me	They strongly believe that people should care for nature. Looking after the environment is important to them. They believe all the worlds' people should live in harmony. Promoting peace among all groups in the world is important to them. They want everyone to be treated justly, even people they don't know. It is important to them to protect the weak in society. It is important to them to adapt to nature and to fit into it. They believe that people should not change nature.	
Global self-definition (from Identification with all humanity; Reese et al., 2015) 1 not at all 2 a little 3 a moderate amount 4 a lot 5 very much	I feel close to people all over the world I think of people all over the world as "we" I feel like I have a lot in common with people all over the world I feel as if people all over the world are one community I identify with people all over the world	Cronbach's α = .89
Global self-definition (from Identification with all humanity) 1 not at all 2 a little 3 a moderate amount 4 a lot 5 very much	I empathize with people all over the world when bad things happen I feel like I care about people all over the world I feel the need to be a responsible citizen of the world I feel loyal towards people all over the world I want to help people all over the world	Cronbach's α = .90
Consideration of future consequences (from consideration of future consequences) 1 very uncharacteristic of me 2 3 4 5 6 7 very characteristic of me	I consider how things might be in the future, and try to influence those things with my day to day behavior. Often I engage in a particular behavior in order to achieve outcomes that may not result for many years. I am willing to sacrifice my immediate happiness or well-being in order to achieve future outcomes. I think it is important to take warnings about negative outcomes seriously even if the negative outcome will not occur for many years. I think it is more important to perform a behavior with important distant consequences than a behavior with less important immediate consequences. When I make a decision, I think about how it might affect me in the future. My behavior is generally influenced by future consequences. When I make a decision, I think about how it might affect others in the future. (self-constructed)	Cronbach's α = .82

Consideration of future consequences (from consideration of future consequences; Joireman et al., 2012) 1 very uncharacteristic of me 2 3 4 5 6 7 very characteristic of me	I only act to satisfy immediate concerns, figuring the future will take care of itself. My behavior is only influenced by the immediate (i.e., a matter of days or weeks) outcomes of my actions. My convenience is a big factor in the decisions I make or the actions I take. I generally ignore warnings about possible future problems because I think the problems will be resolved before they reach crisis level. I think that sacrificing now is usually unnecessary since future outcomes can be dealt with at a later time. I only act to satisfy immediate concerns, figuring that I will take care of future problems that may occur at a later date. Since my day to day work has specific outcomes, it is more important to me than behavior that has distant outcomes.	Cronbach's α = .77
Agency beliefs (from Future Consciousness; Lalot et al., 2020) 1 strongly disagree 2 somewhat disagree 3 neither agree nor disagree 4 somewhat agree 5 strongly agree	I believe I can succeed at most any endeavor to which I set my mind. I hardly ever expect things to go my way. (-)	Spearman-Brown coefficient: .51.

4.2.3 Results and Discussion

All analyses were conducted using Jamovi (The jamovi project, 2021). For established measurement instruments (susceptibility and climate change perceptions), we created indices for each subconstruct where possible, with internal reliabilities reported in Table 4.2. A full report of descriptive statistics is presented in the supplementary materials, together with the full analysis code. The dataset is also available on request.

As part of a preliminary analysis, we investigated participants' interpretation of timeframes relating to the immediate future and the distant future. Participants were asked twice about which locations they felt were impacted by climate change: Once for now or the immediate future, and once for the distant future. Results suggested that participants' interpretation of these frames may have differed quite a lot, as there was a large variance in the number of years seen to be describing the immediate future (*Md* = 10, *IQR* = 15, *M* = 16, *SD* = 19.5) and the distant future (*Md* = 22.5, *IQR* = 65, *M* = 67.9, *SD* = 190). The estimations for immediate future were very similar to those given on the term "future" in a cross-cultural study (Tonn et al., 2006). This same study also indicated that people struggled to imagine the future beyond 15-20 years – together, this would indicate that the immediate future timeframe captures those years most concrete and meaningful to people's risk perception and decision-making.

Within this study, we chose subjective timeframes to represent participants' own meaningful interpretation of the future. However, climate change communication often uses concrete timeframes such as the year 2050 (IPCC Working Group 2, 2022), and other studies may prefer to use such objective timeframes to relate to these reports or campaigns. From our results, it is difficult to say how such subjective and objective timeframes relate, and how they would impact participants' responses, but the results do indicate that interpretation of terms such as immediate and distant future may vary between participants. Future studies could systematically compare how participants' subjective interpretations of near and distant future frames differ from objective frames using specific years, and how this impacts their reaction to climate impacts taking place in these frames. In this dataset, neither the immediate nor the distant future timeframe estimation was meaningfully related to climate change worry, concern or affect (r_t <= .09), so we did not include the timeframe estimations in other calculations.

Finally, participants' estimations of years until the immediate or distant future were positively related (r_t = .42), with a high variance in the difference between the two timeframes (*Md* = 10, *IQR* = 50, *M* = 51.8, *SD* = 183). It is therefore likely that participants used different timeframes in which they thought about and named impact locations – for some, the immediate or distant future was closer than for others, and equally, for some the two timespans were closer together than for others.

Impacted locations and place beliefs

First, participants had been asked to name places negatively and severely impacted by climate change. Since we provided participants with a larger textbox in which to write their response, many gave extensive answers, describing types of impact and places associated with them. For example, participants described "in the near future the sea level rising around the world" or "everywhere is being effected by climate change. The Maldives are being put under water, places are being greatly affected by the more extreme weathers". Others gave more concise responses such as "the entire planet" or "Africa, Aleppo, Yemen, South America". These detailed answers may be interesting to researchers investigating people's awareness of climate change impact locations and are available within the full dataset in the Supplementary Materials. However, since the focus of our study was on exploring the place affinity framework, we let these responses serve primarily as notes for the participants themselves, who were then asked whether they lived in one of those places they had mentioned and which of those places were the most familiar, socially similar and cared for to them.

When asked about whether they lived in one of the places that they had described previously, 39% of participants stated that they did so currently or would do in the immediate future, with a further 56% stating that they would do so in the distant future. This seems relatively low, considering that extreme weather already impacts the UK (World weather attribution, n.d.) and climate models firmly predict impacts to Europe (IPCC Working Group 2, 2022). It is also lower than findings from recent representative opinion polls, in which most participants perceive climate change to already be impacting the UK (75%-82%) and their own local area (54%) (Department for Business, Energy and Industrial Strategy, 2020; Department for Business, Energy and Industrial Strategy et al., 2021; Ipsos MORI, 2021). In addition, other studies have found that 55%-65% of UK participants indicate seeing climate change as a threat to themselves or their family (CAST (Centre for Climate Change and Social Transformations), 2020; Ipsos MORI, 2021).

These differences could be attributable to different question phrasings. Although these polls asked participants to rate threat to a variety of prespecified categories, our study asked participants to name affected places in open text, requiring participants to freely recall those places most salient to themselves. It is likely that this approach taps into places treated prominently in the media, in which climate change has long been associated with landscapes. For example, polar and ice imagery feature in the UK media much more so than in the media in other countries (O'Neill & Smith, 2014). The apparent difference that is observed in naming places across different question phrasings is potentially important, as it is possible that salient, freely-recalled places are more influential for everyday decision-making than places that are not as readily accessible to memory (Pohl, 2022; Tversky & Kahneman, 1973).

We also asked specifically about negative and severe impacts, which could mean that although some participants in our study did perceive a personal threat, they might not have thought it to be very severe (as indicated in qualitative work e.g., K. Lee & Barnett, 2022). This can also be observed in opinion polls that specify the level of threat. For example, only 50% of participants saw climate change as a large or significant threat for the UK, and only 21% for themselves (YouGov & Sky, 2021). Similarly, 36% of UK participants saw climate change as an extremely or very serious threat to themselves and their family (Department for Business, Energy and Industrial Strategy et al., 2021); this is considerably lower than many of the survey results discussed above that did not specify the severity of the threat. This underlines the importance of assessing likelihood and severity of risks separately, as suggested by risk perception frameworks (van der Linden, 2015). We chose the alternative approach of specifying to participants that we were asking only about severe risks, which allowed us to focus on those impacts that may have the most potential for motivating concern and action.

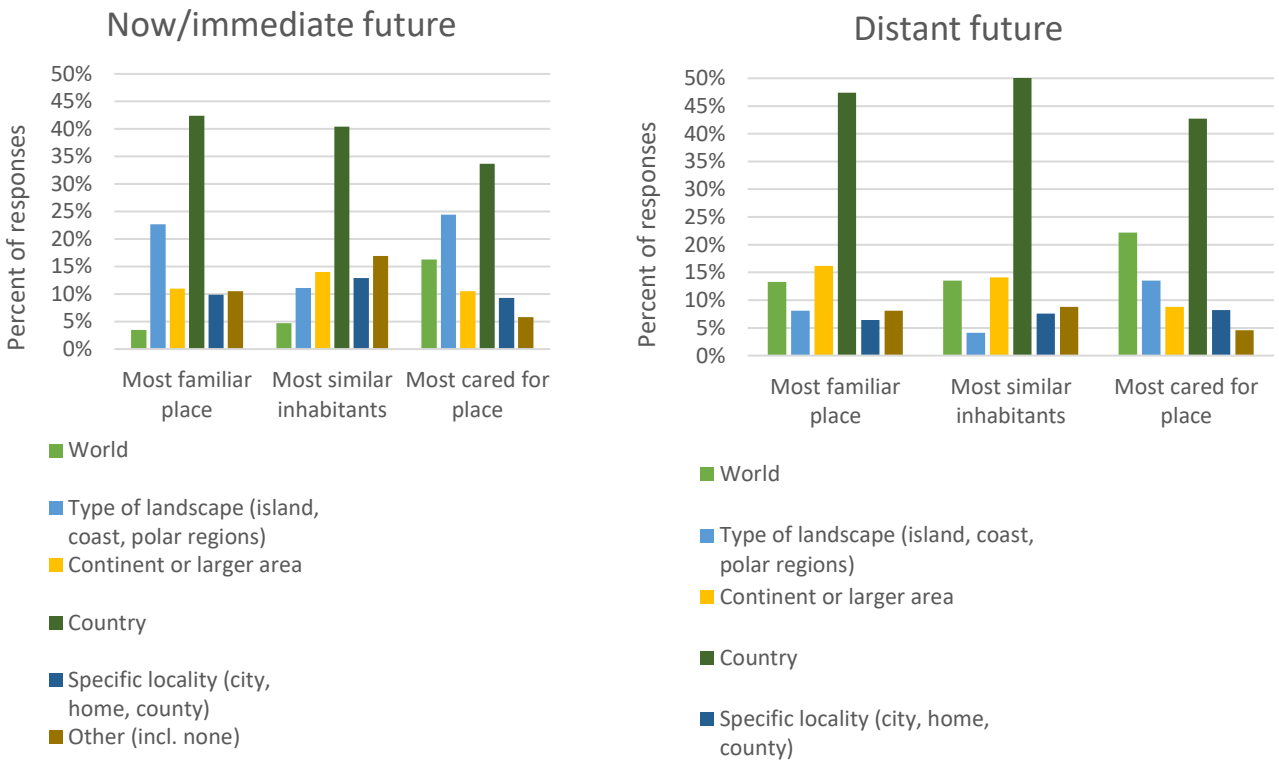
Next, we had asked participants to select the place that they felt were most socially similar to, most familiar with, and cared for the most (respectively) out of those that they had named in the previous question, and also to rate the extent of these beliefs. We had also asked participants how similar the impacted place was to their own, but since 39% of participants stated that they currently lived in one of the impacted places, and 56% that they would do so in the future, there would have been a large proportion of participants for whom the most similar impacted place and their own place would be identical. We therefore decided in the following analysis to focus on social similarity, familiarity and caring, all of which can vary even in regard to one's own place and therefore provide more information.

This meant that we analysed six places named by each respondent: two places they were most familiar with (one impacted in the present or immediate future, one in the distant future), two places they felt most socially similar to and two places they felt most caring towards. Out of these six places, 42% of respondents named the UK, or a place within the UK, as at least one of those six places, with another 9% naming Europe. These proportions are smaller than those who previouly stated that they lived in one of the affected places (39% in the present of immediate future, 56% in the distant future), so it is possible that some of those participants reported feeling that other places were more familiar and socially similar than their own location and that they also had more caring toward such places, be it a specific place (e.g., another country) or an abstract place (e.g., the planet). The openly named familiar, similar and cared for places were then further coded into spatial levels, including the categories of countries, continents, specific places (e.g., a city, region, home) or more abstract places

such as types of landscapes (e.g., deserts, island states) or the world as a whole[2]. Statements of "did not know", "N/A" or "none" were summarised under the category "other".

Figure 4.1 shows that participants felt that countries were their most familiar, socially similar and cared for place. Types of landscapes seemed more likely to be named as most familiar and cared for compared to most socially similar. This finding makes sense as landscapes are likely to be more strongly associated with natural elements. The world as a whole was named most frequently under the frame of caring compared to the other place beliefs. This could suggest that the relatively general belief of caring might elicit abstract place categories such as the world or types of landscapes; but it could, at the same time, indicate genuine appreciation of the planet. Researchers who investigate objects of care might be interested in further exploring such associations.

Figure 4.1
Percentage of participants naming various categories of places as their most familiar place, the place that was most socially similar and their most cared for place.



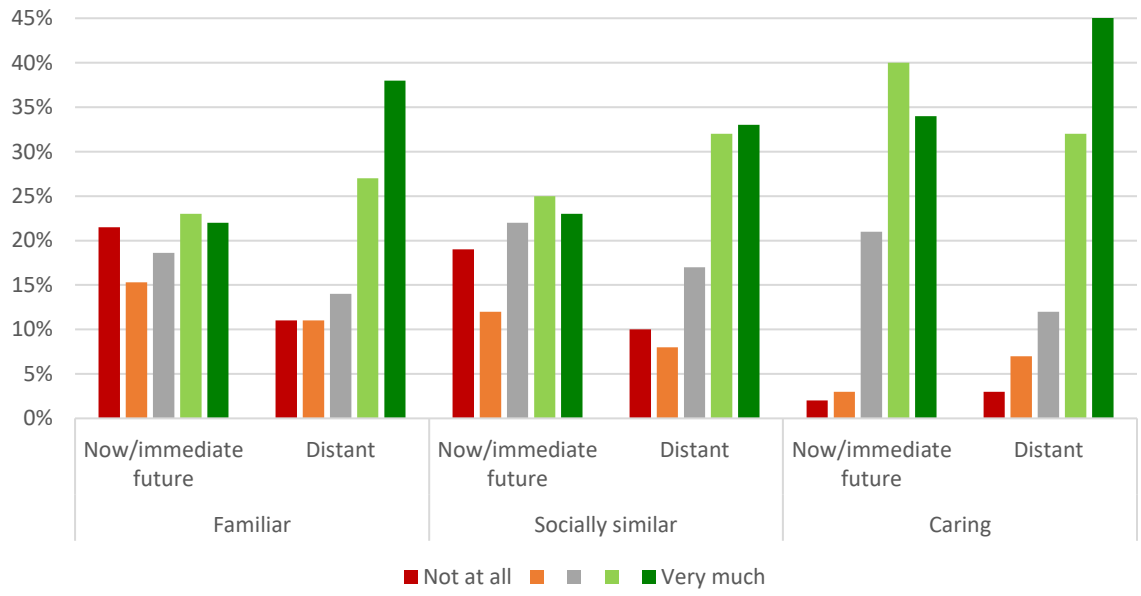
[2] This decision was made after inspecting the results and looking for categories; there are many more ways in which this data could be analysed, and we refer the reader to the available dataset for further exploration.

Note. Each respondent named one most familiar, one most socially similar and most cared for place per timeframe; percentages are calculated out of this total.

Similar categories were present for the two timeframes, although even more participants named a country for the distant future, and fewer seemed to name places from categories such as types of landscape or other/none. This could imply that, as future climate change impacts are expected to be more widespread, more people are able to name specific places. Research has also found that people tend not to be aware of localised climate change impacts unless they have experienced them themselves (Duke & Holt, 2022); this could explain why, for the current and immediate future timeframe, fewer participants were able or willing to name specific affected places. More insight into this pattern of responding can be derived from the open-ended data, which will be discussed below.

Figure 4.2 shows the extent to which participants scored their named places on the dimensions of familiarity, social similarity and caring. On the one hand, fewer participants expected to feel high levels of social similarity and familiarity with an affected place in the immediate future than in the distant future, perhaps reflecting expectations of more widespread impacts to come. On the other hand, participants were likely to indicate that they already cared for a place impacted in the immediate future, with these scores becoming even higher in the distant future – perhaps reflecting care towards general categories such as the world or types of landscapes that are seen as already impacted today.

Figure 4.2
The extent of familiarity with a place, social similarity with a place (in terms of the inhabitants) and caring for a place affected by climate change, contrasting the current/immediate future timeframe (left) with the distant future timeframe (right).



We then investigated whether participants' place belief scores were related to the category of location that they named. A comparison of ranks (Kruskal-Wallis) indicated that participants expressed different levels of familiarity for different categories of places, $\chi^2(4) = 41$, $p < .001$, $\varepsilon^2 = .27$. In particular, Dwass-Steel-Critchlow-Fligner comparisons indicated that they felt more familiarity with countries than with types of landscapes ($W = 8.21$, $p < .001$). However, most comparisons, and other differences in other place beliefs were small and non-significant, especially when accounting for multiple testing, which is why they are not further reported here (full details can be found in the supplementary materials).

Relationships between place affinity and risk perception

We combined the place beliefs (familiarity, social similarity, caring) into two factors, which captured present place affinity for places in the immediate future ($\alpha = .81$) and future place affinity for places in the distant future ($\alpha = .90$). This was done by taking an averaging index of the respective three items.

Although both of these place affinity indices were related to concern and worry, this relationship was stronger for present place affinity ($r_t = .32$ with concern, $r_t = .17$ with worry) than future place affinity ($r_t = .20$ with concern, $r_t = .12$ with worry). We then ran OLS regressions to predict concern and worry from the place affinity indices (immediate future and distant future) as well as the climate change perceptions variables (belief in human causes of climate change, belief in climate change, valence of climate change). The climate change perception variables had been combined into indices in preparation for the analysis, with good internal reliability (αs or Spearman Brown coefficient ≥ .78). Full correlations between place affinity and climate perception variables and regression assumption tests can be found in the supplementary materials. Both models are shown in Table 4.3. The models predicting concern ($F(6, 165) = 21.1$, $p < .001$) and worry ($F(6, 165) = 10.6$, $p < .001$) were significant, with 41% of the variance explained for concern and 25% for worry. Affinity for presently affected places was among the strongest predictors of concern ($\beta = .22$), of similar strength as belief in the reality of climate change ($\beta = .21$) and its human causes ($\beta = .22$), whereas affinity for places affected in the distant future was only a weak and nonsignificant predictor ($\beta = .11$). For worry, only the valence of climate change consequences was important with $\beta = .24$.

Table 4.3

Models showing the regressions of the place affinity indices on concern and worry

	Concern			Worry		
	B	β [95% LCI, UCI]	*p*	*B*	β [95% LCI, UCI]	*p*
Belief in human causes	0.32	.22 [0.04, 0.401]	.018	0.11	.06 [-0.15, 0.27]	.563
Present place affinity	0.28	.22 [0.09, 0.35]	< .001	0.15	.10 [-0.05, 0.24]	.181
Belief in climate change	0.41	.21 [0.04, 0.39]	.018	0.38	.17 [-0.03, 0.36]	.097
Valence of climate change	0.18	.12 [-0.08, 0.32]	.227	0.44	.24 [0.01, 0.46]	.031
Future place affinity	0.13	.11 [-0.01, 0.23)	.081	0.13	.09 [-0.05, 0.23]	.196
Climate change affect	0.06	.04 [-0.11, 0.19]	.585	0.11	.06 [-0.11, 0.23]	.476
	$F(6, 165) = 21.1$, $p < .001$			$F(6, 165) = 10.6$, $p < .001$		
	$R^2 = 43\%$, adjusted $R^2 = 41\%$			$R^2 = 28\%$, adjusted $R^2 = 25\%$		

These results show that the more affinity participants felt for the places they thought were impacted by climate change, the more they were concerned about climate change overall. On the other hand, how frequently participants worried about climate change was not predicted by place affinity, but primarily by valence (negativity of climate change impacts). These differences could be due to worry being measured in terms of frequency; it is conceivable, for example, that a person is genuinely very concerned about climate change, but that other issues in their lives currently demand more immediate attention and thus worry. This is consistent with the "hierarchy of concern", as introduced by van der Linden (2017), wherein generalised concern is necessary, but not sufficient for personal worry.

Similarly, there are many narratives that aim to deprioritise climate change action in favour of other issues, for example by placing the responsibility to act on other people, institutions or countries (Lamb et al., 2020). These narratives may allow people not to translate perceived climate change risk and concern into everyday worry, perhaps partly explaining the differences between the two. We note that concern, compared to worry, is much less likely to be emotionally engaging in a way that will motivate the desire to reduce threat. However, concern can still be viewed as an important measure of public opinion and a basis for public engagement with climate change and its mitigation (van der Linden, 2017), and is related to system-level factors such as the acceptance of climate change laws and taxes (Bergquist et al., 2022).

The predictive value of place affinity in terms of concern is promising and suggests that this construct may be informative in understanding climate perceptions. Present place affinity predicted

concern more strongly than future place affinity, suggesting that the locations of current impacts may be more influential for risk perceptions than distant future impacts. This could be because current or imminent impacts are seen to be much more likely and easier to imagine than those in the distant future (Pahl et al., 2014; Tonn et al., 2006).

In terms of climate communication, it would therefore be beneficial to focus on places that are severely impacted by climate change currently or that will be in the immediate future so as to find strategies to increase people's feelings towards these places in terms of the extent of familiarity, social similarity and caring. These feelings could potentially be facilitated through storytelling approaches, which could provide the detail and engagement necessary to increase people's affinity with a place and its inhabitants, which in turn might then relate to higher concern (e.g., Moezzi et al., 2017). Such combined approaches would be interesting to explore in future studies.

Susceptibility towards place affinity

Relationships between susceptibility variables and place affinity were relatively weak, with most effect sizes below r_t = .10, but a few stronger relationships were uncovered: For places impacted in the present or immediate future, a participant was more likely to have higher affinity if they defined themselves as part of, and were invested in, the wellbeing of the global community (r_t = .16 and r_t = .18, respectively), valued universalism (r_t = .16) or power (r_t = .18) and took future consequences into account in their decision-making (r_t = .11). For the places impacted in the distant future, a higher value of power (r_t = .12), holistic thinking (r_t = .11), definition as part of and investment in a global community (r_t = .13 and r_t = .17 respectively), and consideration of future consequences (r_t = .11) were related to higher place affinity. Complete correlations can be found in the supplementary materials.

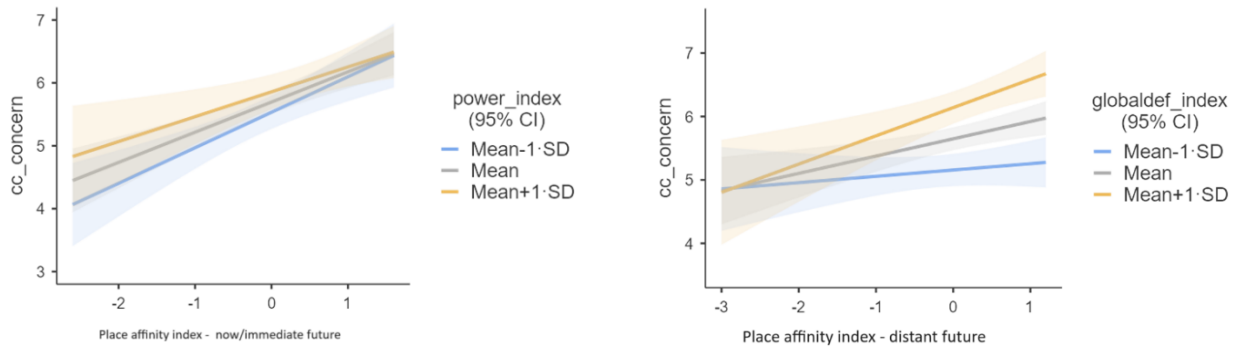
As we were particularly interested in whether these characteristics might affect the relationship between place affinity and risk perception, we ran general linear models with interaction terms to test for moderation effects of susceptibility variables on the relationship between present and future place affinity and concern or worry. These models were specified as 'outcome ~ 1 + susceptibility variable + place affinity index + susceptibility variable*place affinity index', thus predicting the outcome variables (concern or worry) by each of susceptibility variable and place affinity index (present/immediate future or distant future) and the interaction of the latter two. All combinations of two outcome variables, 14 susceptibility variables and 2 place affinity indices were specified, leading to total number of 56 general linear models. Since this analysis was highly exploratory and the high number of models tested would lead to a very inflated chance of finding significant effects, we chose to inspect these models visually via line graphs. The supplementary materials contain the

full details of these analyses, including the plots that informed our interpretation of these relationships.

There was some indication of moderating effects for the immediate future and distant future location indices for both concern and worry. Some variables seemed to be acting as "protectors from location effects", whereby some participants (e.g., those with a high value of power, a high global self-investment or a low agency) showed high concern or worry even with low place affinity. Figure 4.3 shows an example of such a relationship. Other variables seemed to be acting as "enhancers of place effects", whereby some participants were especially responsive to high place affinity, resulting in higher concern (e.g., those with high global self-definition). Examples of both types of relationships are shown in Figure 4.3. Most effects, however, were small, with overlapping confidence intervals, and will therefore not be interpreted here in more detail. Nevertheless, this study was able to provide an investigation of the relationship of several potential susceptibility variables with place affinity and climate change concern and worry, allowing us to get a more comprehensive overview than previous studies which had only investigated one or two susceptibility variables at a time and in relation to psychological distance (e.g., trait empathy; Chu & Yang, 2019), not the more comprehensive construct of place affinity. The next step in exploring such effects would be to compare place affinity and susceptibility towards fewer, pre-defined places.

Figure 4.3

Examples of the moderation effects of susceptibility variables on the relationship between place affinity and concern, as described in the text. Left: "protector" from place effects, right: "enhancer" of place effects.



Conclusion

Study 1 provided a promising first test of the place affinity framework, indicating that place affinity, as determined by several place beliefs, may be related to the degree of concern people experience about climate change impacts. While this suggests that place affinity may be a useful concept in explaining climate change perceptions and should be explored further, it could still be the case that there are further place beliefs that should be integrated into the framework that could improve its explanatory value. The selection of place beliefs proposed in Chapter 3 and explored in this present Chapter 4 rests on our review of relevant literature. While this review has aimed to include both concepts relevant to psychological distance (Chapter 2) and other, related concepts (Chapter 3), it is nevertheless possible that relevant research perhaps using different terminology has been missed. In order to identify any such missing important concepts, or overlooked relationships within or outside the framework, we conducted an additional qualitative Study 2 which is presented below.

4.3 Study 2

A primarily qualitative questionnaire was devised with the aim of supplementing insights from the primarily quantitative Study 1 and identifying major concepts that we previously might have missed, similar to other recent research examining people's perceptions of climate impacts (Duke & Holt, 2022). The aims to this study were identical to those of Study 1, but with a different methodological approach designed to provide a complementary exploration of the place affinity framework and the processes surrounding it in the context of climate impact locations.

4.3.1 Method

The sampling procedure was identical to Study 1, with recruitment through Prolific (Prolific, 2022). A sample size of 20 participants was chosen in order to gain a dataset with meaningful insight into the qualitative questions. All were UK residents, 25 years old on average (SD = 6.11, range 18 to 40), with 60% identifying as female (15% preferred not to say), 15% in full-time employment and 30% in education.

First, the susceptibility items were presented as in Study 1. Descriptive statistics for these items can be found in the supplementary materials, as they were not analysed further for the present work. Then, we presented participants with six open questions designed to gauge thought processes around locations impacted by climate change. We designed the questions to start in a general way ("Think about the consequences that climate change may have at the moment or in the future. What is the first thing that comes into your head?"), then probing the participants on social aspects of

impacts ("Who or what do you think is/will be negatively impacted by climate change consequences?"), emotional consequences ("How do you feel when thinking about those impacts?"), followed by asking about their perception of climate change in general ("What are your overall views on climate change?") and about how these perceptions may be related to impacts and their locations (first generally without leading "What led you to form these views that you described above?", then more specific to the study object "To what extent do your thoughts on the location and time scale of climate change impacts influence your views on climate change overall?"). Finally, we gave participants the opportunity to say anything else they would like on climate change and its consequences. These questions were designed to mirror the research questions addressed by Study 1, that is eliciting which places people think of as being impacted by climate change (RQ1), how they perceive those places (RQ2), and how these perceptions relate to participants' perception of climate and associated risks (RQ3).

Before this block, participants were told that these were the only six remaining questions and asked to take their time and write as little or as much as they needed. The response box was several lines deep to encourage more extensive answers.

4.3.2 Results and Discussion

The qualitative questions were analysed using thematic analysis (Braun & Clarke, 2006) in NVivo (*NVivo*, 2021). Responses were coded deductively, focusing on references to affected locations or people, and summarised in themes. Two themes are presented here which contribute to the understanding of locations of climate impacts; a comprehensive list of all codes can be found in the supplementary materials.

A first theme saw participants contrasting current and future impacts. Current impacts were often perceived to affect only some regions, such as a particular continent, or animal and plants, for example saying, "I think that more immediately it will be certain parts of the world and certain animal species that will be negatively impacted". Future impacts were expected to be much worse, illustrated by the same participant continuing: "I think that humans have the resources to last longer but the human race will be negatively impacted later as well - no place to live, no resources available etc.". Some participants made specific mentions to their own children, but generally, future impacts were discussed very abstractly (e.g., "it's going to get worse", "going to be rough"), referencing humanity, future generations or the earth or planet. This supports previous evidence from qualitative studies, with even (Western) children describing near-term impacts being further away than future impacts (K. Lee & Barnett, 2020). Similarly, cross-sectional evidence has shown that people expect long-term impacts to be more serious to themselves or their area than near-term impacts (Katz et al., 2020).

In order to help people better imagine this near-term future, it may therefore be beneficial to communicate specifically about local or national climate impacts. Evidence suggests that such scenarios wherein, for example, sea level rise is modelled and communicated to coastal communities, may lead to higher acceptance of mitigation measures (Degeling & Koolen, 2021; Galati et al., 2021). Similar strategies in communication about specific places – even if they are not people's own communities – might help increase affinity for places impacted currently or in the immediate future, which were linked to concern in Study 1.

The second theme in the responses consisted of a strong awareness of inequality in terms of who is causing the climate crisis, who suffers as a result of it and who is best placed to mitigate its effects or to adapt to its consequences. Such responses concerned impacts to certain geographical regions ("people who live along the equator", "who live near deserts"), but were most commonly related to countries that are without the resources necessary for adaptation ("those areas which are poor and will struggle to afford the infrastructure to protect them"). In this sense, although severe impacts were known to occur in many places, worry and concern were drawn toward the perceived vulnerability of a country or people, as "everyone [will be affected] – but poorer countries will feel the impact harder where they don't have government funds or insurance to help them".

The notion of vulnerability being a relevant factor has previously been reflected in some measures of psychological distance which ask whether other countries are more vulnerable to the effects of climate change than one's own (Spence et al., 2012). However, the prominence of vulnerability in participants' responses in this study suggests that it may be worth separating this factor from aspects of distance and to investigate both separately. This may help understand people's willingness to act against climate change or support climate policy. For example, Klinsky and colleagues (2012) asked participants to allocate climate change funds and found that some participants allocated more money to closer, more similar countries, and others to countries further away which seemed more vulnerable. In such a scenario, separating judgements of distance, vulnerability and similarity may help to understand why participants allocate the funding they do and in turn, which aspects best to address in climate communication. These latter issues relating to vulnerability to climate change impacts and the availability of resources for adaptation were not included in Study 1 and would be important points to address in the future. It is, in fact, likely that in a UK or other WEIRD sample, the currently threatened places that are most familiar, similar and cared for compared to one's own location are not those perceived to be in the greatest need for support or the most vulnerable to climate impacts. How this potential dichotomy plays out could be very relevant to understanding the location of climate impacts, risk perception and action, and should be addressed in future work.

Another aspect of inequality arose from findings regarding perceptions of who the institutions and people who are responsible for climate change. This responsibility was often placed on governments, big corporations and wealthy people, to be "taken seriously by countries all over the world as a joint effort". At the same time, some felt it was easier to look away because the UK was not under immediate threat, for example, stating that, "I think living in a country that doesn't suffer extreme weather conditions due to climate change does make you slower in wanting to make a change." It is possible that this lower urgency translates into the notion of governments and corporations needing to take action, which removes personal responsibility. It would be interesting if stronger place affinity, and therefore increased urgency, might encourage a personal motivation to bring about systemic change. Such relationships between place affinity and different forms of climate actions are therefore another promising avenue for future research. Efficacy beliefs, that is the perceived ability to bring about change individually or collectively, can be assumed to play a role too; such future directions will be discussed in more detail below.

4.4 General Discussion and Directions for Future Research

In this chapter, we investigated people's beliefs towards places impacted by climate change and the effect of such place affinity on their feelings of concern and worry. In conceptualising these place beliefs, we suggested an integration of both novel and established constructs in climate psychology. These constructs serve to shape how we feel towards a place and react to it being threatened, such as spatial distance, place identity, place attachment and degree of caring as well as our sense of familiarity, similarity and intimacy to places and their inhabitants.

We conducted two studies to describe and explore some of these constructs, consisting of a primarily quantitative (Study 1) and a primarily qualitative (Study 2) questionnaire. In Study 1, we first asked participants to name which places they thought were impacted by climate change currently (in the immediate future) or in the distant future. We then asked which one of those places was the most familiar, cared for and socially similar to their own location, and then asked them how familiar, cared for and socially similar the named place was. This operationalisation, in which participants were asked for their free associations of climate change impact locations and then rated place beliefs towards those places, was designed for this study, based on conclusions from Chapters 2 and 3, and had not been implemented in the previous literature. We found that, in this operationalisation, stronger place affinity toward places impacted in the immediate future that were more familiar, more socially similar and more cared for was related to higher concern for climate change overall and was of a similar predictive strength to that of belief in climate change and the negativity of its consequences. This suggests that place affinity, with its associated place beliefs, can help us understand climate perceptions and is worth exploring further. However, there was no

meaningful relationship of present or future place affinity with the frequency of worry or between future place affinity and either worry or concern.

We also suggested that there may be individual characteristics, termed susceptibility variables, which influence the strength of place beliefs and whether they have an impact on risk perception. Some susceptibility variables were found to be related to the place affinity index, so that individuals with a higher value of power, universalism, sense of agency, and global identity tended to have affinity toward places they perceived as being impacted currently or in the immediate future. The statistical effects of these susceptibility variables were relatively small, but indicated that these characteristics might help people develop stronger place affinity. Exploring these further in future research may help explain why certain people respond with more or less concern to the threat of climate change to a particular location.

A key aim of the previous chapter was to integrate disparate aspects of the literature into a conceptual framework that could be explored empirically to provide a basis for future confirmatory research (Eronen & Bringmann, 2021; Scheel et al., 2020). The new operationalisations and novel combinations of measurement instruments in Study 1 and Study 2 enabled us to collect rich and informative data, but also come with limitations. For example, our place belief items targeted the *most* salient and *most* familiar, similar and cared for locations, which should capture the most influential place-person relationships and which we indeed found to be related to risk perceptions. The drawback of this approach was that places were self-generated, and thus effects between different places are much harder to compare. As a next step, measuring the same beliefs towards pre-determined locations (e.g., those appearing in news reports) would provide further support for our framework. Such an approach might also facilitate an exploration of the complex interactions between place beliefs and susceptibility variables, which presented a challenge in the current study. The use of a longitudinal design would also help to advance an understanding of how perceptions relating to impacted locations and associated affinities change over time, particularly as climate change impacts become increasingly prominent.

A further limitation of Study 1 arose from our measures of concern and worry. These were based on an established risk perception framework (van der Linden, 2015), which we were going to follow in combining the two variables into an aggregate construct. However, these measures showed such different relationships with place affinity that we retained them as single item measures. This shows that, in the context of climate change impact locations, investigating worry and concern separately may provide useful information. Investigating worry in more detail may have additional benefits: For example, worry can be both well adapted or maladaptative, where the former provides motivation and resources for problem solving, and the latter inhibits problem solving by encouraging

repetitive thinking (Stewart, 2021). Understanding such mechanisms may help to better understand why certain aspects of risk perception do or do not lead people to act on climate change. Finally, the participants in this study were exclusively UK residents. This sampling approach was implemented to keep spatial distances stable as there were many other dynamic aspects at play in this study. However, it will be important for future research to explore perceptions in other, more vulnerable populations.

Besides these methodical considerations, we have multiple suggestions for how future research can test the conceptual framework and the surrounding processes that we have proposed in this study. We can see at least three main directions for future research, which relate to the development of a deeper understanding of: (1) the nature of place beliefs that are relevant to place affinity; (2) the emotional reactions that are aroused in relation to place affinity; and (3) the path from meaningful places being threatened to feelings of concern.

Regarding the first point, the place beliefs that we have included as predicting place affinity (social similarity, familiarity and care) may not be (and most likely are not) the only other factors contributing to place affinity. The strength and intention of the place affinity framework is that more place beliefs can be included as relevant. For example, Study 2 suggested that aspects of climate justice, such as perceived vulnerability and responsibility for climate change may also inform people's perceptions of impacted places. Determining how these relate to each other, to the concept of place affinity, and to factors such as risk perception, behaviour and policy support would be valuable in future research and would extend the framework tested in this study in a meaningful way. Such effects could also explain why some studies with Western samples report stronger behavioural intentions when participants are faced with threat to developing countries than threat to their own (Shackley, 2021; Spence et al., 2012).

Equally, some place beliefs may be related to others in more complex ways. The framework tested in this study assumed an equal contribution of all place beliefs to place affinity. However, it is possible that some place beliefs are more important to understanding place affinity than others and that identifying these could help ensure the parsimony of future models, and thus their effectiveness in relation to climate change mitigation and adaptation. More advanced modelling techniques which assess the differing contribution of place beliefs to place affinity are implemented in the next chapter.

Regarding the second point (emotional reactions), this study included emotional aspects of climate perceptions by measuring general affect as part of an established risk perception model (van der Linden, 2015). We found that affect was not predictive of concern or worry about climate

change, opposed to what would be expected based on previous literature (van der Linden, 2017; Verplanken et al., 2020). However, as emotions are integral to beliefs such as objects of care (Wang et al., 2018) and as reports of climate change impacts on different places have previously been shown to influence different types of emotions (Chu & Yang, 2019; Verplanken et al., 2020), then a clear recommendation is to assess more explicitly both the nature and intensity of emotions in future research, for example determining whether threats to places with different levels of place affinity are associated with different levels of emotions, or different emotions altogether. This could be included as a further outcome variable in the processes surrounding the place affinity framework, or as part of more complex mechanisms.

Thirdly, we recommend more research into understanding the path from perceiving a threatened place to experiencing concern. The research in this chapter has simplified this relationship. Specifically, the framework explored in this chapter assumes that threat to a place one has high affinity with leads directly to concern or worry about climate change. There are, however, several nuances to consider in terms of the potential associations between these constructs. It is possible, for instance, that the relationship between meaningful places and concern works in both directions. People with a strong connection to their local environment, or a strong environmental identity, could be more aware of impacts as they would be more likely to notice or hear about them and attribute them to climate change (Duke & Holt, 2022). There may also be factors which moderate the relationship between threat and concern. For example, risk to personally meaningful places and people may actually feel too threating to certain individuals such that the threat triggers defensive reactions – particularly for people with low self-efficacy (perceived ability to influence climate mitigation or adaptation; Koletsou & Mancy, 2011) or those reluctant to engage in the kinds of climate action that might negatively impact their current lifestyle (Brügger, Dessai, et al., 2015). It is possible that threat to meaningful places in these latter cases is met with a denial of responsibility to act (Gosling et al., 2006) or avoidance of threatening information (Sweeny et al., 2010). Emotion regulation strategies were only included in two of the studies reviewed in Chapter 2, with one finding that the choice of emotion regulation strategy influences what adaptation techniques farmers used to respond to distant climate threats (Acharibasam & Anuga, 2018). The other study found that the type of emotion experienced (basic vs. self-conscious) influenced what kind of emotion regulation strategy participants used to respond to abstract threats; however, effects of these strategies on behaviour or policy support were not investigated (Ejelöv et al., 2018). Further exploring emotion regulation strategies, as well as influencing factors such as efficacy or attitude towards mitigation and adaptation measures, may therefore help explain the circumstances under which threat towards meaningful locations translates into concern, clarifying the respective mechanisms surrounding our framework of place affinity and providing a potentially promising insight into the effectiveness of

climate communication (Pihkala, 2022a). This may also help to better understand different effects on concern and worry as found in this study, as the two concepts may be influenced to different degrees by such emotion regulation strategies.

In conclusion, the results of the studies presented in this chapter suggest that the concept of place affinity may provide a useful theoretical basis for understanding the perception of localised climate impacts and their effect on risk perception and action. The findings and discussion points provide a conceptual foundation on which to expand this research to produce further insights into people's understanding and communication of climate impacts.

4.5 Outlook

The study described in this chapter provided an exploration of the framework of place affinity and its relation to climate change perceptions. However, the cross-sectional and explorative nature of this study limited the insights into the mechanisms at play between place affinity and climate perceptions. Additionally, the free responses collected in this study made it difficult to compare how people respond to different levels of place affinity. Since such comparisons are crucial in order to make recommendations for climate communication, as the next step we undertook an experimental study that addressed some of the limitations of this cross-sectional study, applying the framework of place affinity to a more ecologically valid context and providing data to corroborate the framework from a different methodological perspective. This experimental study is presented in Chapter 5.

5 How Affinity with Places Affects the Indirect Experience of Extreme Weather Events: an Experimental Test

The explorative study reported in Chapter 4 provided an in-depth analysis of the place affinity framework in a cross-sectional setting. However, the cross-sectional data did not allow any insights into causal mechanisms and investigated links with only a limited number of dependent variables. In this chapter, we therefore addressed these issues in order to gain a better understanding of the utility and limitations of the place affinity framework. Additionally, we wanted to set our study in an ecologically valid context in order to assess place affinity effects in a context that people encounter in day-to-day life. For this context, we chose the indirect experience of extreme weather events through news reports.

5.1 Extreme Weather Events in the Media

Global climate change manifests itself in events such as storms, droughts and heatwaves (IPCC Working Group 2, 2022). News media often report on these manifestations because specific incidents more easily generate interest than abstract climate models (e.g., Boykoff, 2008; McGinty et al., 2014; Wozniak, 2021). Currently, it is unclear whether such indirect, mediated climate change experiences increase risk perception, worry or action (Howe et al., 2019; Ojala et al., 2021). We argue that instead of trying to determine whether these links exist, it may instead be more informative to focus on the circumstances under which such links are more or less likely (for similar arguments concerning effects of direct experiences, see Brügger et al., 2021). What all extreme weather events share is that they happen in particular places. How people relate to these places could then be a key factor influencing people's reactions to such events.

As discussed in the previous chapters, insight into the perception of climate impact locations has historically often been produced in research on "psychological distance" within Construal Level Theory (CLT; Trope & Liberman, 2010). This theory posits that anything can be construed as proximate or distant on four dimensions: spatial (location of an event), social (who is affected), temporal (when the event takes place) and hypothetical (uncertainty). Research applying this theory to climate impact locations has shown how each dimension can be related to climate perceptions (see Chapter 2; Maiella et al., 2020). However, as we have shown throughout this thesis, psychological distance can only explain limited aspects of climate change perceptions (see also Brügger, 2020; Wang et al., 2021), and evidence seemingly supporting the original CLT framework has been questioned because of publication bias (Maier et al., 2022). Additionally, with the impacts of climate change increasing worldwide, most people will feel close to the climate crisis sooner rather than later. This means that constraining research to aspects of distance will limit our

understanding of climate impact perceptions (Bradley et al., 2020), and that other approaches may be more suitable to exploring place- and distance-related aspects than CLT.

These criticisms of CLT and distance-related research pose a challenge for identifying suitable alternative perspectives on the perception of climate impact locations. In our previous systematic review on the psychological distance of climate change and following meta-scientific discussions (Chapters 2 and 3), we concluded that future research would benefit from a bottom-up view to identifying and describing knowledge around objects of study. This allows for collation of research from different fields, building a solid empirical basis for effective theoretical developments. It also limits the risk of being constrained by specific theories that are inappropriate for particular research contexts (Eronen & Bringmann, 2021; Scheel et al., 2020), which may have occurred with research on the psychological distance of climate change (Brügger, 2020). We therefore applied this approach of focusing on bottom-up research to the study of climate change impact locations. In this context, research has already identified multiple facets that determine people's relationship with locations and their reaction to climate consequences. We proposed that these facets can be described as "place beliefs" (e.g., spatial and social similarity, familiarity and caring for a place and its inhabitants), which together determine people's "affinity" with a place.

Below, we briefly review this evidence on place affinity, with particular attention to research on extreme weather events, and summarise our previous cross-sectional work linking place affinity to climate concern (Chapter 4). We then present the results of two pilot studies investigating participants' affinity with relevant places with and without the context of extreme weather events. Finally, we report an experiment that assesses the effect of these different levels of place affinity on participants' emotions, risk perceptions, personal behaviour, policy support and emotion regulation in relation to reports of extreme weather events.

5.2 Place Affinity and Place Beliefs: People's Relationship with Climate Change Impact Locations

To investigate the effects of *spatial distance* on responses to climate change, previous research has compared participants' reactions to reports about climate impacts in close versus far-away places. In some experiments, seeing impacts in one's own country versus abroad led to increased policy support (Chu & Yang, 2018) and seeing regional versus global impacts led to increased perceived risk (Wiest et al., 2015). Additionally, reading news articles about spatially far climate impacts made climate change feel further away, which was related to lower policy support (Chu, 2022) and climate protective behaviour (Loy & Spence, 2020). However, these relationships were based on path models in which the mediators (psychological distance) were measured after the

manipulation, i.e., by asking participants how far away the presented impacts felt. This design, known as conditioning on post-treatment variables, leads to biased mediation models since the random assignment of the manipulation can only inform direct causal effects (Montgomery et al., 2018). These studies therefore only provide limited evidence on causal mechanism behind perceived spatial distance. Other researchers investigating spatial distance have found differing risk perceptions, but not mitigation attitudes or fear (Spence & Pidgeon, 2010), or no effects on policy support, risk perception or pro-climate intentions (Chu & Yang, 2020b, 2020a; Rickard et al., 2016). Emotional reactions were found to be more complex still and potentially linked to emotion-regulation strategies (Chu & Yang, 2019; Ejelöv et al., 2018).

Although these results suggest that reading about extreme weather in different locations could influence risk perception and policy support, it is difficult to determine under which conditions such effects occur. Only one paper presented news about a particular event, a heavy rainstorm (Ejelöv et al., 2018), while others summarised general climate consequences. This limits inferences regarding how people perceive reports of extreme weather events. Such research is also lacking in the field of media studies, which often focuses on content or framing analyses (for reviews see Agin & Karlsson, 2021; Dhaher & Gumus, 2022) or that of extreme weather events perceptions, which has not investigated the indirect, mediated experiences that this study focuses on (for a review see Howe et al., 2019).

Additional challenges arise from the choice of places in experimental designs. These have primarily been selected to differ in spatial distance, but it is unavoidable that they will also differ in closely linked factors (e.g., the other place beliefs discussed below). Systematically choosing which places to compare, based on a holistic selection of place beliefs, will help inform the extent to which different place beliefs contribute to differences in extreme weather perceptions.

One factor closely related yet distinct from spatial distance is *spatial similarity*. When evaluating extreme weather, people might interpret similar geographies as a cue that similar events could happen at home, which may increase perceived risk. But the similarity with the inhabitants of places can also influence threat perceptions. Social identity theory proposes that people will protect their own social group from harm (Masson & Fritsche, 2021), and this social group can be based on *social similarity* (e.g., profession, hobby, societal categories; Fielding & Hornsey, 2016) or *social intimacy* (e.g., close personal connection, friends and family; Wang et al., 2019). Consequently, climate impacts in a place with high social similarity and/or social intimacy may be associated with higher risk perceptions and willingness to address the threat.

An alternative perspective from CLT suggests that feeling socially distant does not necessarily engender less engagement, but rather elicits changes in the factors used for decisions and evaluations (Brügger et al., 2016; Trope & Liberman, 2010). For example, believing climate impacts to affect loved ones (proximity) would make one focus on low-level, concrete information such as others' opinions in evaluating a threat. Perceiving impacts as only affecting strangers (distance) would make one focus on abstract, personal values and ideology. Cross-sectional CLT studies indicate that in Western samples, perceiving threats to similar people (e.g., other Westerners) is related to higher concern (Spence et al., 2012). Threats to developing countries were not necessarily related to concern, but were sometimes related to willingness to act (Shackley, 2021; Spence et al., 2012). Problematically, this literature assumes that Westerners generally feel low social similarity with people in developing countries. This makes it difficult to investigate nuances in social similarity and the results may not generalise to other, non-WEIRD (Western, educated, industrialised, rich, democratic) samples. Additionally, these results are based on cross-sectional data, which cannot indicate causal mechanisms or the malleability of the variables.

Another concept potentially contributing to place affinity is *objects of care* (Wang et al., 2018). This concept suggests that people are less likely to experience strong emotions about abstract climate change but are more likely to respond to threats to specific objects they care about (e.g., certain people, places or nature). In the context of extreme weather events, reading about impacts to a place one cares about might result in a stronger willingness to address this threat. Finally, feelings of care and high similarity may be more likely to exist when people feel *familiar* with a place. On the other hand, familiarity could also work independently, enabling people to contextualise and understand extreme weather events in a particular place.

In Chapter 4, when asking for open-ended comments on climate impact locations, participants also linked place and risk perceptions to aspects of inequality. These were places' *responsibility for causing climate change* (including that of populations, social, legal, economic and political systems, currently and historically) as well as their *vulnerability*. Participants indicated larger concern for places perceived as more vulnerable and less responsible for climate change. Vulnerability can be defined as a place's or population's sensitivity to a hazard and their ability to respond and recover from it (Cutter & Finch, 2008). Although perceived vulnerability of impact locations has only been researched in very specific contexts such as tourist perceptions (Huebner, 2012), we included it as a place belief as the aforementioned results indicate it may influence people's responses to extreme weather events. Similarly, evidence regarding perceived responsibility is sparse, but shows that it may influence reactions to climate impacts. For example, a shared sense of responsibility can be the basis for identification with a place or population. This can lead to an in-

group sentiment and the motivation for climate action to protect this in-group (Swim & Bloodhart, 2018). In contrast, being told that one's own group has responsibility for causing climate change has been associated with perceiving the issue to be less controllable, engendering lower concern and policy support (Jang, 2013).

5.3 Previous Evidence on the Place Affinity Framework and Climate Change Impact Locations

Chapter 4 provided a cross-sectional test of the place affinity framework. Participants were asked to name places they thought were impacted by climate change and rate their familiarity, social similarity and care towards them. Findings indicated that people's affinity with a place they saw as currently or soon to be affected predicted their overall climate concern at a strength comparable to belief in climate change and its human causes. However, affinity with places affected in the distant future did not predict concern, and worry was not predicted by either current or distant future place affinity.

Although this study indicated that place affinity and place beliefs may be useful concepts to understand perceptions of climate change impact locations, it had several limitations. The design allowed participants to freely name places they thought were severely and negatively impacted by climate change. This resulted in many place types (e.g., cities, countries, landscapes) that were difficult to compare between different categories and different levels of place affinity. Because of this complexity, only a small number of place beliefs and dependent variables were measured. These limitations mirror those with research reviewed above, in particular that cross-sectional data only provide preliminary indications regarding causal networks, and existing relationships do not guarantee that place affinity can be manipulated. Additionally, previous studies typically focused on selected aspects of place beliefs or distance, tended to measure limited and often difficult-to-compare dependent variables, and, when experimental, often involved unsystematic manipulations. We therefore build upon previous work by conducting an experiment to compare the causal effects of different levels of place affinity, as indicated by a wider selection of place beliefs, and on a variety of personal and system-level outcome variables in an ecologically valid but under-researched context (i.e., the perception of extreme weather events through news media).

5.4 The Present Study: Applying Place Affinity to Climate Change Reporting

This experiment investigated whether place affinity, as indicated by several place beliefs, can inform an understanding of people's reactions to a news article about an extreme weather event related to climate change. We conducted a three-condition, between-participants experiment in which participants were shown one of two fabricated news articles on a recent extreme weather

event (differing only by location) or a general article about weather induced by climate change as a control. Our aim was to mimic a real-life situation that people experience (and will increasingly experience). We conducted two pilot studies to identify how levels of place affinity with affected countries differ from each other and to determine which countries to include in the experimental manipulations.

5.4.1 Pilot Study 1: Countries Cluster Along Levels of Place Affinity

First, we wanted to explore participants' affinity with relevant countries and whether they could be represented in different affinity clusters. We focused on UK participants to provide a comparable reference point for affinity levels, and for comparability with previous research (Chapter 4). Additionally, UK residents, as citizens with a globally high socio-economic status, have considerable influence in helping or hindering climate action (Nielsen et al., 2021) and are therefore valuable to understand as a sample.

Pilot 1 was conducted to identify any patterns or groups in UK residents' affinity towards relevant countries. To select these relevant countries, we used World Weather Attribution (World weather attribution, n.d.) and the Global Climate Risk Index (Eckstein et al., 2021) to first identify extreme weather events attributable to climate change which have taken place in the UK (i.e., flooding, heatwaves and storms) and then to identify places in which the same type of extreme weather events, attributable to climate change, have occurred. This resulted in a list of twenty countries. To reduce the list, for neighbouring countries we chose the one with the largest population (e.g., Mozambique instead of Zimbabwe or Malawi), resulting in a final list of 17 places.

We recruited a sample of 102 participants to rate these countries. To gather a relatively diverse sample, participants were recruited through Prolific, which provides high-quality data (Peer et al., 2022). Participants with UK residence for at least 10 years were eligible (to increase similar baseline affinity with the UK). All were paid the equivalent of the UK hourly minimum wage (£7.50). Participants were on average 40 years old (*SD* = 15.3) and 50% female and 50% male (Prolific only provides binary sex, no gender identity data), with 53% in full-time employment, 15% in part-time employment, 20% not in paid employment, and 14% being students (irrespective of employment status).

We presented the country names and flags (including the UK) to these 102 participants and asked them to rate place beliefs toward each country. All items were measured on a five-point Likert scale, measuring familiarity ("How familiar with this place do you feel?", from 1 (*not familiar at all*) to 5 (*extremely familiar*)) spatial distance ("How close does this place feel to you geographically" from 1 (*not at all close*) to 5 (*extremely close*)), social intimacy ("How close do you feel to the people in this

place (e.g., have family, friends, acquaintances or colleagues there?" from 1 (*not at all close*) to 5 (*extremely close*)), social similarity ("How similar do the people in this place feel to you?" from 1 (*not at all similar*) to 5 (*extremely similar*)), care ("How much do you care about this place?" from 1 (*not at all*) to 5 (*a great deal*)), perceived vulnerability ("How well do you think is this place able to respond to and recover from climate change impacts, based on current political and personal resources?" from 1 (*not well at all*) to 5 (*extremely well*)) and perceived responsibility ("How responsible do you think this place is for causing climate change?" from 1 (*not at all*) to 5 (*a great deal*)). For spatial and social similarity, spatial distance and perceived vulnerability and responsibility, we also included a "don't know" option in case participants were not familiar enough with a country to answer these questions. Finally, two response items were included as attention checks, in which participants were told to "respond with "agree" to this question. This is an attention check" (Meade & Craig, 2012).

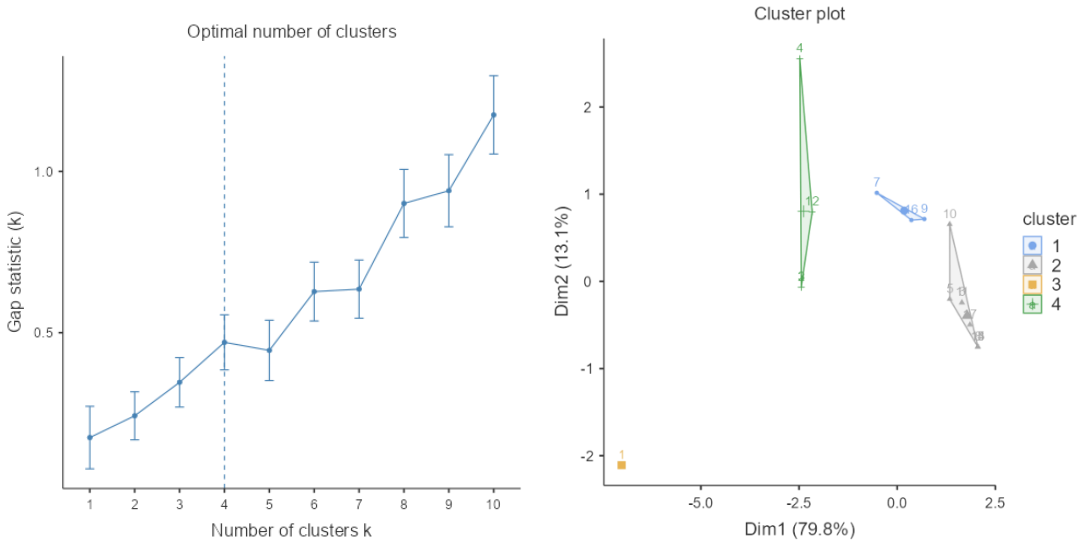
There were no speeders (defined as <> 1.5*IQR response time). When checking for responses, no outlier was found on the longest consecutive responses, but one outlier was found on the longest average consecutive response (with 1.44 average consecutive response). This outlier was then excluded from the analysis. There was very little missing data, not necessitating any further action.

The place belief scores were inspected visually with boxplots and broadly compared for similarity. The boxplots suggested that there were different groups of place beliefs profiles present (all graphs available in the Supplementary Materials), which led us to investigate these groups statistically.

To further investigate these suggested groups, a cluster analysis was conducted using the R packages factoextra (Kassambara & Mundt, 2020) and cluster (Maechler et al., 2022), and Jamovi (The jamovi project, 2021). For each place belief, a median score was calculated across participants and entered into a k-means cluster analysis. The gap statistic (Tibshirani et al., 2001) suggested a four-cluster solution (see Figure 5.1 left). These results suggested that participants' affinity responses could be classified into four groups: high place affinity (UK), medium affinity (Germany, Italy, USA, Australia), low-medium affinity (South Africa, India, Japan) and low affinity (Bahamas, Bolivia, Afghanistan, Pakistan, Siberia, South Sudan, Niger, Mozambique, Madagascar). The clusters are displayed visually in Figure 5.1 (right).

Figure 5.1

Four-cluster solution of countries. Cluster 1: South Africa, India, Japan; Cluster 2: Bahamas, Bolivia, Afghanistan, Pakistan, Siberia, South Sudan, Niger, Mozambique, Madagascar; Cluster 3: UK; Cluster 4: Germany, Italy, USA, Australia



These results indicated that UK residents regard countries with similar extreme weather experiences within four categories of place affinity. These findings provided a first overview of patterns of affinity with relevant places and suggested that we can distinguish between distinct affinity groups. However, the countries were presented without context. Therefore, as a next step, we tested whether these four groups could still be differentiated when participants rated place affinity after reading reports about extreme weather events in those places.

5.4.2 Pilot Study 2: Clusters are Reduced in the Context of Climate Change Reporting

To investigate the four affinity clusters in the context of extreme weather news, we showed participants one of four news articles and asked them to rate affinity with the place. To represent the four clusters, we chose the country closest to each centroid: high affinity (UK), medium affinity (Germany), low-medium affinity (South Africa) and low affinity (Madagascar). All countries have recently experienced flooding, as focused on in the stimuli.

The stimuli were realistic, online news articles that were general enough to reflect events that had occurred in each country. To fulfil these criteria, we collated flooding reports for each country from BBC Online (a relatively neutral news source used by UK readers across the political spectrum; Pew Research Center, 2018) and based the structure and content of stimuli on those articles, ensuring the inclusion of factual information (e.g., damage, responses, climate change link) and personal stories (e.g., affected locals, politicians, scientists). Stimuli were equivalent in all

conditions except for place references. As participants were told the articles were fictitious for ethical reasons, we increased realism by specifying that the reports were realistic and based on previous events, and by including the storytelling components to increase similarity to real articles and engagement (Morris et al., 2019).

Our aims for Pilot Study 2 were: (1) to test whether the four levels of place affinity could be replicated in the news context; and (2) to pre-test the experimental stimuli for the main experiment. UK residents (*n* = 99) were recruited with the same procedure and eligibility crtieria as were used in Pilot Study 1. Participants were on average 38 years old (*SD* = 12.5), 76% female, 23% male and 1% preferring not to say, with 33% in full time-employment, 30% in part-time employment and 22% not in paid employment. Irrespective of employment status, 11% of participants were students.

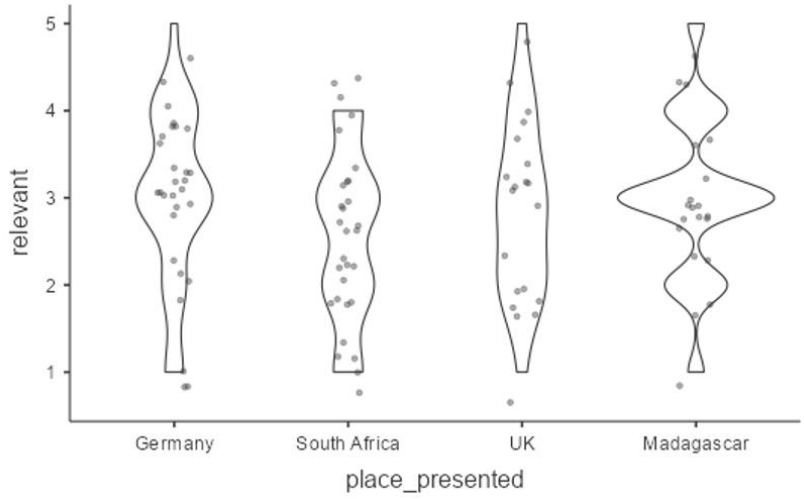
Participants gave their informed consent and were then randomly assigned to read the news article located in one of the four countries (UK, Germany, South Africa, Madagascar). We asked participants to rate the place beliefs as implemented in Pilot 1. We then elicited understanding and engagement by asking participants to name the country the reported event took place in and to name to which extent they thought the article was engaging, interesting, relevant, and understandable (scale from 1 = *not at all* to 5 = *very much so*). We were additionally interested in what type of settlement participants imagined was reported to be flooded so that we would have a clearer idea of their mental imagery. For that purpose, we asked participants to state, "What kind of place did you think was being described as being flooded?" with options from a hamlet, village, township, town, small city, large city or metropolis. We also gave participants an open comment box to name anything that was unclear or bothered them while reading the article.

Jamovi (The jamovi project, 2021) and R studio (R Core Team, 2022) were used for the analysis. To clean and prepare the data, we checked for speeders below three SDs of response durations (according to Prolific Policy) and for missing values. There were no speeders and not more than 8 missing values on any one variable and not more than 2 missing values for any one person, leading us to proceed with the analysis.

In terms of understanding, only one person could not remember which country they had read about, so the saliency of the country seemed sufficient. Understandability was also rated highly (*M* = 4.36, *Md* = 4, *SD* = 0.69, *IQR* = 1). A few participants said the article would benefit from breaking up into smaller paragraphs for readability, which we implemented in an updated version. Participants found the articles engaging (*M* = 3.75, *Md* = 4, *SD* = 0.90, *IQR* = 1) and interesting (*M* = 3.89, *Md* = 4, *SD* = 0.93, *IQR* = 2). The relevancy was slightly lower (*M* = 2.83, *Md* = 3, *SD* = 0.98, *IQR* = 1), which was expected for the conditions with lower affinity. We therefore visually inspected relevancy scores in

the four conditions, which showed that lower-affinity conditions did have slightly lower scores, but relevancy was relatively spread out across the scale for all conditions as can be seen in Figure 5.2.

Figure 5.2
Perceived relevancy across conditions



The materials were therefore deemed engaging and understandable enough to be used in the main experiment, with the minor change of using smaller paragraphs. Most participants imagined the place to be a village (41%), a township (54%) or a town (48%), showing a similar interpretation of the article. It is possible that participants' may perceive an article as more relevant if it describes a place similar to the size of their own settlement. For that reason, the main experiment included a measure on the size of place participants live in.

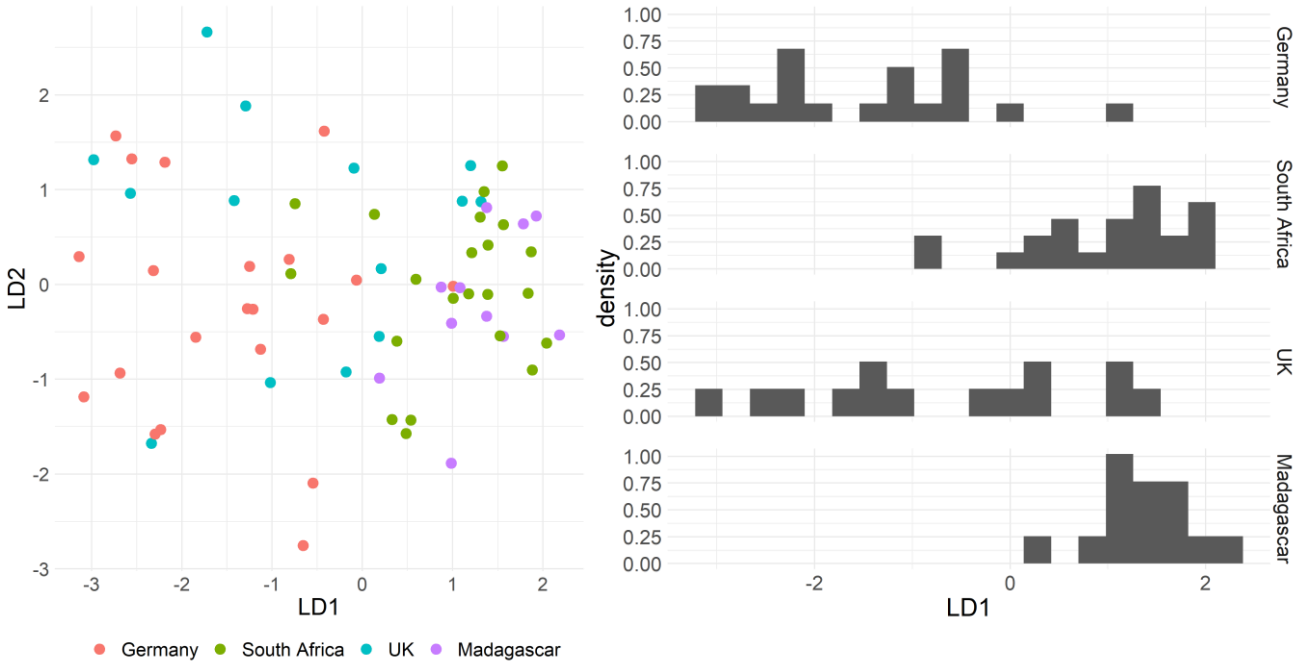
We conducted a MANOVA and discriminant analysis to investigate differentiation between the four conditions[3]. MANOVA test statistics, Wilk's $\lambda = 0.32$, $F(24, 224) = 4.51$, $p < .001$, suggested there was a significant difference between conditions on a linear combination of the place beliefs, with an effect size of $\eta^2_p = 0.44$. To investigate how conditions were differentiated from one another, we ran a discriminant analysis. Discriminant analyses are recommended as post hoc tests in preference to individual ANOVAs and pairwise comparisons because they show differentiations in the linear combination of the dependent variables (i.e., place beliefs) rather than testing them separately

[3]A MANOVA was chosen for place affinity, rather than an ANOVA for each place belief because: (1) place affinity is conceptualised as a combination of all place beliefs; (2) consequently, Pilot Study 1 separated countries by place affinity clusters, not through individual place beliefs; and (3) place beliefs are assumed, and shown in prior research (see literature review), to be related to each other. Together, these are ideal conditions for a MANOVA and would lead to biased results in multiple ANOVAs (Denis, 2020; Tabachnik & Fidell, 2013). Pilot Study 2's Spearman's Rho correlations between .24 and .67 supported the view that place beliefs were too highly correlated for separate testing, but not correlated enough for a place affinity index (but see supplementary materials for the exception of "care", which had some lower correlation coefficients).

(Denis, 2020; Tabachnik & Fidell, 2013). Figure 5.3 shows that there were some differences between all conditions, but both UK/Germany and South Africa/Madagascar had very similar place affinity levels.

These results suggested that the experiment successfully manipulated place affinity. However, although there were four distinct categories of place affinity in Pilot Study 1 (when participants rated countries without context), these were reduced to two distinct categories of high and low affinity in Pilot Study 2, when rated in the context of news articles about extreme weather events. It is possible that the contextual information about climate change or the storytelling elements smoothed out more subtle differences between places, focusing only on starker affinity differences. As we focus primarily on effects in an ecologically valid context, we decided to pursue these two conditions in the main experiment, which tested for differences in emotional, behavioural and attitudinal reactions towards reports of extreme weather events in places with high or low place affinity.

Figure 5.3
Scatterplot (left-hand graph) and histogram (right-hand graph) showing the discriminant function values.



Note. In the histogram, overlapping distributions between conditions signify less separation between groups. The scatterplot shows individual values of cases on the linear discriminant functions 1 and 2. Interpretation focuses on LD1 (x-axis), which achieves better separation than LD2 (see also supplementary materials, S2.1 and S2.4.1).

5.5 Main Experiment

We conducted a three-condition, between-participants experiment to test the effects of newspaper reports on extreme weather events in a high or low affinity place, compared to a general climate change article on flooding as a control condition. We chose this control because Pilot Study 2 suggested that more subtle differences in place affinity are less relevant in the context of climate change related extreme weather events. In the main experiment, we therefore wanted to control for the extent to which the climate change and flooding information was responsible for effects, or whether place affinity can contribute to effects. As the control, we used an article that reports on climate change flooding, but without any mention of particular places or people. This has the theoretical benefit of allowing more stringent conclusions to be drawn regarding what has caused the effects, and it has the practical benefit of facilitating recommendations concerning information that should be included in climate communication (or omitted, should we unexpectedly find the control to be more effective than the low-affinity condition).

We were interested in both individual-level and system-level forms of climate-mitigation support, leading us to investigate the dependent variables of emotional reactions, risk perceptions, policy support and pro-climate behaviour. Our primary research question was therefore:

RQ1: How is the reaction to news articles about an extreme weather event influenced by place affinity with the location of that event?

Based on the foregoing literature review, we hypothesised that reading about a specific extreme weather event compared to a general climate change article would result in stronger reactions, as would reading about a high-affinity place versus a low-affinity place. The hypotheses are detailed in Table 5.1.

Table 5.1

Main experiment hypotheses

Dependent variables	Treatment[1] versus control	High versus low place affinity
	Reading about an extreme weather event compared to a general climate change article (control) will lead to:	Reading about an extreme weather event in a high-affinity versus low-affinity place will lead to:
H1 Emotional reactions	**H1a**: Stronger emotional reactions	**H1b**: Stronger emotional reactions
H2 Risk perceptions	**H2a**: Higher perceived climate change risk	**H2b**: Higher perceived climate change risk
H3 Policy support	**H3a**: Higher policy support	**H3b**: Higher policy support
H4 Pro-climate behaviour	**H4a**: Higher pro-climate behaviour	**H4b**: Higher pro-climate behaviour

Note. [1]Treatment refers to the high-affinity and low-affinity conditions, thus, each of these hypotheses will be tested through two comparisons (high-affinity vs. control and low-affinity vs. control); see also Table 5.2.

In addition to these main hypotheses, we were interested in whether emotion-regulation strategies influence people's reactions to threats to different places. Positive and negative emotions are an important driver of climate change perception and action (Brosch, 2021; Ojala et al., 2021). However, they can be met with very different emotion-regulation strategies, which may influence people's reactions to climate risks. People have been found to engage in action to address the problem, to grieve or otherwise engage with their emotions, or to distance themselves from the issue to avoid or manage distress (Pihkala, 2022a; Wullenkord & Ojala, 2023). For example, Ojala (2012), applying the Transactional Model of Coping (Lazarus & Folkman, 1984), found that to manage climate worry, young people used problem-focused coping (action), emotion-focused coping (avoiding, regulating or minimising emotions) and meaning-focused coping (finding meaning in unavoidable threat).

Some studies suggest that problem-focused coping, meaning-focused coping or both are associated with more frequent pro-environmental behaviour than emotion-focused coping (Homburg et al., 2007; Ojala, 2013; Ojala & Bengtsson, 2019), and others suggest that together they can lead to collective climate action (Dual Pathway Model; van Zomeren et al., 2010, 2012). We propose that indirect experience of extreme weather is a prime example of where such strategies might be employed. A recent review indicates that emotion regulation is an area with important implications, where further research is needed to document and analyse strategies (Pihkala, 2022a). In cases where no solid empirical base has yet been established, explorative and descriptive research is required to understand underlying phenomena (Scheel et al., 2020). We therefore aimed to contribute to evidence regarding these mechanisms by asking the following secondary, open research question:

RQ2: To what extent are emotion-regulation strategies present in the reactions to news articles about extreme weather events in places with different levels of place affinity?

5.5.1 Method

Participants

To determine an appropriate sample size, we surveyed applicable effect sizes from different areas to use in a power analysis, although we had difficulty finding comparable research designs. As shown in the literature review above, there is a lack of research experimentally comparing perceptions of news articles about specific climate change consequences. We surveyed effect sizes and comparability of different research areas and found effect sizes around small benchmarks in the storytelling (Gustafson et al., 2020) and psychological distance literatures (Chu & Yang, 2019) and very small effect sizes in intervention studies (Rode et al., 2021).

As there is no clearly corresponding previous research, we think it is important in this applied context to consider the smallest effect size of practical interest (e.g., Lakens, 2022), that is, to assess whether detecting a very small effect size would be useful to theory and practice. Theoretically, place affinity may not be a useful framework for assessing the perception of extreme weather events in the media if it produces very small effect sizes; the same applies from a practitioner's view. We therefore concluded that a design detecting a small effect size represents a good compromise of sensitivity and effective use of resources.

Table 5.2 contains power calculations for all planned analyses. The analyses requiring the most participants are the between-group ANOVAs for H3 and H4, with N = 969 to detect a small omnibus effect of f = .1 and small pairwise comparison effect of d = .2 (Faul et al., 2007). To allow for participant exclusion due to careless responding (see analysis plan), we aimed to overrecruit by 10%, resulting in N = 1066.

Participants were recruited from Prolific as in the pilot studies, with the additional criterion of balanced male and female gender identities (but no criteria for other gender identities). A total of N = 1115 participants were recruited[4]. We checked for and excluded participants who failed the attention check (n = 3), strongly misrepresented the articles (n = 16), speeders (none), slow responders (n = 49) and straight-liners (n = 75), leading to a final sample of N = 972 participants.

[4] Prolific allows the rejection of participants based on attention checks and lack of meaningful engagement, so these participants were re-recruited on the platform, leading to a higher than preregistered sample size.

Participants were on average 42 years old (*SD* = 14.1), with 50% female participants (Prolific provides only sex, not gender identity). The majority were in full-time (54%) or part-time employment (19%), or students (9%). Most (82%) had lived in the UK for more than 25 years, and the majority (64%) lived close to a body of water. About a third lived in a town (10 000 - 100 000 inhabitants), with fewer participants in smaller or larger places. Finally, 20 participants expressed climate denial or scepticism in their open responses.

All research adhered to the APA ethical standards (American Psychological Association, 2017) and ethical approval was obtained through the authors' Institutional Review Board.

Materials

We chose a three condition (high affinity, low affinity, control) between-participants design. Pilot Study 2 suggested the UK and Germany as high-affinity countries, and Madagascar and South Africa as low-affinity countries. Of these, we chose Germany for the high-affinity condition, as there were more potential confounders in UK residents' affinity with the UK than towards Germany (e.g., participants' own experience of extreme weather, different places of residence within the UK), and Madagascar for the low-affinity condition, as it had lower affinity ratings than South Africa and would therefore maximise differences between the two conditions.

Newspaper articles. **W**e presented the same newspaper articles as developed for Pilot Study 2, with minor changes resulting from participants' comments (e.g., to shorten paragraphs). For the control condition, we showed participants a general climate change article, similar to previous studies presenting general climate news (Chu & Yang, 2020a; Fesenfeld & Rinscheid, 2021; Halperin & Walton, 2018; Loy & Spence, 2020) and based on information by the Intergovernmental Panel on Climate Change (IPCC Working Group 2, 2022). We created the article to be similar to the treatment article regarding information on flooding, consequences to communities and general climate change, but without any mention of particular places or people. The length was slightly shorter than the treatment article (405 vs. 631 words) as it may take more time to read a factual, abstract article compared to one involving storytelling components (the text for both the treatment and control articles is in the Supplementary Materials).

Summary of the article and manipulation check. After reading the report, participants were asked to summarise it. Specifically, participants were told to "imagine that a friend has asked about the article you have just read. Please take a few minutes to write a message (e.g., small paragraph) to them, explaining what you have just read and what you were thinking or feeling while reading it." This was to increase engagement with the report, to check for comprehension and attention, and to

assess emotional reactions. As a manipulation check, participants in the treatment conditions then rated place beliefs as described for the pilot studies.

Emotional reactions. Two measures were employed to test H1 (emotional reactions). First, participants rated the extent to which they experienced 13 emotions commonly used in climate psychology (Fear, worry, anxiety, sadness, grief, guilt, shame, hope, empowerment, anger, frustration, helplessness, embarrassment; Pihkala, 2022b) on a scale from 1 (*not at all*) to 5 (*very much*). As these measures do not reflect an established instrument, we conducted a Principal Component Analysis (PCA) to identify any subdimensions and create emotion indices accordingly. Parallel analysis suggested three components: negative basic emotions (sadness, worry, helplessness and grief, $\alpha = .83$), negative self-conscious emotions (shame and embarrassment, $\alpha = .81$; see Ejelöv et al., 2018 for a discussion of these emotion categories) and hope (single item).

Second, we analysed the message to a friend through non-computational sentiment analysis (Jost et al., 2019) to identify the message's valence (positive, negative, neutral) and emotional intensity. We employed non-computational sentiment analysis, meaning manual coding of sentiments in the text, because of its benefit of achieving high accuracy and reducing potential errors regarding semantic structures and other nuances in the text, and because it was feasible with a relatively small corpus (Jost et al., 2019). Additionally, most sentiment analyses in the area of climate change so far have been based on social media, especially Twitter (e.g., Allen & McAleer, 2018; Dahal et al., 2019; Mohamad Sham & Mohamed, 2022), which may only partially apply to messages such as in this study. We therefore employ the more qualitative approach of manual coding.

We were interested in both intensity as well as valence (positive, negative, neutral) of the message. We therefore created a continuous scale (+2, +1, 0, -1, -2) on which messages were categorised. Messages were rated based on overall sentiment, so that for example a description with very negative sentiment was rated -2, a neutral message 0, and a very positive message +2. Potential examples for each of the categories were provided in the preregistration for the study. Two raters coded sentiment valence and strength of 25 messages per condition following the protocol defined in the pre-registered analysis plan. After comparing ratings, two adjustments were made to the classification system: Firstly, there were a lot of messages that contained both positive and negative sentiment, especially in the control article condition. This was probably because the control article mentioned some solutions, which made some participants hopeful, e.g.: "I just read an article on flooding as a result of climate change; it talked about the causes of flooding, how it affects people and the land, and what we need to do to tackle the issue. I felt quite gloomy reading the article at first, because climate change is such a frightening and depressing topic. It's easy to feel powerless and hopeless when thinking about the state of the world and what the future might look like. The

article did end quite hopefully though - it discussed a few processes being put in place to protect areas from flooding, or the after-effects of flooding, and it encouraged further change." Coding these messages as 0, which was originally intended for mixed sentiment, would erase the emotion that was portrayed by those participants. Additionally, since only the strength of sentiment, and not valence was used for the main analyses, it was decided to retain only sentiment strength for mixed sentiment messages. While this is a change from the pre-registered plan, we saw it as preferable to miscoding the data which would have led to uninformative analyses.

Secondly, we decided to distinguish between participants describing the emotions of others or their own. For example, when participants talked about the affected people's feelings, but did not identify with them and use more descriptive language, lower intensity coding of (-)1 is used (e.g.; "There's been devastating floods in Germany that overwhelmed new defences. I don't know if anyone was killed but houses have been completely destroyed. Hard to tell if the defences were not good enough anyway with an official saying it's another one in a hundred years event. I would be really upset if that had happened to me."). When they identified with the people's feelings or express their own negative sentiment (e.g., "I read about flooding in a German town that left shops and homes devastated and had taken away peoples' livelihoods. The town was prepared for flooding but not on this scale and the defences were not enough. I felt so sad reading the article and thinking of all the people who had lost their homes and that this is what the world is coming to. We are ruining the planet and making it miserable for everyone."), (-)2 is used. This was because we interpreted their emotions to be stronger when they experienced them themselves, but still acknowledged the presence of some emotional reaction when they imagined the emotions on behalf of others.

After these adjustments, inter-rater reliability was 80%, and thus ratings were continued by one rater. Since H1 predicted that the strength (not necessarily valence) of emotional reactions will be stronger for high-affinity places, the resulting sentiment scores was transformed into a variable which specified only the strength of the sentiment (i.e., 0, 1, 2). This was used as the second dependent variable for H1.

Risk perceptions. To test H2 (risk perceptions), we employed an eight-item risk-perception measure following van der Linden (2015, 2017). This included a measure of worry ("How often do you worry about the potentially negative consequences of climate change?" from 1 (*very rarely*) to 5 (*very frequently*)) and concern ("How concerned are you about climate change?" from 1 (*not concerned at all*) to 5 (*very concerned*)) as well as measures of risk magnitude and likelihood. For the latter two, participants were first asked about their perceived likelihood of climate impacts being a risk to themselves or society ("In your judgment, how likely are you, sometime during your life, to experience serious threats to your health or overall well-being, as a result of climate change?" and

"In your judgment, how likely do you think it is that climate change will have very harmful, long-term impacts on our society?" on a scale from 1 (*very unlikely*) to 5 (*very likely*)), and then about the severity of such threats ("How serious of a threat do you believe that climate change is, to you personally?", "How serious of a threat do you think that climate change is to the natural environment?", "How serious would you rate current impacts of climate change around the world?" and "How serious would you estimate the impacts of climate change for the United Kingdom?" on a scale from 1 (not serious at all) to 5 (very serious)). These items were then averaged into a personal (Cronbach's $\alpha = .88$) and societal (Cronbach's $\alpha = .91$) risk perception index.

Policy support. Regarding climate-mitigation policy (H3), reviews have shown a diversity of measures owing to different regional contexts, study designs and lack of theoretical grounding (Kyselá, Ščasný, et al., 2019). To ensure an ecologically valid measure, we developed an instrument based on the primary recommendations for climate policy by the Climate Assembly UK (2020). The policies suggested by the climate assembly are those thought to be both most effective and most acceptable within the UK for addressing climate change, based on collective considerations by the cross-section of the UK public which constituted the assembly (Climate assembly UK, 2020). This selection of policies is therefore a useful one to understand better in terms of public perceptions. To develop the measure, we took the main recommendations in the assembly's report and created 20 short items (e.g., "promote investment in greenhouse gas removals by airline industry"; "promote a change in diet to reduce meat and dairy consumption (e.g., through education)"). The items span areas such as transport, electricity, energy use, land use, consumption and greenhouse gas removals.

We piloted this measure in a sample of 102 UK residents of at least ten years (as above) recruited from Prolific (2022), using equivalent procedure and eligibility as the previous Pilot Studies. Participants were on average 37 years old ($SD = 14.3$), 51% female, with 49% in full-time employment, 22% in part-time employment, and 23% not currently in paid employment. Irrespective of employment status, 18% of the sample were students.

We asked participants to rate the policies on a scale from 1 (*completely unacceptable*) to 5 (*completely acceptable*). Acceptability (instead of support) was chosen on recommendation by Kyselá and colleagues (2019), who recommend differentiating between passive evaluations (i.e., accepting) and active reactions (i.e., supporting) to a policy proposal, whereby levels of acceptance tend to be higher than those of support. We suggested that for our study, levels of acceptance are sufficiently interesting as a dependent variable, as they are a necessary base for support. Our aims for this pilot study were to establish a) any unclear items (we added an open comments box asking for any comprehension issues), b) any subdimensions of policies which may need to be differentiated and c) distribution of the items to include in statistical analysis later on.

After data collection, responses were checked for speeders (no outliers at 1.5*IQR) and maximum consecutive response (to identify straight-lining). For the latter, there were 13 outliers above 1.5*IQR of consecutive responses. Because it would be a legitimate response to fully agree with all policy measures and we did not want to blindly exclude legitimate response, we proceeded to send all outlier participants a message asking them whether they had responded to the items honestly, explaining that they would not be facing any penalty (they had already been paid) and that they were only asked so that we could better understand the results. Two participants responded by withdrawing their submissions, three participants did not respond to the message, and the remaining confirmed that they had answered honestly. Consequently, the former two groups of participants were removed from the data and additional participants were recruited to fill the sample size. In these additional recruitments, there were again two outliers in consecutive responses, who both confirmed that they had responded honestly.

A principal component analysis was conducted using Oblimin rotation, allowing components to correlate with each other. Parallel analysis (Crawford et al., 2010) suggested a unidimensional structure with loadings between .702 and .504, with only one policy item ("using wood in construction") showing very low loadings (.311) and thus being removed. The internal consistency of the resulting index was Cronbach's $\alpha = .90$, acceptable for analysis. Some participants indicated in the open comments box that they were unclear about items on carbon storage, carbon sinks and home retrofits – these items were amended to include more detailed explanations.

Finally, most of the items received very high ratings of acceptability, which raised the concern of ceiling effects in the experiment. We therefore decided to rephrase the items to ask for support instead of acceptance, and thus make the items more difficult (Kyselá, Ščasný, et al., 2019) and less skewed towards the top. This was done by changing the phrasing of the instructions from "Please read the following policy suggestions which could be implemented to address climate change. For each policy, please rate how acceptable you would find it if these policies were realised by the UK government in the near future." To "Please read the following policy suggestions which could realistically be implemented by the UK government to address climate change. Experts have stated that each of these policies would be effective in addressing climate change, but there is a public debate about which policies should be brought into action in the immediate future. How likely would you be to actively support these policies? (e.g., vote for them, endorse when asked by family, friends or colleagues etc.)". The options on the response scale were changed accordingly to 1 (*would not support at all*) to 5 (*would support completely*).

Consequently, 19 policy statements were rated by participants in the main study, with the full list available in the Supplementary Materials. The items were again averaged into an index, with

high internal reliability (Cronbach's α = .90). Additional measures to check and account for ceiling effects were taken in the main study as described below.

Pro-climate behaviour. To test H4 (pro-climate behaviour), we measured observed individual behaviour as reviewed by Lange (2022). At the end of the questionnaire, we informed participants that we would give away a £50 online shopping voucher as a raffle. They were given the choice, in case of winning, either to receive all the money as an Amazon voucher, or to donate some or all of it to their choice of one of five climate-friendly organisations (Friends of the Earth, The Climate Coalition, Climate Outreach, RSPB (Royal Society for the Protection of Birds), National Trust). We included a link to each organisation in case participants wanted more information in order to make their decision. The donation amount was used with minor adjustments (e.g., removing £ signs) as the dependent variable for H4 and the voucher was paid out to the winning participant after the experiment was concluded.

Emotion regulation. To assess RQ2 (emotion regulation), we employed a measure focusing on situational emotion-regulation strategies, that is, ways of dealing with the news article (rather than those assessing stable traits and strategies, e.g., Panno et al., 2015; Wullenkord & Reese, 2021). Following Ojala (2012), we asked participants who indicated strong negative emotions (scoring 4 or 5 on fear, worry, anxiety, sadness, grief, guilt, shame, anger, frustration, helplessness or embarrassment) to "Think back to when you were reading the article. When you felt distressed, did you do or think anything to address these emotions? If yes, please describe what you did?". For participants without strong negative emotions, a projective coping measurement was used. Here, participants were asked to "Imagine that in response to your message, you received a message back in which your friend is expressing a lot of distress - what would you say to help them feel more positive about the situation?".

The responses to these questions about self or projective coping strategies were coded to identify any instances of emotion regulation strategies, such as problem-focused coping, emotion-focused coping and meaning-focused coping. The definitions for these strategies were taken from previous literature on emotion regulation strategy (Ojala, 2012), framing problem-focused coping as "about addressing and trying to do something about the problem/stressor causing the negative emotions" (p.539), emotion-focused coping as "concerns strategies to regulate or get rid of the negative emotions that are evoked by the problem/stressor" (p.539) and meaning-focused coping to "involve finding meaning in a difficult situation, drawing on values and beliefs, and using strategies whereby one acknowledges the threat but re-appraises it in a more positive manner and thereby makes it more manageable" (p.540). Coding followed thematic analysis (Braun & Clarke, 2006). First, responses were read in full, then coded, and finally grouped into themes and sub-themes as

identified in the data. The process was primarily deductive, but additional emotion regulation strategies present in the data were coded inductively, following Ojala's (2012) approach. Coding was undertaken by one coder, blind to condition. Missing, ambiguous and unintelligible responses were recorded and marked as such in the coding. No further procedure was used to deal with such responses, but they were reported alongside the themes in the results. Codes were combined and arranged into themes - e.g., some of the inductive codes were sub-themes of others (e.g., distancing as a form of emotion-processed coping). Then, all codes were exported by theme into Excel files, allowing us and future researchers to sort and explore these by subtheme, condition and self- vs projective measure. Additionally, the frequencies of codes were exported, but these should be treated with caution as the focus of the measure was not on creating numerical data.

Procedure

The questionnaire was administered through Qualtrics (2020), using fully random assignment to conditions. Participants gave informed consent and were then shown one of the three news articles. They then summarised the article in the message to a friend. If they were in a treatment group, they then rated the place beliefs. All participants then responded to items on the outcome variables of emotions, risk perception and policy support. They were then asked about any emotion regulation strategies and about their living situation (size of town and proximity to water), with the behaviour measure being administered at the end of the questionnaire.

Analysis plan and Preregistration

Table 5.2 presents the analyses and power calculations for each hypothesis, including MANOVAs for manipulation checks and H1 and H2, ANOVAs for H3 and H4 and a thematic deductive analysis for RQ2. The detailed, preregistered analysis plan is in the supplementary materials and describes the steps to prepare data, the statistical models for manipulation checks and confirmatory hypothesis testing, and conditions to check before drawing inferences (e.g., responding patterns, statistical assumptions, ceiling effects). The analysis plan also describes procedures that were used to analyse the open-response data (i.e., sentiment analysis and thematic coding). This study was preregistered as a Stage 1 Registered Report.

Table 5.2

Design overview

Research question	Hypothesis	Sampling plan (e.g., power analysis)	Analysis plan	Interpretation given different outcomes
Manipulation check	The conditions differ significantly with respect to place beliefs.	For small effect size ($f^2(V) = 0.02$), $\beta = .80$, $\alpha = .05$, 2 groups (treatment conditions) and 8 response variables: $N = 760$	MANOVA (IV: 2 treatment conditions; DV: place beliefs).	Successful if conditions significantly differ from each other, as indicated by MANOVA test statistics. Unsuccessful if conditions do not differ from each other.
RQ1: How is the reaction to news articles about an extreme weather event influenced by the place affinity with the location of that event?	H1a: Reading about an extreme weather event will lead to stronger emotional reactions than reading an unrelated article (control).	For small effect size ($f^2(V) = 0.02$), $\beta = .80$, $\alpha = .05$, 3 groups and 2 response variables: $N = 303$	MANOVA with discriminant analysis as post hoc test (IV: 3 conditions; DVs: emotions index/indices and sentiment score).	Hypothesis supported if: (1) MANOVA test statistics indicate significant differences between the conditions; and (2) visual interpretation of graphs (histogram and scatterplot of discriminant function) supports differentiation between conditions. Regarding (2), hypothesis is fully supported if both high- and low-affinity conditions are different from the control, and partially supported if only one of the two treatments differs from the control.
	H1b: Reading about an extreme weather event in a high-affinity place will lead to stronger emotional reactions than in a low-affinity place.	As above	As above	Hypothesis supported if: (1) MANOVA test statistics indicate significant differences between the conditions; and (2) visual interpretation of graphs (histogram and scatterplot of discriminant function) supports differentiation between conditions
	H2a: Reading about an extreme weather event will lead to higher perceived climate change risk than an unrelated article (control).	For small effect size ($f^2(V) = 0.02$), $\beta = .80$, $\alpha = .05$, 3 groups and 2 response variables: $N = 303$	MANOVA with discriminant analysis as post hoc test (IV: 3 conditions; DV: both risk-perception scores).	Hypothesis supported if: (1) MANOVA test statistics indicate significant differences between the conditions; and (2) visual interpretation of graphs (histogram and scatterplot of discriminant function) supports differentiation between conditions. Regarding (2), hypothesis is fully supported if both high- and low-affinity conditions are different from the control, and partially supported if only one of the two treatments differs from the control.
	H2b: Reading about an extreme weather event in a high-affinity place will lead to higher perceived climate change risk than in a low-affinity place.	As above	As above	Hypothesis supported if: (1) MANOVA test statistics indicate significant differences between the conditions; and (2) visual interpretation of graphs (histogram and scatterplot of discriminant function) supports differentiation between conditions.
	H3a: Reading about an extreme weather event will lead to higher policy support than an unrelated article (control).	ANOVA: For small effect size ($f = 0.1$), $\beta = .80$, $\alpha = .05$, 3 groups: $N = 969$ Pairwise comparisons: For small effect size ($d = .2$), $\beta = .80$, $\alpha = .017$ (Bonferroni adjusted for three comparisons): $N = 880$	One-way ANOVA (IV: exp conditions; DV: policy support index) with post hoc pairwise comparisons.	Hypothesis supported if: (1) ANOVA omnibus is significant; and (2) pairwise comparison is significant. Regarding (2), hypothesis is fully supported if both high- and low-affinity conditions are different from the control, and partially supported if only one of the two treatments differs from the control. Interpretation focuses on effect size of the pairwise comparison.

	H3b: Reading about an extreme weather event in a high-affinity place will lead to higher policy support than in a low-affinity place.	As above	As above	Hypothesis supported if: (1) ANOVA omnibus is significant; and (2) pairwise comparison is significant. Interpretation focuses on effect size of the pairwise comparison.
	H4a: Reading about an extreme weather event will lead to higher pro-climate behaviour than an unrelated article (control).	ANOVA: For small effect size (f = 0.1), β = .80, α = .05, 3 groups: N = 969 Pairwise comparisons: For small effect size (d = .2), β = .80, α = .017 (adjusted for three comparisons): N = 880	One-way ANOVA (IV: exp conditions; DV: pro-climate behaviour (donation amount)) with post hoc pairwise comparisons.	Hypothesis supported if: (1) ANOVA omnibus is significant; and (2) pairwise comparison is significant. Regarding (2), hypothesis is fully supported if both high- and low-affinity conditions are different from the control, and partially supported if only one of the two treatments differs from the control. Interpretation focuses on effect size of the pairwise comparison.
	H4b: Reading about an extreme weather event in a high-affinity place will lead to higher pro-climate behaviour than in a low-affinity place.	As above	As above	Hypothesis supported if: (1) ANOVA omnibus is significant; and (2) pairwise comparison is significant. Interpretation focuses on effect size of the pairwise comparison.
RQ2: To what extent are emotion-regulation strategies present in the reactions to news articles about extreme weather events in places with different levels of place affinity?	N/A	N/A	Thematic deductive analysis, with themes described narratively.	Interpretation of results will focus on describing the themes and comparing these to prior research (e.g., Lazarus & Folkman, 1984; Ojala, 2012).

Note. Table design from the Center for Open Science (Center for Open Science, 2022). Power analyses conducted with G*Power (Faul et al., 2007), effect sizes for MANOVA and ANOVA based on Cohen (1988).

5.5.2 Results

A detailed protocol and all analysis code is available in the supplementary materials, to ease cross-referencing with the preregistered analysis plan.

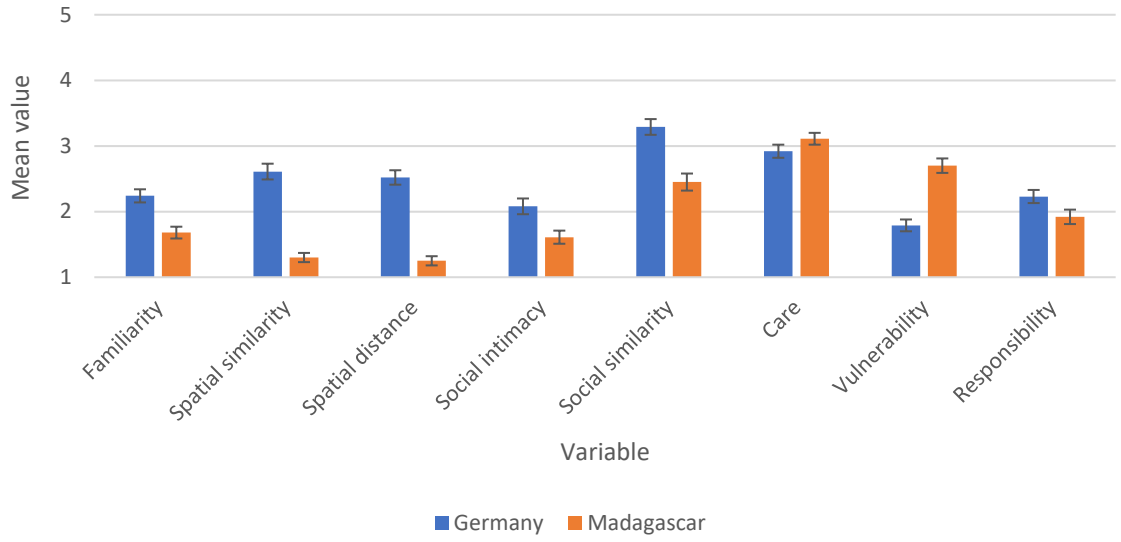
Manipulation check

First, we tested whether the experimental conditions differed from each other on the combination of the place beliefs (place affinity). Our analysis plan had consisted of a MANOVA; however, one of the necessary assumptions for a MANOVA is appropriate multi-collinearity, that is variables must be sufficiently ($r > .3$) but not too highly ($r < .8$) correlated with each other. Since care, vulnerability and responsibility were not sufficiently correlated with the remaining place beliefs to be integrated into a single model (multiple correlations $r_s < .3$, full table in the supplementary materials), we conducted a MANOVA with the place beliefs of familiarity, spatial distance and similarity and social similarity and intimacy, with additional t-tests to check for differences in levels of care, vulnerability and responsibility. The MANOVA indicated a significant difference between conditions, Pillai's trace $V = 0.43$, $F(5, 637) = 96.6$, $p < .001$, $\eta^2_p = 0.43$. Care ($t(656) = -2.66$, $p = .008$, $d = -0.21$, 95% CI [-0.33, -0.05]), vulnerability (Welch's $t(615) = 11.9$, $p < .001$, $d = 0.94$, 95% CI [0.76, 1.06]) and responsibility (Welch's $t(612) = 4.07$, $p < .001$, $d = 0.33$, 95% CI [0.16, 0.45]), were also significantly different between conditions, together confirming the success of the manipulation.

Figure 5.4 shows descriptive means across all place beliefs, demonstrating the direction of differences (not pre-registered for the manipulation check, but helpful for interpretation). Of note is that participants expressed more care for Madagascar, whereas all other place beliefs are rated higher for Germany. A follow-up discriminant analysis also indicated that spatial distance and spatial similarity were most important in the separation of the two conditions within the MANOVA, with coefficients of -0.84 and -0.66 on the linear discriminant function, respectively (compared to coefficients from 0.24 to -0.02 for the remaining place beliefs).

Figure 5.4

Mean values and 95% CI intervals for all place beliefs, by experimental condition.



Main hypotheses

Table 5.3 includes all descriptives for the main analysis variables and Table 5.4, a summary of all hypothesis tests.

Table 5.3

Descriptives for main analysis variables

	Condition	Negative basic emotions	Negative self-conscious emotions	Hope	Personal risk	Societal risk	Policy support	Donation amount (out of £50)
N	Total	972	972	972	972	972	972	909
	Germany	336	336	336	336	336	336	317
	Madagascar	322	322	322	322	322	322	304
	Control	314	314	314	314	314	314	288
M	Total	3.40	1.98	2.17	3.34	4.07	4.03	17.4
	Germany	3.47	1.65	2.06	3.36	4.04	4.01	17.3
	Madagascar	3.49	1.94	2.14	3.31	4.05	4.05	17.5
	Control	3.23	2.38	2.32	3.34	4.11	4.03	17.5
SD	Total	0.94	1.02	1.06	0.96	0.89	0.57	14.9
	Germany	0.92	0.82	1.03	0.97	0.92	0.59	14.7
	Madagascar	0.93	1.01	1.12	0.95	0.86	0.54	15.2

Table 5.3

Descriptives for main analysis variables

Condition	Negative basic emotions	Negative self-conscious emotions	Hope	Personal risk	Societal risk	Policy support	Donation amount (out of £50)
Control	0.95	1.09	1.00	0.96	0.87	0.57	14.9

Table 5.4

Results for main experiment hypotheses

Dependent variables	Treatment[1] versus control	High versus low place affinity
	Reading about an extreme weather event compared to a general climate change article (control) will lead to:	Reading about an extreme weather event in a high-affinity versus low-affinity place will lead to:
H1 Emotional reactions	**H1a**: Stronger emotional reactions - Sentiment score: partially supported (Germany vs. control) - Negative emotions: partially supported (small visual difference, biggest for Germany vs. control) - Hope: partially supported (Germany vs. control)	**H1b**: Stronger emotional reactions - Sentiment score: supported - Negative emotions: not supported - Hope: not supported
H2 Risk perceptions	**H2a**: Higher perceived climate change risk - Not supported	**H2b**: Higher perceived climate change risk - Not supported
H3 Policy support	**H3a**: Higher policy support - Not supported	**H3b**: Higher policy support - Not supported
H4 Pro-climate behaviour	**H4a**: Higher pro-climate behaviour - Not supported	**H4b**: Higher pro-climate behaviour - Not supported

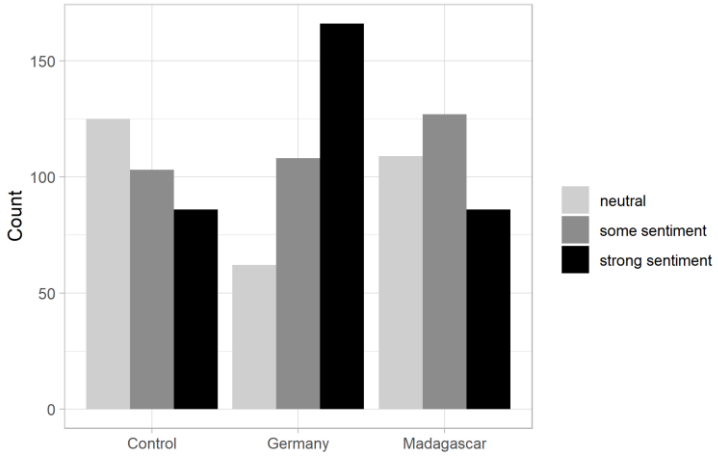
Note. [1]Treatment refers to the high-affinity and low-affinity conditions, thus, each of these hypotheses is tested through two comparisons (high-affinity vs. control and low-affinity vs. control).

H1 Emotional reactions

First, a χ^2 test indicated a significant difference in sentiment score between conditions, $\chi^2(4) = 60.8$, $p < .001$, with a small effect size of Cramer's $V = .18$. A visual inspection (Figure 5.5) indicated that participants in the Germany condition expressed stronger sentiment than participants in the control condition. This difference was less prominent for the Madagascar versus control comparison,

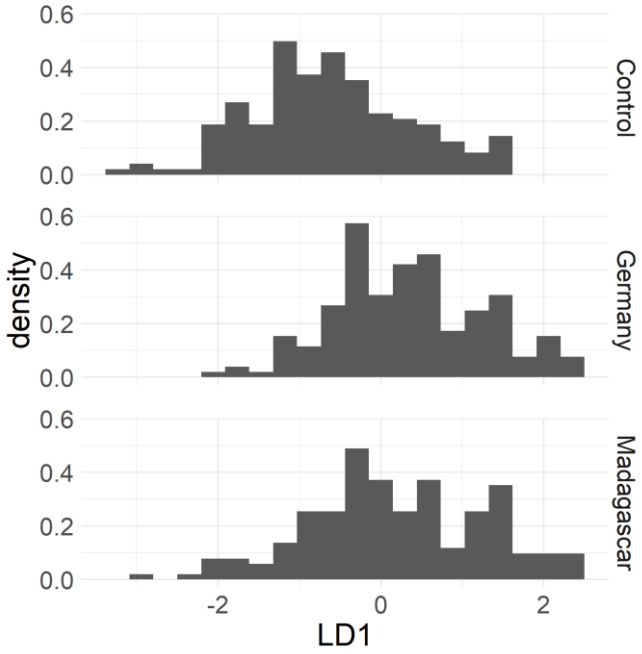
thus giving partial support for H1a. H1b was supported, as participants in the Germany condition expressed stronger sentiment than those in the Madagascar condition.

Figure 5.5
Sentiment strength per condition.



Second, a MANOVA indicated a small but significant difference between conditions along the combination of negative basic and negative self-conscious emotions, Pillai's trace $V = 0.16$, $F(4, 1938) = 41.7$, $p < .001$, $\eta^2_p = 0.08$. A discriminant analysis showed that both types of emotions similarly contributed to the differences (coefficients of .88 and -1.12 on linear discriminant function, respectively). However, as Figure 5.6 shows, separation between the three conditions was limited and primarily between the Germany and the control condition, giving partial support to H1a. H1b, a difference between Germany and Madagascar, was not supported.

Figure 5.6
Histogram of linear discriminant function.



Finally, an ANOVA was conducted for hope, which was not sufficiently correlated with the negative emotion scores to be integrated with the MANOVA model (r_s = .12 with basic negative emotions and r_s = .14 with self-conscious negative emotions). The model indicated significant differences $F(2, 969) = 5.29$, $p = .005$, $\eta^2 = .011$, with participants experiencing more hope in the control condition than in the Germany condition, $t(969) = -3.18$, $p = .005$, d = -0.25, 95% CI [-0.40, -0.10], and no other significant comparisons. Again, these results provide partial support for H1a, but no support for H1b.

H2, H3 and H4: Risk perceptions, policy support, pro-climate behaviour

A MANOVA on personal and societal risk perceptions indicated no group differences, Pillai's trace $V = 0.01$, $F(4, 1938) = 1.46$, $p = .212$, $\eta^2_p = 0.003$. ANOVAs for policy support and pro-climate behaviour, as seen in Table 5.5, indicated no significant differences either. Group differences remained non-significant when adjusted for ceiling effects (corrected $F = 0.87$, $p = .419$ for risk perceptions, corrected $F = 0.29$, $p = .750$ for policy support).

Table 5.5 holds information on equivalence testing, which we conducted additionally (not preregistered) to determine whether group means were equivalent as well as statistically inseparable (Caldwell, 2022; Lakens et al., 2018). Mean differences for all variables were statistically equivalent, supporting the conclusion that participants' risk perceptions, policy support and pro-climate behaviour were not affected by condition.

Table 5.5

ANOVA results with equivalence testing

DV	*df*1	*df*2	*F*	*p (null)*	η^2_p	Equivalence bound[1]	*p (equivalence)*
Personal risk	2	969	0.27	.765	.00	.01	.003
Societal risk	2	969	0.73	.481	.00	.01	.015
Policy support	2	969	0.43	.651	.00	.01	.006
Pro-climate behaviour	2	906	0.001	.999	.00	.01	> .001

Note. [1]Equivalence bounds are based on the smallest effect size of interest as determined for power analyses above.

Research question 2: Emotion regulation

Many participants across conditions, and in both the self and projective emotion-regulation measures, described the three deductively coded strategies of emotion-focused, problem-focused and meaning-focused coping. Additionally, a substantial number of participants used no regulation strategies or gave an unclear or irrelevant response. Below, we will outline the different themes, with all codes reported for exploration in the supplementary materials.

Many participants took steps to reduce their negative emotional reactions in various forms of emotion-focused coping. This included general advice such as “don’t worry about it” and many more specific strategies: for example, participants stated that they reminded themselves that “it wasn’t a real scenario”, indicating that they clearly experienced some emotions, but were able to reduce those by focusing on stressor’s fictionality. At the same time, some participants acknowledged that they knew the article to be realistic (e.g., “the truth is, it’s not unbelievable”), showing an internal conflict between supressing and acknowledging their emotions. A large number of participants also emphasised physical distance (“e.g., “at least it’s not happening here!” or “I just thought I was lucky not to live in an area that gets flooded easily”) or general separation from the separation (“reminded myself that this is not directly happening to me at this very moment”) as a tool to reduce their negative feelings. More generally, some participants used physical regulation strategies such as taking deep breaths or grounding exercises, many stated that they simply tried to distract themselves, such as “think[ing] of happier times” or “push[ing] it away”, and some spoke about plans to talk with others about their feelings.

It also became apparent that many participants felt personally incapable of addressing either the specific flooding situation or climate change in general and consequently avoided engaging with

their emotions, such as "[I'd] encourage them to try and think less about things they have practically no control over" or "I believe it's down to the big companies, so I didn't feel distressed/worry about this as I feel helpless". This would indicate that for these participants, problem-focused coping did not feel like an option, leading them instead to try to reduce their own emotions. Other participants were able to engage in problem-focused coping, either to address the flooding event (e.g., "I thought about what I could do to help those people") or climate change in general. Regarding the latter, participants named a broad range of actions, primarily on an individual or consumerist level (e.g., "Tried to think of little things I can do to make things better. Like recycling for example."). However, collective, political or activist action was also mentioned (e.g., "Exercise your right to vote in elections supporting most progressive candidates"). Taken together, it seems likely that participants' self-efficacy had some impact on whether they utilised emotion-focused or problem-focused coping.

Several participants who utilized problem-focused coping also employed meaning-focused coping by reminding themselves of ongoing progress to cultivate positive emotions. These included both emphasising their own behaviour (e.g., "thought what impacts I have on climate change and pleased that I do try hard to reduce my carbon footprint.") and societal progress (e.g., "people are starting to come together to tackle climate change"), as well as focusing on the positive aspects of the flooding event itself (e.g., "at least no lives were lost and buildings can always be repaired"). It's important to point out that many of these comments were not necessarily accurate, for example engaging in technological optimism (Lamb et al., 2020), such as hoping that "in times of real crisis we always seem to develop some technological change to help". Finally, participants drew on perceived vulnerability of places to create hope, for example speaking about Germany's "extensive resources and a high level of organisation" for a positive outlook.

There were also a large number of participants who stated that they did not engage in any emotion regulation strategies. Most of those gave no reason for this, but some stated that they wanted to acknowledge their own emotions, with one even writing that "actually I think that is not appropriate, I prefer to be distressed and stay alert in regards to the issue". Others indicated that they had not felt any distress and therefore did not engage in any emotion regulation strategy. Since these participants had expressed negative emotional reactions after the article, it is possible that "distress" was not seen as an umbrella term and rather as a specific emotion which they did not identify with – in the words of one participant, "No. I just felt sad!". Others, however, indicated that they had simply become numb with these types of stories because "these events are too commonplace and now lack a sense of direct intense personal connection", which may mean that these participants no longer felt the need to regulate these now commonplace emotions.

Overall, it became apparent that there were a large number of emotion-regulation strategies present in participants' reactions, partly with complex interdependencies with other variables such as self-efficacy. Although no formal comparison between conditions can be made based on this data, it can be noted that there seemed to be a general overlap in strategies in all groups.

5.7 Discussion

5.7.1 Discussion of Results

In this chapter, we conducted a robust test of how place-related and distance-related factors influence the perception of extreme weather through media reports. This is a context common in everyday life that is not yet well understood by research (Dhaher & Gumus, 2022; Howe et al., 2019) and therefore benefiting from the contribution of this chapter. In two pilot studies, we established that participants experienced higher place affinity towards some countries than others. We then asked participants to read an article about flooding in a high-affinity place (Germany) and a low-affinity place (Madagascar) as well as a neutral article (control) to assess any effects caused by strong differences in their place affinity. We addressed several of the limitations of previous literature (including the previous chapter), providing a more holistic conceptualisation of place-related and distance-related effects through the construct of place affinity, developing manipulation and measurement through several pilot studies, and preregistering the analysis. Results showed that differences in place affinity did not affect risk perceptions, policy support and pro-climate behaviour. Instead, explorative analysis showed that they were statistically equivalent, indicating that all articles had an equal (or no) effect on these dependent measures. There were some differences in emotional reactions, which were stronger in the high-affinity condition than the control (see later discussion of this point).

A manipulation check confirmed that participants expressed higher affinity (familiarity, spatial distance and similarity, social similarity and intimacy), higher perceived responsibility for causing climate change and less perceived vulnerability to climate change consequences in the Germany than in the Madagascar condition. Participants showed slightly more care for Madagascar, perhaps due to increased perceived vulnerability. This finding might echo findings by Klinsky and colleagues, who asked participants to allocate climate funds to different countries (Klinsky et al., 2012). They found that while some participants gave funding to close, similar countries, others focused more on countries that were spatially further away and perceived to be more vulnerable. In a similar way, participants in this study may have experienced more care as a response to perceived vulnerability in Madagascar.

Overall, the main findings lead us to conclude that the event location does not have a prominent influence on risk perception, policy support and individual behaviour, at least in short-term reactions to fictional (but realistic) media reports. This is in line with the only previous study showing an extreme weather event in a near versus a distant country, in which the spatial manipulation did not impact willingness to change oneself in relation to climate change or repair damage (Ejelöv et al., 2018). However, in this study the manipulation of the intended spatial psychological distance was not successful, whereas our manipulation of place affinity was achieved. Further experimental work could explore the circumstances under which effects of place affinity are (not) present. Several methodological choices in this study could have influenced our results, including presenting an abstract article as a control condition, presenting fictional articles, and not presenting imagery. Future work could employ a location-neutral, but less abstract control article, include more imagery or test other media forms such as video. Additionally, many climate beliefs are relatively stable (Jenkins-Smith et al., 2020) and strongly related to stable individual characteristics (Hornsey et al., 2016), which may have contributed to the null effects in this study. Longitudinal research could investigate how place-related perceptions change over time (e.g., Shehata et al., 2022).

However, overall, our findings suggest that place- and distance- related effects, including the place affinity framework, may not be the most fruitful approach to understanding the perception of climate change and extreme weather events in particular. Previous reviews of Construal Level Theory literature suggest that the research on the psychological distance of climate change often leads to inconsistent results that can even be unintentionally damaging by maintaining a false "distance narrative" (Chapter 2, Brügger, 2020; Van Valkengoed et al., 2023). This study, with its robust, systematic design and a more holistic integration of distance with variables such as care, social identity and familiarity, supports and extends this conclusion.

To researchers wanting to further investigate extreme weather reports, we would recommend investigating other avenues which might influence people's reactions. For example, a next step could involve having participants react to a large selection of media reports differing on a large number of potentially relevant factors, including location, but also news source (Cheng & Gonzalez-Ramirez, 2021), framing (e.g., Nabi et al., 2018) and imagery (O'Neill, 2013). Analysis could then compare which factors most prominently determine people's reactions to such reports. This would allow researchers to focus on important factors and make specific recommendations to climate communicators regarding the design of such reports, as the present study suggests that the consideration of place alone does not lead to significantly different perceptions.

Finally, emotional reactions may warrant further investigation, as these were the only outcome (partially) affected by location in this study. These differences existed primarily between the high-affinity and the control condition and were either non-existent in other comparisons or only present in the sentiment score (emotional language used to summarise the article). Overall, differences between Germany and the control were far more pronounced than any others, suggesting that the combination of storytelling and high affinity may have increased affective responses. This coheres with research showing that storytelling about climate impacts evokes both worry and compassion (Gustafson et al., 2020). Feelings of compassion especially may have been stronger in the high-affinity than the low-affinity group due to higher social similarity and intimacy (Masson & Fritsche, 2021), which could lead participants to experience stronger emotional reactions. Previous research manipulating psychological distance has sometimes (Chu & Yang, 2019), but not always (Ejelöv et al., 2018; Spence & Pidgeon, 2010) impacted emotional reactions. Our findings suggest that aspects of storytelling and resulting feelings of compassion may be contributing to these different findings.

Investigating such mechanisms around affective reactions is valuable as emotions can be a powerful predictor of pro-climate action (Brosch, 2021), especially in response to extreme weather events (Ojala et al., 2021). However, even if extreme weather reports induce strong emotions, they do not necessarily translate into concern and action. Research on emotion regulation demonstrates that confrontation with the climate crisis can be met with action, emotional engagement or distancing, leading to various levels of pro-climate action (Pihkala, 2022a). Previous to this study, there had been no exploration of the presence or the role of emotion regulation strategies in the perception of extreme weather events, and only one study assessing emotion regulation strategies in the context of climate impact locations (Ojala, 2012). This present study therefore provided valuable data showing that emotion regulation strategies were indeed prominent in the context of our experiment. In fact, all types of responses documented by Ojala (2012), in the form of problem-oriented, meaning-oriented and emotion-oriented coping, were also described by our participants in their responses to reading the article. Problem-focused coping has been closely linked with pro-environmental behaviour, but is less likely to occur when people engage in distancing (Wullenkord & Ojala, 2023). Consequently, it is worth testing whether stimulating particular forms of emotion regulation increases people's risk perception, policy support and pro-climate behaviour when confronted with extreme weather reports in high-affinity or low-affinity locations. Previous research has also documented that individuals tend to have different emotion-regulation "toolboxes", which they draw upon to regulate specific situations (Grommisch et al., 2020). It is thus possible that our

participants' reactions to the extreme weather reports were shaped by their personal emotion-regulation "toolbox"; linking such individual strategies of emotion regulation with climate perceptions may help further understand people's reactions to climate communication.

5.7.2 Limitations and Future Directions

There are several limitations as a result of trade-offs taken in designing this study. First, we prioritised creating almost identical materials between conditions, which meant that articles had to be fictional. Since participants commented on this aspect as something that influenced their emotion processing, future work may benefit from repeating a similar study with real articles. News articles also vary in many more aspects than the location of events, which can only be disentangled to a limited degree in an experimental study such as this. This means that our findings only have limited generalisability to other articles and should instead be interpreted as only a laboratory test of one aspect of realistic articles. Second, our measures were limited in that we did not include pre-measures so as not to bias participants. To understand whether the articles all had the same effect, or all had no effect whatsoever, future research may want to include pre-post comparisons. This could be integrated with a closer look at the emotion-regulation processes and their relationship with other variables, which we were only able to investigate superficially in our open measure. Finally, our sample was restricted to UK participants and therefore does not necessarily generalise to other national contexts; further research is needed to establish whether place affinity has similar effects (or lack thereof) for other audiences.

5.7.3 Conclusion

In conclusion, this experiment tested whether place affinity influences participants' reactions to reports of extreme weather events. Levels of risk perceptions, policy support and pro-climate behaviour were equal in the high-affinity, low-affinity and control conditions. Emotional reactions were stronger in response to the high-affinity condition than the control and the low-affinity conditions. Participants also spoke about a large number of emotion-regulation strategies, which may have influenced their reactions. Future research may be able to benefit from investigating these emotional aspects in more detail, and climate change communicators may conclude that reports about extreme weather in different places do not affect climate attitudes and beliefs in the short term, but they may still cause different emotional reactions with potential consequences in the long term.

In the next chapter, we will integrate these insights with those from the previous chapters to synthesise an understanding of research into psychological distance and place affinity and to derive implications from this knowledge base.

6 General Discussion

6.1 Synthesis of Findings

The overarching aim of this thesis was to investigate how people-place relationships affect the perception of climate change. Our starting point was Construal Level Theory (Trope & Liberman, 2010), a framework commonly used to describe distance-related aspects of climate change and their relation to risk perception and climate change (Brügger, 2020). In a systematic review we first documented a number of problematic limitations of this approach, such as inconsistencies between the theory and its applications to climate change, which led us to focus the remaining chapters of this thesis on collating and testing an alternative framework of place affinity to describe people-place relationships more accurately. In this General Discussion, we will first give a brief summary of each chapter and their implications, followed by a discussion of the more general theoretical and practical implications of this research. We will also overview the novel contributions of this thesis as well as the remaining limitations and consider how these can be used to shape future research directions.

The first study contained in this thesis consisted of a systematic review of studies investigating psychological distance in the context of climate change (Chapter 2). This review was motivated by previous researchers' observations of a highly inconsistent evidence base in this prolific research field (Brügger, 2020; Wang et al., 2021; and more recently, van Valkengoed et al., 2023). We identified and summarised a large number of relevant papers (84 studies with a total of 81,393 participants). These included qualitative, quantitative cross-sectional and quantitative experimental work, primarily applied to the location of climate impacts, but also to other subjects such as pro-climate policies or mitigation projects. We found a diverse range of theoretical and methodological approaches, which made it unsurprising that previous research and evidence was inconsistent. We argued that part of this inconsistency may have been due to some key characteristics of climate change perceptions that Construal Level Theory is unable to address, such as the stability of distance beliefs, the complexity of climate change decision making, and interdependencies of various distance dimensions. Some of these misalignments have been suggested in a previous comment (Brügger, 2020) and were supported and extended by our systematic review; others, we added based on our analysis.

We also showed that distance in climate change perceptions can be comprised of multiple components; specifically, objective and perceived distance. The former refers to the actual observed locations of climate change across the world – most prominently, in the location of extreme weather events. This objective distance changes constantly as the climate crisis accelerates and will continue

to influence people's climate beliefs. Perceived distance influences how that objective distance is conceptualised in people's minds. A number of studies in this review investigated this perceived distance by presenting the same impact in a number of different ways; for example, on differently scaled maps or timelines (Bashir et al., 2014; Soliman et al., 2018). Being aware of these two types of distance and how they interact may be another step towards a more differentiated and refined understanding of distance-related climate perceptions.

Overall, we concluded from the systematic review that continuing to adapt CLT for climate change research is not the most fruitful way forward, as CLT is unable to address climate change's complicated decision-making contexts, stable climate beliefs and the interdependencies of different distance dimensions. This recommendation was supported by a recent review of the classic CLT literature, which indicated that evidence based on CLT may be overestimated due to publication bias (Maier et al., 2022). Instead, we suggested focusing on other existing theories, or developing new theories, which will be more theoretically and practically useful in this line of investigation. This was the focus of Chapter 3. Here, we took a step back to look at meta-scientific discussions about the replication and theory crisis and how they may help in tackling the challenges of this field. A line of reasoning proposed by these philosophers of science is that there are certain steps that research has to take in order to build useful theories (Bringmann et al., 2022; Eronen & Bringmann, 2021; Scheel et al., 2020). The first of these is to build a descriptive and thorough evidence base in order to describe the phenomenon in question. Only once this is created, can researchers propose and test theories to describe this phenomenon and to explain its relationships to other variables. If the first descriptive step is skipped, or insufficiently addressed, there is a risk of premature theory, which inadequately describes the phenomenon. This can lead to so-called degenerative research lines, in which researchers mould the theory around the results they produce. However, since these results are themselves based on a vague or ill-fitting framework, the theory cannot improve or evolve, and the field continues to produce inconsistent results.

If this process of degenerative research lines has taken place with research surrounding the psychological distance of climate change, it would explain why the field keeps producing inconsistent results. This explanation is in line with our observations of misalignments between CLT and PD in the context of climate change, as discussed above. This explanation also aligns with the fact that climate change perceptions are a fast-growing and recent research field that, understandably, carries an urgency to provide robust results quickly and without the perceived luxury of engaging in explorative and descriptive research. These pressures may well be exacerbated by competition from funders, institutions and journals, which tend to prefer confirmatory research that provides simple and

powerful causal frameworks (e.g., *Journal of Environmental Psychology*, 2023). Although this is understandable considering the time pressure of the climate crisis, it can lead to ineffective confirmatory research that is unfortunately not able to provide the recommendations for policy and practice that are so urgently needed. Such pressures can even be actively harmful, by focusing resources on questions and constructs that are not the best fit for the evidence base. In the case of research on the psychological distance of climate change, these limitations may manifest themselves in ineffective recommendations made to policy makers and climate communicators and can perpetuate discourses of climate change being more distant than it is, as well as more distant than it is perceived to be by the general public (Van Valkengoed et al., 2023)

For researchers investigating distance-related perceptions in climate change, we believe that it would be helpful to keep the risks of premature confirmative research in mind. For example, although we recommended moving on from CLT research and looking for alternative theoretical frameworks, we would caution not to prematurely apply an alternative theory and repeat the same process. Instead, we think it is important to focus on the descriptive evidence base first, and then to choose, or build, a theory on top. We argue that it is easiest to do so when focusing on one particular aspect of climate change, which is then easier to describe thoroughly.

In the remainder of Chapter 3, we applied this line of reasoning to the context of the location of climate change impacts such as extreme weather events. By focusing on this particular context, we were able to draw on various strands of the literature that have already amassed relevant evidence, such as social identity research and objects of care (Fielding & Hornsey, 2016; Wang et al., 2018). As a first step, we chose to reframe our research from distance-related to place-related aspects of climate change perceptions, therefore explicitly allowing us to consider a much wider and more flexible range of relevant research. This included some of the literature on psychological distance, but also, for example, opinion polls on climate beliefs, social identity theory and objects of care. We proposed a framework of place affinity, which is defined by multiple place beliefs that people hold towards locations of climate impacts: spatial distance and similarity, social similarity and intimacy, familiarity and care. The strength of this framework is its ability to combine existing evidence with emerging constructs to produce findings that can more holistically describe people's relationships with affected places in this context. It makes no inherent causal assumptions and therefore allows researchers to define phenomena first and relate them to other constructs later.

We also introduced the concept of susceptibility to place affinity. Under this umbrella, we presented personal characteristics that may moderate the extent to which place affinity affects a

person's reaction towards a particular location being impacted by climate change. These constructs, which were primarily identified through the systematic literature review in Chapter 2, included traits such as empathy, thinking styles, temporal thinking and agency. We suggested, based on previous research, that these characteristics may help us to understand people's different reactions to climate impact locations and may therefore be a further, useful explanatory block in place-related climate perceptions.

In Chapters 4 and 5, we embarked on an exploration and test of this framework through multiple methodologies and applications. First, we provided an exploratory and descriptive starting point through a cross-sectional Study 1 (Chapter 4). We asked participants to state freely where they believed climate change to have serious and negative consequences, and then to rate their place affinity towards those places. Participants named different types of places, ranging from landscapes to continents to countries and cities, showing a large variety of different mental conceptualisations of climate impacts. We found that stronger affinity towards places that are currently impacted by climate change, or would be impacted in the near future, was related to higher concern for climate change overall. However, affinity towards places impacted in the distant future was not related to concern. Frequency of worry was equally unrelated to affinity towards places impacted now or in the future. The included susceptibility variables did not seem to moderate these relationships to any meaningful degree. We also ran a second, primarily qualitative study on the same issues, to detect any important concepts or relationships that we might otherwise have missed. A key result of this qualitative component was that a place's vulnerability to climate change consequences, as well as a place's responsibility for causing climate change, played into participants' thoughts on impact locations and concern.

We concluded from this explorative study that the relatively strong relationship between place affinity and concern warranted further investigation of the framework, but that there were several key limitations of this study that we wanted to address. First, we wanted to apply the framework to an everyday scenario, to test its explanatory power not just in a cross-sectional, but in an experimental setting. Second, we wanted to expand our selection of place beliefs to include vulnerability and responsibility. Third, we wanted to test the effect of place affinity on individual and collective climate action outcomes. Finally, we wanted to probe participants' emotion-regulation strategies to assess whether their further investigation would be valuable in this context.

To address these aims, we conducted an experimental study in which we showed participants a news article about a flooding event attributed to climate change (Chapter 5). The event was

described to have taken place in either Germany or Madagascar, which we established in pilot studies to be high-affinity and low-affinity places, respectively, to UK residents. Additionally, we had a control condition in which participants were shown a general article on flooding caused by climate change. Contrary to our hypotheses, there were no differences between conditions in risk perception, policy support and behaviour. There were small differences in emotional reactions, primarily indicating that reading about flooding in Germany induced stronger negative emotions than the place-unspecific control article. Additionally, when participants were asked how they regulated their emotional responses to the article, they spoke about a large number of emotion regulation strategies. Within our study design, we were unable to compare these emotion regulation strategies between experimental conditions. However, since people's choice of emotion regulations strategy can have a large influence on climate action (Pihkala, 2022a), our results do suggest that it may be valuable to conduct further research into these processes.

6.2 Theoretical Implications

Researchers and climate change communicators frequently claim that one of the reasons why residents of WEIRD countries do not exhibit more concern or climate action is that climate change impacts take place in locations that are perceived to be too psychologically distant (e.g., CRED, 2009; Van Lange & Huckelba, 2021). The theory usually used to support these arguments is CLT (Trope & Liberman, 2010). Recent reviews have questioned the value and accuracy of CLT and its associated line of reasoning because of persistent, inconsistent findings in the literature, attributed to a misfit between the theory and the climate change context (Brügger, 2020; Maier et al., 2022; Van Valkengoed et al., 2023; Wang et al., 2021). Various suggestions for how to continue to develop psychological distance or similar constructs are given in these reviews, yet even when researchers agree that research on psychological distance and related constructs needs to adapt, there have been limited attempts to find the most fruitful and efficient way forward.

Based on our systematic literature review (Chapter 2), meta-scientific considerations (Chapter 3), and exploration of an alternative framework to understand distance, and place-related aspects of climate change (Chapters 4 and 5), we arrived at several suggestions to consider when conducting research in this field in the hope of identifying suitable research avenues. These can be useful for researchers wanting to conduct context-specific, bottom-up research, as well as those looking to evaluate alternative theoretical approaches to psychological distance such as risk processing or mental models, Bayesian updating or conceptual change (e.g., risk processing, Bayesian updating; Brügger, 2020).

6.2.1 Implications for Studying Psychological Distance of Climate Change or Related Concepts

The first group of recommendations concerns general implications for research related to distance and place-related climate change perceptions. These are described in detail in Chapter 2 and 3, but here we present three action points to guide future research:

1. Do not assume the generalisability of a theory or context until proven otherwise

We recommend that researchers shift their focus from trying to find or test a general theory of distance or place to instead focus on specific contexts, such as the location of climate impacts or mitigation projects. A general theory of psychology such as CLT is assumed to capture a universal phenomenon that generalises to a wide variety of situations and populations, unless shown otherwise – an assumption that has been increasingly questioned in recent years (e.g., Yarkoni, 2022). The psychological distance of climate change is an area that is particularly vulnerable to these overgeneralisations. This is because these phenomena are too complex to be targeted with a universal theory - especially a theory that has been established for a very different set of decision-making contexts (see Chapter 2 and 3). We therefore recommend that researchers start from a position of not assuming generalisability, instead exploring and describing particular contexts one at a time, building a rich evidence base, and then moving on to the building and testing of explanatory theories.

2. Embrace exploratory and descriptive work

In order to conduct the research described in Point 1 above, it is important to embrace exploratory, descriptive work. This can take the form of dedicated qualitative work, but even including open-ended questions in surveys can provide additional perspectives that may otherwise go unnoticed (Singer & Couper, 2017). One example from this thesis comes from the first study that we reported, where participants were asked to freely state where they thought climate change impacts took place (Chapter 4). The answers ranged not only in the location, but also in the type of places participants associated with climate impacts, including landscapes, continents, countries or cities. Such open-ended questions may be more difficult to analyse when assessing relationships with other variables, but they can lead to more externally valid responses and provide much deeper insight into people's everyday experiences and mental representations than more traditional opinion polls. There are study designs implementing this approach to a far more extensive degree, such as diary or event reconstruction studies (Laffan et al., 2023). Such designs may be especially useful to implement in future research which aims to explore distance-related or place-related effects in a particular climate change context.

3. Consider overlapping constructs and related disciplines

The psychological distance of climate change is an intuitive and general concept, which often means that it may overlap with a range of other variables from psychology and related disciplines (see Chapter 3). Some of these are explored under the umbrella of place affinity and place beliefs in this thesis, but many others are likely to exist. Disregarding this previous research leads to several issues. Researchers may not link their work pre-existing evidence and therefore conduct duplicate research without realising; but the lack of awareness also implies that an interdisciplinary perspective, crucial in climate change research (Schipper et al., 2021), is lacking. This thesis only considers a small number of constructs related to distance and place perceptions for the context of the location of climate impacts. Programmatic and more resourceful research could continue investigations into place- and distance-related perceptions of climate change, through interdisciplinary reviews and exploratory, descriptive and applied research.

6.2.2 Implications for Place Affinity Work and the Context of Extreme Weather Event Locations

In this thesis, we also explored the concept and framework of place affinity as a tool to describe people-place relationships in the context of climate impacts (Chapter 3). While investigating this framework, we found that cross-sectional data suggested that place affinity can be strongly associated with concern at a similar strength of prediction to belief in climate change and its human causes (Chapter 4); however, these relationships did not translate into between-group differences when making different place affinities salient in an experimental setting (Chapter 5). More research is needed to explore these different applications, leading us to the following recommendations for future research into place affinity or similar concepts:

1. Conceptualisations of affected places

First, we recommend gaining a better understanding of the varied ways and spatial scales in which participants think about affected places. This is because any researcher wanting to investigate distance and place effects in climate change must invariably refer to particular places in questionnaires or manipulation materials. Our research has shown, however, that people vary greatly in terms of how they conceptualise affected places – for example, as types of landscapes specific countries or even cities, as indicated in our study (Chapter 4). Since these different conceptualisations likely impact how people relate to the respective places, it would be valuable to explore these conceptualisations further, for example using free-text responses and qualitative or

mixed-method approaches. This might help researchers arrive at a better justification for exactly which kinds of place relationships they investigate in their research on climate change impacts.

2. Conceptual clarity of place affinity

Second, we suggest that researchers should explore the components of place affinity as well as its relationships with related concepts. This is an important step in clarifying the concept so that it can be distinguished from others, or combined with them, whichever is more effective. Although this step is necessary in all psychological research (Bringmann et al., 2022), it is especially important in an area such as distance-related and place-related effects of climate change, which has been investigated from a wide variety of angles and disciplines (as shown in Chapter 3). Our studies have given some insight into how components of place affinity differ between each other – for example, indicating that vulnerability and responsibility are relevant as place beliefs (Chapter 4), but that they conform to different patterns than the other place beliefs such as spatial distance and similarity, social similarity and intimacy as well as care (Chapter 5). Future research could investigate how these place beliefs relate to each other and inform one another, potentially through qualitative investigations into people's process of forming place perceptions in the context of climate change impacts.

Care should also be taken to consider that these place beliefs may depend on the wider context, and that generalisability to other contexts cannot be assumed (see above). Part of this work could therefore consist of exploring related contexts and comparing findings. For example, although Chapter 5 investigated the context of online news articles, further studies could focus on other media such as audio, video or virtual reality, or vary other components of the reported news such as using real articles or the degree of storytelling. More generally, concepts such as personal relevance have often been implicitly thought to be related to psychological distance, but have not been sufficiently differentiated theoretically and empirically (Brügger, 2020). Investigating these, along with potential moderators such as holistic thinking or empathy (see Chapter 2) may allow researchers to establish systematically the concept and the boundaries of its utility.

3. Focus on short-term effects of emotion and emotion regulation

Our experimental study indicated that the salience of place affinity affects the emotional reactions of participants to reports of extreme weather events. Additionally, participants reported a large number of emotion-regulation strategies, such as emotion-focused, problem-focused and meaning-focused coping. We recommend exploring these reactions further, since emotion regulation

can play an important role in shaping people's strategies in responding to the climate crisis (Pihkala, 2022a).

4. Understanding long-term effects around the perception of climate impact locations

Climate change is a long-term phenomenon, around which most people have already established their beliefs (Jenkins-Smith et al., 2020). Understanding how these beliefs are formed and how – over time – they may be changed, could be an important tool in understanding place-related effects around climate change. This thesis has helped to differentiate the aspects of place-related effects that may be subject to change and that may therefore be valuable to investigate. This includes people's perceptions of where climate change impacts take place (see Chapter 3) and their relationships with those affected places (e.g., place affinity, Chapters 3-5), but also mechanisms (e.g., emotion regulation, Chapter 5) or individual characteristics (e.g., susceptibility variables, Chapter 4) that may shape people's reactions to climate impacts.

It could be especially helpful to investigate people's place affinity after certain moments in time, or after changes in people's life. Research around the habit discontinuity hypothesis has shown that people may be more open to changing habitual behaviour after experiencing general disruption changes, such as moving house (Verplanken & Whitmarsh, 2021). A similar process might take place when people's beliefs around the location of climate change impacts are disrupted; for example, through the experience of an extreme weather event either directly or through repeated exposure in the news, or when joining a particular community or social media bubble such as climate activists. Such disruptive moments of 'shock' or 'awakening' have been shown to play an important role in many people's path from unawareness to climate action (Pihkala, 2022b). Researching how distance-related and place-related perceptions change throughout these processes may therefore further our understanding of how climate beliefs are established and maintained. The belief-updating literature may also help guide research into such long-term belief changes; this and other possible approaches to similar questions are discussed by Brügger (2020).

6.3 Practical Implications

The results of this thesis have practical implications for those who communicate about climate change and its impacts, such as charities, non-profit organisations, campaigners, journalists and policymakers. Currently, many guidelines for how to communicate about climate change state that people are unmotivated to support or partake in climate action because climate change is too far away (Van Valkengoed et al., 2023). However, our systematic review of the literature concerning the psychological distance of climate change (Chapter 2) shows that, across different methodologies

and applications, this assumption cannot be supported. Although some studies did find that participants saw climate change as taking place far away, the majority saw their own country as impacted too; and in either case, the perceived distance was not consistently linked to risk perceptions. Similarly, interventions to reduce this distance could not be consistently linked to increased risk perceptions, behaviour or policy support, which indicates that such campaigns may not necessarily be the most effective use of resources.

Should we therefore recommend that climate communicators better not focus on distance-beliefs around climate change in their campaigns? Unfortunately, our literature review and our own exploration of perceived climate impact locations (Chapters 3 and 4) indicate that it might not be as simple as that. We found that people's perceptions of locations of climate impacts can be diverse, depending on the kinds of impacts and timescales studied as well as whether participants are asked for free associations or to respond to free categories. In other words, the kinds of places people think are impacted *to some degree* by climate change differ from the kinds of places that people think are impacted *severely*; similar different associations are held between locations that are impacted now versus those that are impacted at a point in the distant future. Consequently, when asked whether climate change takes place in their own country, many people agree, leading opinion polls to declare that people widely believe that climate change takes place in their own country. Yet at the same time, people's spontaneous, unguided associations with worst-hit locations may still consist of more stereotypical regions such as the poles, or of countries which have recently been in the news. Since research on such spontaneous, unguided associations is rare, we cannot yet say whether there is a link between these and risk perceptions, behaviour or policy support.

The consequence of these findings is that we cannot make clear recommendations as to whether distance is a barrier to climate change action. Our results indicate that perceived distance depends on many factors, and campaigners will have to assess their particular campaign goals to decide on whether and how to focus on this distance. We can, however, support recent arguments that proximising climate change is not a sure-fire way toward increasing climate action (Brügger, 2020; Brügger et al., 2016; Van Valkengoed et al., 2023). Instead, it may be more useful to remind people of their already existing knowledge that climate change does, or will, take place in their own location, focusing on updating their more habitual thought patterns.

Our findings regarding place affinity as a framework for understanding people's relationships with affected places are very preliminary and require further research before they can be transformed into concrete practical guidance. Previous evidence and our own investigations suggest

that place beliefs may influence how a particular climate change impact or extreme weather event is perceived – especially in regard to emotional reactions (see Chapter 5). Although our experimental investigations showed that reading about an extreme weather event occurring in high-affinity or low-affinity locations does not change participants' immediate risk perceptions, policy support or behaviour, it is still possible that long-term effects of such reporting may influence these factors (Chapter 5). Additionally, place affinity, when measured through a cross-sectional questionnaire, does seem to be related to concern – especially in regard to places that are currently seen as impacted by climate change. We would therefore recommend that journalists and other communicators who do report on such events consider the way that the affected location and people are described and take any possible measures to increase readers' affinity towards these places. However, we must emphasise that further research is needed to evaluate such measures and to better explore any mechanisms that may influence their effectiveness (such as emotion regulation, see Chapter 5).

6.4 Novel Contributions

This thesis provides a number of novel contributions to the field of place- and distance-related aspects of climate change perceptions. Our systematic review (Chapter 2) was the first to provide a systematic, comprehensive analysis of the field of psychological distance. Our analysis of the literature was able to provide new insights into the evidence base surrounding the construct as well as its limitations in its current application. In Chapter 3, we then combined these insights with considerations from meta-scientific and philosophy of science work to develop directions for future research. This approach sets our suggestions apart from previous works, in which analyses of the field and recommendations were neither based on comprehensive systematic reviews nor meta-scientific evidence for effective and efficient research (e.g., Brügger, 2020; Maiella et al., 2020; Wang et al., 2021). Based on our analysis, we then focused on further investigating the location of climate impacts and introduced the novel framework of place affinity, which provides the opportunity to integrate existing and new research to achieve a more holistic perspective than previously utilised constructs. After developing this framework, we explored and tested the factors influencing place affinity and the processes surrounding it (Chapter 4). Besides the novel contribution of the framework itself, we employed a new measure to elicit climate impact locations that were salient to participants, and measured ratings of place affinity towards those salient locations. This allowed us to receive rich and ecologically valid data which we were able to relate to quantitative measures of place affinity, climate beliefs and risk perception. The resulting data provided new insights into the potential effects of place affinity on risk perception, and participants' susceptibility to these effects.

Another contribution of this chapter was the primarily qualitative Study 2, which was able to highlight a potentially important distinction of perceived vulnerability and responsibility from other place beliefs such as spatial distance.

Finally, in Chapter 5, we contributed to the field with a test of the place affinity framework in the context of extreme weather reports. This study was run as a Registered Report, and included preregistered analysis, open data and open code. This rigour was valuable in an area which has seen a lot of inconsistent evidence and therefore benefits especially from transparent research. We also developed measurements and manipulation materials through three pilot studies, adding to the quality of the experiment. Additional novel contributions of this study were the use of MANOVAs to model the influence of place beliefs on outcome variables and remove the assumption that all place beliefs contribute to place affinity equally, and the exploration of emotion regulation strategies which had not previously been investigated in the context of extreme weather events and only sparingly in the context of climate change impact location. The experiment was able to provide reliable, new insight into the effects of place affinity on the perception of extreme weather reports, which will be of interest to researchers and practitioners interested in the perception of extreme weather events.

Overall, this thesis was able to contribute to the field of psychological distance, place affinity and related constructs by (a) providing a systematic analysis of the literature, (b) building on this analysis by demonstrating how a novel framework can be used to integrate existing evidence, and (c) exploring and testing this framework from a variety of perspectives. The results are of use to researchers in the area of distance and place beliefs, as well as practitioners such as climate change communicators and policy makers, with specific learnings and recommendations for each of those groups provided in the discussion above.

6.5 Key Limitations with Present Research

There are a number of important limitations to consider within the studies we report. First, our two empirical studies are highly context-specific to the location of climate impacts (Chapter 4) and to written news reports of extreme weather events (Chapter 5). As we show in our systematic review (Chapter 2) and in the meta-scientific discussion (Chapter 3), such context-specific research is necessary to adequately describe the complex interactions of variables that are present in the climate change domain. However, it does mean that our research is not necessarily generalisable to other areas such as other forms of media (e.g., TV news, social media), interpersonal discussion of climate impacts or people's personal experiences of extreme weather. For future research wanting

to extend our findings to other climate change contexts, it is important to consider that other factors, not explored in the present research, may be important. For example, the selection of place beliefs may have to be extended or limited, and there may be external factors that are especially influential in a particular area (e.g., choice of social media platform). Additionally, the influence of moderating variables such as emotion regulation may depend on the particular context, making it difficult to generalise results without in-depth research into each context. Therefore, a concrete recommendation for research wanting to extend our framework would be to aim to replicate our findings in adjacent areas, but to take into account already existing research that is specific to this context. In this way, an evidence base can be built that embraces new frameworks such as ours while at the same time utilising existing work.

Second, our work only includes cross-sectional (Chapter 4) or short-term experimental (Chapter 5) effects. As we mention above, it is likely that many people develop and change climate change attitudes over a longer period of time, as these attitudes tend to be relatively stable (Jenkins-Smith et al., 2020) and strongly related to stable individual characteristics (Hornsey et al., 2016). We were unable to investigate such longitudinal effects through our research designs. This is general limitation of research in this domain - for example, none of the studies we reviewed in Chapter 2 employed longitudinal designs. Therefore, a clear recommendation for future research would be to focus on tracking which places people perceive to be impacted by climate change as well as their affinity towards these places over longer periods of time. This would be possible both within a descriptive design, such as measuring place affinity and any relation to prominent extreme weather events (example with local extreme weather: Mildenberger et al., 2019), or within an experimental design, such as repeatedly exposing participants to climate change reporting about high- or low-affinity places (example manipulating message valences: Diamond & Urbanski, 2022).

Finally, our research only investigated UK residents. While this population can have a large influence on mitigating climate change and is therefore valuable to investigate (Nielsen et al., 2021), it means that our findings cannot be assumed to generalise to other populations. Research around psychological distance is generally biased towards WEIRD populations, although there has been a recent increase in studies set in non-WEIRD countries (see Chapter 2). Since place-related research such as that reported in this thesis can be assumed to be particularly dependent on local contexts, it is important to continue this trend and further investigate the place affinity framework and its relevance in various local, regional and national contexts. Care should be taken not to exploit these non-WEIRD populations and instead enter a meaningful collaboration with local researchers (Odeny

& Bosurgi, 2022), which will also be helpful in terms of recognising important local factors that should be taken into consideration in such studies.

6.6 Conclusion

In this thesis, we presented a critical investigation of distance-related and place-related research concerning climate change. We showed that the current prominent framework of Construal Level Theory and psychological distance is difficult to apply to the context of climate change and suggested that this has led to the wide variety in approaches and inconsistent results present in the field. We proposed and tested an alternative framework of place affinity, in which we collated evidence around related constructs and employed bottom-up research to describe distance-related and place-related effects around climate change impacts. Our results suggested that this framework may be promising in explaining links between stable place beliefs and risk perceptions. However, these effects did not seem to be present in regard to short-term effects around reports of extreme weather events.

Taken together, we demonstrate how prioritising a descriptive basis to portray ongoing phenomena, and then progressing to explanatory frameworks, can help researchers in conducting more informative research around place and distance in the climate change context. The theoretical implications described in the last chapter will be beneficial to researchers interested in this or similar areas in helping guide their investigations. The practical implications will help both researchers who are taking an impact-focused approach in guiding their research questions, and climate change practitioners who are interested in providing evidence-based campaigns and communications.

7 References

Acharibasam, J. W., & Anuga, S. W. (2018). Psychological distance of climate change and mental health risks assessment of smallholder farmers in Northern Ghana: Is habituation a threat to climate change? *Climate Risk Management*, *21*, 16–25. https://doi.org/10.1016/j.crm.2018.04.002

Agin, S., & Karlsson, M. (2021). Mapping the field of climate change communication 1993-2018: Geographically biased, theoretically narrow, and methodologically limited. *Environmental Communication - A Journal Of Nature And Culture*, *15*(4), 431–446. https://doi.org/10.1080/17524032.2021.1902363

Altinay, Z. (2017). Visual communication of climate change: Local framing and place attachment. *Coastal Management*, *45*(4), 293–309. https://doi.org/10.1080/08920753.2017.1327344

American Psychological Association. (2017). *Ethical principles of psychologists and code of conduct*. https://www.apa.org/ethics/code/

Aslam, A., & Rana, I. A. (2022). Impact of the built environment on climate change risk perception and psychological distancing: Empirical evidence from Islamabad, Pakistan. *Environmental Science & Policy*, *127*, 228–240. https://doi.org/10.1016/j.envsci.2021.10.024

Azadi, Y., Yazdanpanah, M., & Mahmoudi, H. (2019). Understanding smallholder farmers' adaptation behaviors through climate change beliefs, risk perception, trust, and psychological distance: Evidence from wheat growers in Iran. *Journal of Environmental Management*, *250*, 109456. https://doi.org/10.1016/j.jenvman.2019.109456

Bago, B., Rand, D. G., & Pennycook, G. (2023). Reasoning about climate change. *PNAS Nexus*, *2*(5), 1–13. https://doi.org/10.1093/pnasnexus/pgad100

Baltruszewicz, M., Steinberger, J. K., Paavola, J., Ivanova, D., Brand-Correa, L. I., & Owen, A. (2023). Social outcomes of energy use in the United Kingdom: Household energy footprints and their links to well-being. *Ecological Economics*, *205*, 107686. https://doi.org/10.1016/j.ecolecon.2022.107686

Bar-Anan, Y., Liberman, N., & Trope, Y. (2006). The association between psychological distance and construal level: Evidence from an implicit association test. *Journal of Experimental Psychology: General*, *135*(4), 609–622. https://doi.org/10.1037/0096-3445.135.4.609

Bar-Anan, Y., Liberman, N., Trope, Y., & Algom, D. (2007). Automatic processing of psychological distance: Evidence from a Stroop task. *Journal of Experimental Psychology: General*, *136*(4), 610–622. https://doi.org/10.1037/0096-3445.136.4.610

Bashir, N. Y., Wilson, A. E., Lockwood, P., Chasteen, A. L., & Alisat, S. (2014). The time for action is now: Subjective temporal proximity enhances pursuit of remote-future goals. *Social Cognition*, *32*(1), 83–93. https://doi.org/10.1521/soco.2014.32.1.83

Berger, N., Lindemann, A.-K., & Böl, G.-F. (2019). Public perception of climate change and implications for risk communication [Wahrnehmung des Klimawandels durch die Bevölkerung und Konsequenzen für die Risikokommunikation]. *Bundesgesundheitsblatt - Gesundheitsforschung - Gesundheitsschutz*. https://doi.org/10.1007/s00103-019-02930-0

Bergquist, M., Nilsson, A., Harring, N., & Jagers, S. C. (2022). Meta-analyses of fifteen determinants of public opinion about climate change taxes and laws. *Nature Climate Change*, *12*(3), 235–240. https://doi.org/10.1038/s41558-022-01297-6

Bø, S., & Wolff, K. (2020). I can see clearly now: Episodic future thinking and imaginability in perceptions of climate-related risk events. *Frontiers in Psychology*, *11*, 218. https://doi.org/10.3389/fpsyg.2020.00218

Bostrom, A. (2017). Mental models and risk perceptions related to climate change. In A. Bostrom, *Oxford Research Encyclopedia of Climate Science*. Oxford University Press. https://doi.org/10.1093/acrefore/9780190228620.013.303

Boykoff, M. T. (2008). Media and scientific communication: A case of climate change. *Geological Society, London, Special Publications*, *305*(1), 11–18. https://doi.org/10.1144/SP305.3

Bradley, G. L., Babutsidze, Z., Chai, A., & Reser, J. P. (2020). The role of climate change risk perception, response efficacy, and psychological adaptation in pro-environmental behavior: A two nation study. *Journal of Environmental Psychology*, *68*, 101410. https://doi.org/10.1016/j.jenvp.2020.101410

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101.

Bringmann, L. F., Elmer, T., & Eronen, M. I. (2022). Back to basics: The importance of conceptual clarification in psychological science. *Current Directions in Psychological Science*, 7. https://doi.org/oi.org/10.1177/09637214221096485

Brosch, T. (2021). Affect and emotions as drivers of climate change perception and action: A review. *Current Opinion in Behavioral Sciences*, *42*, 15–21. https://doi.org/10.1016/j.cobeha.2021.02.001

Brosch, T., Stussi, Y., Desrichard, O., & Sander, D. (2018). Not my future? Core values and the neural representation of future events. *Cognitive, Affective and Behavioral Neuroscience*, *18*(3), 476–484. https://doi.org/10.3758/s13415-018-0581-9

Brügger, A. (2013). *Fear appeals and localising climate change: Neither is a panacea to motivate action on climate change: A social psychological perspective* [Doctoral dissertation, University of Exeter]. https://ethos.bl.uk/OrderDetails.do?uin=uk.bl.ethos.590895

Brügger, A. (2020). Understanding the psychological distance of climate change: The limitations of construal level theory and suggestions for alternative theoretical perspectives. *Global Environmental Change*, *60*, 102023. https://doi.org/10.1016/j.gloenvcha.2019.102023

Brügger, A., Demski, C., & Capstick, S. (2021). How personal experience affects perception of and decisions related to climate change: A psychological view. *Weather, Climate, and Society*, *13*(3), 397–408. https://doi.org/10.1175/WCAS-D-20-0100.1

Brügger, A., Dessai, S., Devine-Wright, P., Morton, T. A., & Pidgeon, N. (2015). Psychological responses to the proximity of climate change. *Nature Climate Change*, *5*(12), 1031–1037. https://doi.org/10.1038/nclimate2760

Brügger, A., Morton, T. A., & Dessai, S. (2015). Hand in hand: Public endorsement of climate change mitigation and adaptation. *PLOS ONE*, *10*(4). https://doi.org/10.1371/journal.pone.0124843

Brügger, A., Morton, T. A., & Dessai, S. (2016). "Proximising" climate change reconsidered: A construal level theory perspective. *Journal of Environmental Psychology*, *46*, 125–142. https://doi.org/10.1016/j.jenvp.2016.04.004

Brügger, A., & Pidgeon, N. (2018). Spatial framing, existing associations and climate change beliefs. *Environmental Values*, *27*(5), 559–584. https://doi.org/10.3197/096327118X15321668325966

Brügger, A., Tobias, R., & Monge-Rodríguez, F. S. (2021). Public perceptions of climate change in the Peruvian Andes. *Sustainability*, *13*(5), 2677. https://doi.org/10.3390/su13052677

Busse, M., & Menzel, S. (2014). The role of perceived socio-spatial distance in adolescents' willingness to engage in pro-environmental behavior. *Journal of Environmental Psychology*, *40*, 412–420. https://doi.org/10.1016/j.jenvp.2014.10.002

Caldwell, A. R. (2022). *Exploring equivalence testing with the updated TOSTER R package*. PsyArXiv. https://doi.org/10.31234/osf.io/ty8de

Carmi, N., & Bartal, E. (2014). Perception of environmental threat in the shadow of war: The effect of future orientation. *Human and Ecological Risk Assessment*, *20*(3), 872–886. https://doi.org/10.1080/10807039.2013.798217

Carmi, N., & Kimhi, S. (2015). Further than the eye can see: Psychological distance and perception of environmental threats. *Human and Ecological Risk Assessment: An International Journal*, *21*(8), 2239–2257. https://doi.org/10.1080/10807039.2015.1046419

CAST (Centre for Climate Change and Social Transformations). (2020). *CAST Data Portal—Public perceptions of climate change dashboard*. https://cast.ac.uk/publicperceptiondashboard/

Center for Open Science. (2022). *Template-preregistration-RR.rtf*. https://osf.io/93znh

Chen, M.-F. (2019). Social representations of climate change and pro-environmental behavior intentions in Taiwan. *International Sociology*, *34*(3), 327–346. https://doi.org/10.1177/0268580919832737

Chen, M.-F. (2020). Effects of psychological distance perception and psychological factors on pro-environmental behaviors in Taiwan: Application of construal level theory. *International Sociology*, *35*(1), 70–89. https://doi.org/10.1177/0268580919881870

Cheng, H., & Gonzalez-Ramirez, J. (2021). Trust and the Media: Perceptions of Climate Change News Sources Among US College Students. *Postdigital Science and Education*, *3*(3), 910–933. https://doi.org/10.1007/s42438-020-00163-y

Choi, I., Koo, M., & Jong An Choi. (2007). Individual differences in analytic versus holistic thinking. *Personality and Social Psychology Bulletin*, *33*(5), 691–705. https://doi.org/10.1177/0146167206298568

Chu, H. (2022). Construing climate change: Psychological distance, individual difference, and construal level of climate change. *Environmental Communication*, *16*(7), 883–899. https://doi.org/10.1080/17524032.2022.2061027

Chu, H., & Yang, J. (2018). Taking climate change here and now – mitigating ideological polarization with psychological distance. *Global Environmental Change*, *53*, 174–181. https://doi.org/10.1016/j.gloenvcha.2018.09.013

Chu, H., & Yang, J. (2019). Emotion and the psychological distance of climate change. *Science Communication*, *41*(6), 761–789. https://doi.org/10.1177/1075547019889637

Chu, H., & Yang, J. (2020a). Risk or efficacy? How psychological distance influences climate change engagement. *Risk Analysis*, *40*(4), 758–770. https://doi.org/10.1111/risa.13446

Chu, H., & Yang, J. (2020b). Their economy and our health: Communicating climate change to the divided American public. *International Journal of Environmental Research and Public Health*, *17*(21), 1–17. https://doi.org/10.3390/ijerph17217718

Climate assembly UK. (2020). *The path to net zero*. UK House of Commons. https://www.climateassembly.uk/recommendations/index.html

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Erlbaum.

Cook, J., & Lewandowsky, S. (2016). Rational irrationality: Modeling climate change belief polarization using bayesian networks. *Topics in Cognitive Science*, *8*(1), 160–179. https://doi.org/10.1111/tops.12186

Coulter, L., Serrao-Neumann, S., & Coiacetto, E. (2019). Climate change adaptation narratives: Linking climate knowledge and future thinking. *Futures*, *111*, 57–70. https://doi.org/10.1016/j.futures.2019.05.004

Crawford, A. V., Green, S. B., Levy, R., Lo, W.-J., Scott, L., Svetina, D., & Thompson, M. S. (2010). Evaluation of Parallel Analysis Methods for Determining the Number of Factors. *Educational and Psychological Measurement*, *70*(6), 885–901. https://doi.org/10.1177/0013164410379332

CRED. (2009). *The psychology of climate change communication: A guide for scientists, journalists, educators, political aides, and the interested public*. Columbia University.

Cutter, S. L., & Finch, C. (2008). Temporal and spatial changes in social vulnerability to natural hazards. *Proceedings of the National Academy of Sciences*, *105*(7), 2301–2306. https://doi.org/10.1073/pnas.0710375105

Davis, M. H. (1980). A multidimensional approach to individual differences in empathy. *Journal of Personality and Social Psychology*, *10*(58).

de Guttry, C., Döring, M., & Ratter, B. (2017). How distant is climate change? Construal level theory analysis of German and Taiwanese students statements. *International Journal of Asian Social Science*, *7*(5), 434–447. https://doi.org/10.18488/journal.1.2017.75.434.447

de Guttry, C., Süsser, D., & Döring, M. (2019). Situating climate change: Psychological distances as tool to understand the multifaceted dimensions of climate change meanings. *Geoforum*, *104*, 92–100. https://doi.org/10.1016/j.geoforum.2019.06.015

Degeling, D., & Koolen, R. (2021). Communicating climate change to a local but diverse audience: On the positive impact of locality framing. *Environmental Communication*, 1–19. https://doi.org/10.1080/17524032.2021.1998177

Denis, D. J. (2020). *Univariate, bivariate, and multivariate statistics using R: Quantitative tools for data analysis and data science* (First edition). Wiley.

Department for Business, Energy and Industrial Strategy. (2020). *BEIS Public Attitudes Tracker: Key findings*. https://www.gov.uk/government/statistics/beis-public-attitudes-tracker-wave-33

Department for Business, Energy and Industrial Strategy, Department for Environmental, Food & Rural Affairs, & Demski, C. (2021). *Climate change and net zero: Public awareness and perceptions*. https://www.gov.uk/government/publications/climate-change-and-net-zero-public-awareness-and-perceptions

Dhaher, C., & Gumus, A. (2022). Lessons from media-centered climate change literature. *Sustainability*, *14*(3). https://doi.org/10.3390/su14031404

Diamond, E., & Urbanski, K. (2022). The Impact of Message Valence on Climate Change Attitudes: A Longitudinal Experiment. *Environmental Communication*, *16*(8), 1046–1058. https://doi.org/10.1080/17524032.2022.2151486

Droseltis, O., & Vignoles, V. L. (2010). Towards an integrative model of place identification: Dimensionality and predictors of intrapersonal-level place preferences. *Journal of Environmental Psychology*, *30*(1), 23–34. https://doi.org/10.1016/j.jenvp.2009.05.006

Duan, R., Takahashi, B., & Zwickle, A. (2019). Abstract or concrete? The effect of climate change images on people's estimation of egocentric psychological distance. *Public Understanding of Science*, *28*(7), 828–844. https://doi.org/10.1177/0963662519865982

Duke, J. R., & Holt, E. A. (2022). Seeing climate change: Psychological distance and connection to nature. *Environmental Education Research*, 1–21. https://doi.org/10.1080/13504622.2022.2042205

Eckstein, D., Künzel, V., & Schäfer, L. (2021). *Global Climate Risk Index 2021*. Germanwatch.

Ejelöv, E., Hansla, A., Bergquist, M., & Nilsson, A. (2018). Regulating emotional responses to climate change – a construal level perspective. *Frontiers in Psychology*, *9*, 629. https://doi.org/10.3389/fpsyg.2018.00629

Eronen, M. I. (2020). Causal discovery and the problem of psychological interventions. *New Ideas in Psychology*, *59*, 100785. https://doi.org/10.1016/j.newideapsych.2020.100785

Eronen, M. I., & Bringmann, L. F. (2021). The theory crisis in psychology: How to move forward. *Perspectives on Psychological Science*, 1–10. https://doi.org/10.1177/1745691620970586

Evans, L., Milfont, T. L., & Lawrence, J. (2014). Considering local adaptation increases willingness to mitigate. *Global Environmental Change*, *25*, 69–75. https://doi.org/10.1016/j.gloenvcha.2013.12.013

Evans, S. (2021, October 5). *Analysis: Which countries are historically responsible for climate change?* Carbon Brief. https://www.carbonbrief.org/analysis-which-countries-are-historically-responsible-for-climate-change

Fang, S.-C., Yu, T.-K., Yu, T.-Y., & Chang, I.-C. (2016). Psychological distance and pro-environmental behavior: An application of behavior model to emerging contaminants in higher education. *Journal of Baltic Science Education*, *15*(6), 759–775.

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–191. https://doi.org/10.3758/BF03193146

Fesenfeld, L. P., & Rinscheid, A. (2021). Emphasizing urgency of climate change is insufficient to increase policy support. *One Earth*, *4*(3), 411–424. https://doi.org/10.1016/j.oneear.2021.02.010

Fielding, K. S., & Hornsey, M. J. (2016). A social identity analysis of climate change and environmental attitudes and behaviors: Insights and opportunities. *Frontiers in Psychology*, *7*. https://doi.org/10.3389/fpsyg.2016.00121

Fox, J., McKnight, J., Sun, Y., Maung, D., & Crawfis, R. (2020). Using a serious game to communicate risk and minimize psychological distance regarding environmental pollution. *Telematics and Informatics*, *46*, 101320. https://doi.org/10.1016/j.tele.2019.101320

Galati, A., Tulone, A., Vrontis, D., Thrassou, A., & Crescimanno, M. (2021). Intention of coastal communities to support climate change mitigation policies for fish and marine ecosystem preservation. *Journal of Enterprising Communities: People and Places in the Global Economy*, *17*(2), 261–283. https://doi.org/10.1108/JEC-05-2021-0069

Gifford, R., Scannell, L., Kormos, C., Smolova, L., Biel, A., Boncu, S., Corral, V., Güntherf, H., Hanyu, K., Hine, D., Kaiser, F. G., Korpela, K., Lima, L. M., Mertig, A. G., Mira, R. G., Moser, G., Passafaro, P., Pinheiro, J. Q., Saini, S., … Uzzell, D. (2009). Temporal pessimism and spatial optimism in environmental assessments: An 18-nation study. *Journal of Environmental Psychology*, *29*(1), 1–12. https://doi.org/10.1016/j.jenvp.2008.06.001

Gosling, P., Denizeau, M., & Oberlé, D. (2006). Denial of responsibility: A new mode of dissonance reduction. *Journal of Personality and Social Psychology*, *90*(5), 722–733. https://doi.org/10.1037/0022-3514.90.5.722

Grommisch, G., Koval, P., Hinton, J. D. X., Gleeson, J., Hollenstein, T., Kuppens, P., & Lischetzke, T. (2020). Modeling individual differences in emotion regulation repertoire in daily life with multilevel latent profile analysis. *Emotion*, *20*(8), 1462–1474. https://doi.org/10.1037/emo0000669

Gubler, M., Brügger, A., & Eyer, M. (2019). Adolescents' perceptions of the psychological distance to climate change, its relevance for building concern about it, and the potential for education. *Climate Change and the Role of Education*, 129–147. https://doi.org/10.1007/978-3-030-32898-6_8

Guillard, M., Fleury-Bahi, G., & Navarro, O. (2021). Encouraging individuals to adapt to climate change: Relations between coping strategies and psychological distance. *Sustainability*, *13*(2), 992. https://doi.org/10.3390/su13020992

Guillard, M., Navarro, O., & Fleury-Bahi, G. (2019). Flooding experience and assessment of climate change: Implication of psychological distance, risk perception and place attachment /

Experiencia de inundaciones y evaluación del cambio climático: Implicaciones de la distancia psicológica, la percepción de riesgo y el apego al lugar. *Psyecology*, *10*(3), 287–312. https://doi.org/10.1080/21711976.2019.1622347

Gustafson, A., Ballew, M. T., Goldberg, M. H., Cutler, M. J., Rosenthal, S. A., & Leiserowitz, A. (2020). Personal stories can shift climate change beliefs and risk perceptions: The mediating role of emotion. *Communication Reports*, *33*(3), 121–135. https://doi.org/10.1080/08934215.2020.1799049

Haig. (2013). Detecting psychological phenomena: Taking bottom-up research seriously. *The American Journal of Psychology*, *126*(2), 135. https://doi.org/10.5406/amerjpsyc.126.2.0135

Halperin, A., & Walton, P. (2018). The importance of place in communicating climate change to different facets of the American public. *Weather, Climate, and Society*, *10*(2), 291–305. https://doi.org/10.1175/WCAS-D-16-0119.1

Hart, P. S., Stedman, R. C., & McComas, K. A. (2015). How the physical proximity of climate mitigation projects influences the relationship between affect and public support. *Journal of Environmental Psychology*, *43*, 196–202. https://doi.org/10.1016/j.jenvp.2015.07.003

Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and Brain Sciences*, *33*(2–3), 61–83. https://doi.org/10.1017/S0140525X0999152X

Homburg, A., Stolberg, A., & Wagner, U. (2007). Coping with global environmental problems: Development and first validation of scales. *Environment and Behavior*, *39*(6), 754–778. https://doi.org/10.1177/0013916506297215

Hornsey, M. J., Chapman, C. M., & Oelrichs, D. M. (2021). Why it is so hard to teach people they can make a difference: Climate change efficacy as a non-analytic form of reasoning. *Thinking & Reasoning*, 1–19. https://doi.org/10.1080/13546783.2021.1893222

Hornsey, M. J., Harris, E. A., Bain, P. G., & Fielding, K. S. (2016). Meta-analyses of the determinants and outcomes of belief in climate change. *Nature Climate Change*, *6*(6), 622–626. https://doi.org/10.1038/nclimate2943

Howe, P. D., Marlon, J. R., Mildenberger, M., & Shield, B. S. (2019). How will climate change shape climate opinion? *Environmental Research Letters*, *14*(11), 113001. https://doi.org/10.1088/1748-9326/ab466a

Huebner, A. (2012). Public perceptions of destination vulnerability to climate change and implications for long-haul travel decisions to small island states. *Journal of Sustainable Tourism*, *20*(7), 939–951. https://doi.org/10.1080/09669582.2012.667107

International Collaboration to Understand Climate Action. (2023, April 24). *Project updates*. https://manylabsclimate.wordpress.com/project-updates/

IPCC Working Group 1. (2021). *Climate change 2021: The physical science basis. Contribution of working group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

IPCC Working Group 2. (2022). *Climate change 2022: Impacts, adaptation and vulnerability. Summary for policy makers*.

Ipsos MORI. (2021). *KnowledgePanel UK: Wave 19 survey—Climate change and Health*. https://www.ipsos.com/sites/default/files/ct/ news/documents/2021-10/21-040088-01%20Tables%20-%20V1-%20 PUBLIC.pdf.

Jang, S. M. (2013). Framing responsibility in climate change discourse: Ethnocentric attribution bias, perceived causes, and policy attitudes. *Journal of Environmental Psychology*, *36*, 27–36. https://doi.org/10.1016/j.jenvp.2013.07.003

Jenkins-Smith, H. C., Ripberger, J. T., Silva, C. L., Carlson, D. E., Gupta, K., Carlson, N., Ter-Mkrtchyan, A., & Dunlap, R. E. (2020). Partisan asymmetry in temporal stability of climate change beliefs. *Nature Climate Change*, *10*(4), 322–328. https://doi.org/10.1038/s41558-020-0719-y

Johannsen, I. M., Lassonde, K. A., Wilkerson, F., & Schaab, G. (2018). Communicating climate change: Reinforcing comprehension and personal ties to climate change through maps. *The Cartographic Journal*, *55*(1), 85–100. https://doi.org/10.1080/00087041.2017.1386834

Jones, C., Hine, D. W., & Marks, A. D. G. (2017). The future is now: Reducing psychological distance to increase public engagement with climate change. *Risk Analysis*, *37*(2), 331–341. https://doi.org/10.1111/risa.12601

Jost, F., Dale, A., & Schwebel, S. (2019). How positive is "change" in climate change? A sentiment analysis. *Environmental Science & Policy*, *96*, 27–36. https://doi.org/10.1016/j.envsci.2019.02.007

Journal of Environmental Psychology. (2023). *Guide for authors*. https://www.elsevier.com/journals/journal-of-environmental-psychology/0272-4944/guide-for-authors

Kaplan, B. A., Reed, D. D., & McKerchar, T. L. (2014). Using a visual analogue scale to assess delay, social, and probability discounting of an environmental loss. *Psychological Record*, *64*(2), 261–269. https://doi.org/10.1007/s40732-014-0041-z

Kassambara, A., & Mundt, F. (2020). *factoextra: Extract and Visualize the Results of Multivariate Data Analyses* (1.07) [R; Windows]. https://CRAN.R-project.org/package=factoextra

Katz, A., Shealy, T., & Godwin, A. (2020). Civil engineering students' beliefs about the technical and social implications of global warming and when global warming will impact them personally

and others. *2020 ASEE Virtual Annual Conference Content Access Proceedings*, 34285. https://doi.org/10.18260/1-2--34285

Kim, K., & Ahn, S. J. (Grace). (2019). The moderating role of cultural background in temporal framing: Focusing on climate change awareness advertising. *Asian Journal of Communication*, *29*(4), 363–385. https://doi.org/10.1080/01292986.2019.1624793

Klinsky, S., Dowlatabadi, H., & Mcdaniels, T. (2012). Comparing public rationales for justice trade-offs in mitigation and adaptation climate policy dilemmas. *Global Environmental Change*, *22*(4), 862–876. https://doi.org/10.1016/j.gloenvcha.2012.05.008

Koletsou, A., & Mancy, R. (2011). Which efficacy constructs for large-scale social dilemma problems? Individual and collective forms of efficacy and outcome expectancies in the context of climate change mitigation. *Risk Management*, *13*(4), 184–208. https://doi.org/10.1057/rm.2011.12

Kraemer, H. C., & Blasey, C. (2015). *How many subjects? Statistical power analysis in research*. SAGE Publications.

Kyselá, E., Ščasný, M., & Zvěřinová, I. (2019). Attitudes toward climate change mitigation policies: A review of measures and a construct of policy attitudes. *Climate Policy*, *19*(7), 878–892. https://doi.org/10.1080/14693062.2019.1611534

Kyselá, E., Tvinnereim, E., & Ivarsflaten, E. (2019). Attitudes to public spending on environmental risk reduction: The role of temporal and spatial distance. *Environmental Sociology*, *5*(4), 362–373. https://doi.org/10.1080/23251042.2019.1643528

Laffan, K., Lades, L. K., & Delaney, L. (2023). Paths that lead astray: Examining the situational predictors of intention-behaviour gaps in meat consumption. *Journal of Environmental Psychology*, 102045. https://doi.org/10.1016/j.jenvp.2023.102045

Lakens, D. (2022). Sample size justification. *Collabra: Psychology*, *8*(1), 33267. https://doi.org/10.1525/collabra.33267

Lakens, D., Scheel, A., & Isager, P. M. (2018). Equivalence testing for psychological research: A tutorial. *Advances in Methods and Practices in Psychological Science*, *1*(2), 259–269. https://doi.org/10.17605/OSF.IO/QAMC6

Lalot, F., Ahvenharju, S., Minkkinen, M., & Wensing, E. (2020). Aware of the future? Development and validation of the futures consciousness scale. *European Journal of Psychological Assessment*, *36*(5), 874–888. https://doi.org/10.1027/1015-5759/a000565

Lamb, W. F., Mattioli, G., Levi, S., Roberts, J. T., Capstick, S., Creutzig, F., Minx, J. C., Müller-Hansen, F., Culhane, T., & Steinberger, J. K. (2020). Discourses of climate delay. *Global Sustainability*, *3*, e17. https://doi.org/10.1017/sus.2020.13

Lampert, M., Çeta, A. B., Metaal, S., & Papadongonas, P. (2021). *Surging mass recognition of threat to planet & joint willingness for action*. Glocalities. https://www.glocalities.com/reports/environmental-trends-2021

Lange, F. (2022). Behavioral paradigms for studying pro-environmental behavior: A systematic review. *Behavior Research Methods*. https://doi.org/10.3758/s13428-022-01825-4

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. Springer Publishing Company.

Lee, K., & Barnett, J. (2020). 'Will polar bears melt?' A qualitative analysis of children's questions about climate change. *Public Understanding of Science*. https://doi.org/10.1177/0963662520952999

Lee, K., & Barnett, J. (2022). Adolescents' representations of climate change: Exploring the self-other thema in a focus group study. *Environmental Communication*, 1–16. https://doi.org/10.1080/17524032.2021.2023202

Lee, P.-S., Sung, Y.-H., Wu, C.-C., Ho, L.-C., & Chiou, W.-B. (2020). Using episodic future thinking to pre-experience climate change increases pro-environmental behavior. *Environment and Behavior*, *52*(1), 60–81. https://doi.org/10.1177/0013916518790590

Leviston, Z., Price, J., & Bishop, B. (2014). Imagining climate change: The role of implicit associations and affective psychological distancing in climate change responses: Implicit associations with climate change. *European Journal of Social Psychology*, *44*(5), 441–454. https://doi.org/10.1002/ejsp.2050

Lewicka, M. (2011). Place attachment: How far have we come in the last 40 years? *Journal of Environmental Psychology*, *31*(3), 207–230. https://doi.org/10.1016/j.jenvp.2010.10.001

Loy, L. S., Reese, G., & Spence, A. (2021). Facing a common human fate: Relating global identity and climate change mitigation. *Political Psychology*, pops.12781. https://doi.org/10.1111/pops.12781

Loy, L. S., & Spence, A. (2020). Reducing, and bridging, the psychological distance of climate change. *Journal of Environmental Psychology*, *67*, 101388. https://doi.org/10.1016/j.jenvp.2020.101388

Loy, L. S., Tröger, J., Prior, P., & Reese, G. (2021). Global citizens – global jet setters? The relation between global identity, sufficiency orientation, travelling, and a socio-ecological transformation of the mobility system. *Frontiers in Psychology*, *12*, 622842. https://doi.org/10.3389/fpsyg.2021.622842

Mackay, C. M. L., Schmitt, M. T., Lutz, A. E., & Mendel, J. (2021). Recent developments in the social identity approach to the psychology of climate change. *Current Opinion in Psychology*, *42*, 95–101. https://doi.org/10.1016/j.copsyc.2021.04.009

Maechler, M., Rousseeuw, P., Struyf, A., Hubert, M., & Hornik, K. (2022). *cluster: Cluster Analysis Basics and Extensions* (2.1.4) [R; Windows]. https://CRAN.R-project.org/package=cluster

Maiella, R., La Malva, P., Marchetti, D., Pomarico, E., Di Crosta, A., Palumbo, R., Cetara, L., Di Domenico, A., & Verrocchio, M. C. (2020). The psychological distance and climate change: A systematic review on the mitigation and adaptation behaviors. *Frontiers in Psychology*, *11*, 568899. https://doi.org/10.3389/fpsyg.2020.568899

Maier, M., Bartoš, F., Oh, M., Wagenmakers, E.-J., Shanks, D., & Harris, A. J. L. (2022). *Publication bias in research on construal level theory* [Preprint]. PsyArXiv. https://doi.org/10.31234/osf.io/r8nyu

Manning, C., Mangas, H., Amel, E., Tang, H., Humes, L., Foo, R., Sidlova, V., & Cargos, K. (2017). Psychological distance and response to human versus non-human victims of climate change. *Handbook of Sustainability and Social Science Research*, 143–161. https://doi.org/10.1007/978-3-319-67122-2_8

Manzo, L. C. (2003). Beyond house and haven: Toward a revisioning of emotional relationships with places. *Journal of Environmental Psychology*, *23*(1), 47–61. https://doi.org/10.1016/S0272-4944(02)00074-9

Masson, T., & Fritsche, I. (2021). We need climate change mitigation and climate change mitigation needs the 'We': A state-of-the-art review of social identity effects motivating climate change action. *Current Opinion in Behavioral Sciences*, *42*, 89–96. https://doi.org/10.1016/j.cobeha.2021.04.006

McGinty, E. E., Webster, D. W., Jarlenski, M., & Barry, C. L. (2014). News media framing of serious mental illness and gun violence in the united states, 1997-2012. *American Journal of Public Health*, *104*(3), 8.

Meade, A. W., & Craig, S. B. (2012). Identifying careless responses in survey data. *Psychological Methods*, *17*(3), 437–455. https://doi.org/10.1037/a0028085

Michel-Guillou, E. (2015). Water resources and climate change: Water managers' perceptions of these related environmental issues. *Journal of Water and Climate Change*, *6*(1), 111–123. https://doi.org/10.2166/wcc.2014.098

Mildenberger, M., Lubell, M., & Hummel, M. (2019). Personalized risk messaging can reduce climate concerns. *Global Environmental Change*, *55*, 15–24. https://doi.org/10.1016/j.gloenvcha.2019.01.002

Moezzi, M., Janda, K. B., & Rotmann, S. (2017). Using stories, narratives, and storytelling in energy and climate change research. *Energy Research & Social Science*, *31*, 1–10. https://doi.org/10.1016/j.erss.2017.06.034

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & The PRISMA Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine*, *6*(7), e1000097. https://doi.org/10.1371/journal.pmed.1000097

Montgomery, J. M., Nyhan, B., & Torres, M. (2018). How conditioning on posttreatment variables can ruin your experiment and what to do about it. *American Journal of Political Science*, *62*(3), 760–775. https://doi.org/10.1111/ajps.12357

Morris, B. S., Chrysochou, P., Christensen, J. D., Orquin, J. L., Barraza, J., Zak, P. J., & Mitkidis, P. (2019). Stories vs. facts: Triggering emotion and action-taking on climate change. *Climatic Change*, *154*(1–2), 19–36. https://doi.org/10.1007/s10584-019-02425-6

Nabi, R. L., Gustafson, A., & Jensen, R. (2018). Framing climate change: Exploring the role of emotion in generating advocacy behavior. *Science Communication*, *40*(4), 442–468. https://doi.org/10.1177/1075547018776019

Newton, C., Feeney, J., & Pennycook, G. (in press). On the disposition to think analytically: Four distinct intuitive-analytic thinking styles. *Personality and Social Psychology Bulletin*. https://doi.org/10.31234/osf.io/r5wez

Ngo, C. C., Poortvliet, P. M., & Feindt, P. H. (2020). Examining the effectiveness of climate change communication with adolescents in Vietnam: The role of message congruency. *Water*, *12*(11), 3016. https://doi.org/10.3390/w12113016

Nielsen, K. S., Nicholas, K. A., Creutzig, F., Dietz, T., & Stern, P. C. (2021). The role of high-socioeconomic-status people in locking in or rapidly reducing energy-driven greenhouse gas emissions. *Nature Energy*, *6*(11), 1011–1016. https://doi.org/10.1038/s41560-021-00900-y

NVivo (Version 20). (2021). [Windows 10]. QSR International Pty Ltd.

Odeny, B., & Bosurgi, R. (2022). Time to end parachute science. *PLoS Medicine*, *19*(9), e1004099. https://doi.org/10.1371/journal.pmed.1004099

Ojala, M. (2012). Regulating worry, promoting hope: How do children, adolescents, and young adults cope with climate change? *International Journal of Environmental & Science*, *7*(4), 25.

Ojala, M. (2013). Coping with climate change among adolescents: Implications for subjective well-being and environmental engagement. *Sustainability*, *5*(5), 2191–2209. https://doi.org/10.3390/su5052191

Ojala, M., & Bengtsson, H. (2019). Young people's coping strategies concerning climate change: Relations to perceived communication with parents and friends and proenvironmental behavior. *Environment and Behavior*, *51*(8), 907–935. https://doi.org/10.1177/0013916518763894

Ojala, M., Cunsolo, A., Ogunbode, C. A., & Middleton, J. (2021). Anxiety, worry, and grief in a time of environmental and climate crisis: A narrative review. *Annual Review of Environment and Resources*, *46*(1), 35–58. https://doi.org/10.1146/annurev-environ-012220-022716

O'Neill, S. J. (2013). Image matters: Climate change imagery in US, UK and Australian newspapers. *Geoforum*, *49*, 10–19. https://doi.org/10.1016/j.geoforum.2013.04.030

O'Neill, S., & Smith, N. (2014). Climate change and visual imagery. *WIREs Climate Change*, *5*, 73–87. https://doi.org/10.1002/wcc.249

Pahl, S., Sheppard, S., Boomsma, C., & Groves, C. (2014). Perceptions of time in relation to climate change. *Wiley Interdisciplinary Reviews: Climate Change*, *5*(3), 375–388. https://doi.org/10.1002/wcc.272

Panno, A., Carrus, G., Maricchiolo, F., & Mannetti, L. (2015). Cognitive reappraisal and pro-environmental behavior: The role of global climate change perception. *European Journal of Social Psychology*, *45*(7), 858–867. https://doi.org/10.1002/ejsp.2162

Parks, B. C., & Roberts, J. T. (2010). Climate change, social theory and justice. *Theory, Culture & Society*, *27*(2–3), 134–166. https://doi.org/10.1177/0263276409359018

Peer, E., Brandimarte, L., Samat, S., & Acquisti, A. (2017). Beyond the Turk: Alternative platforms for crowdsourcing behavioral research. *Journal of Experimental Social Psychology*, *70*, 153–163. https://doi.org/10.1016/j.jesp.2017.01.006

Peer, E., Rothschild, D., Gordon, A., Evernden, Z., & Damer, E. (2022). Data quality of platforms and panels for online behavioral research. *Behavior Research Methods*, *54*(4), 1643–1662. https://doi.org/10.3758/s13428-021-01694-3

Pennycook, G., Cheyne, J. A., Koehler, D. J., & Fugelsang, J. A. (2020). On the belief that beliefs should change according to evidence: Implications for conspiratorial, moral, paranormal, political, religious, and science beliefs. *Judgement and Decision Making*, *15*(4), 476–498. https://doi.org/10.31234/osf.io/a7k96

Pew Research Center. (2018). *In Western Europe, public attitudes toward news media more divided by populist views than left-right ideology*.

Pihkala, P. (2022a). The process of eco-anxiety and ecological grief: A narrative review and a new proposal. *Sustainability*, *14*(24), 16628. https://doi.org/10.3390/su142416628

Pihkala, P. (2022b). Toward a taxonomy of climate emotions. *Frontiers in Climate*, *3*, 738154. https://doi.org/10.3389/fclim.2021.738154

Pohl, R. F. (Ed.). (2022). *Cognitive illusions: Intriguing phenomena in judgement, thinking and memory* (3rd edition). Routledge.

Poortvliet, P. M., Niles, M. T., Veraart, J. A., Werners, S. E., Korporaal, F. C., & Mulder, B. C. (2020). Communicating climate change risk: A content analysis of ipcc's summary for policymakers. *Sustainability (Switzerland)*, *12*(12). https://doi.org/10.3390/SU12124861

Prolific. (2022). *Prolific* (September 2022) [Computer software]. https://www.prolific.co/

Qualtrics. (2020). *Qualtrics* (September 2022) [Computer software]. Qualtrics. www.qualtrics.com

R Core Team. (2022). *R: A language and environment for statistical computing.* [Windows]. R Foundation for Statistical Computing. https://www.R-project.org/

Reese, G., Proch, J., & Finn, C. (2015). Identification With All Humanity: The role of self-definition and self-investment. *European Journal of Social Psychology*, *45*(4), 426–440. https://doi.org/10.1002/ejsp.2102

Rickard, L. N., Yang, Z. J., & Schuldt, J. P. (2016). Here and now, there and then: How "departure dates" influence climate change engagement. *Global Environmental Change*, *38*, 97–107. https://doi.org/10.1016/j.gloenvcha.2016.03.003

Rinscheid, A., Pianta, S., & Weber, E. U. (2020). Fast track or Slo-Mo? Public support and temporal preferences for phasing out fossil fuel cars in the United States. *Climate Policy*, *20*(1), 30–45. https://doi.org/10.1080/14693062.2019.1677550

Ritchie, H., Roser, M., & Rosado, P. (2020). *CO_2 and Greenhouse Gas Emissions*. Our World in Data. https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions

Rode, J. B., Dent, A. L., Benedict, C. N., Brosnahan, D. B., Martinez, R. L., & Ditto, P. H. (2021). Influencing climate change attitudes in the United States: A systematic review and meta-analysis. *Journal of Environmental Psychology*, *76*, 101623. https://doi.org/10.1016/j.jenvp.2021.101623

Rodríguez-Cruz, L. A., & Niles, M. T. (2021). Awareness of climate change's impacts and motivation to adapt are not enough to drive action: A look of Puerto Rican farmers after Hurricane Maria. *PLOS ONE*, *16*(1), e0244512. https://doi.org/10.1371/journal.pone.0244512

Romero-Canyas, R., Larson-Konar, D., Redlawsk, D. P., Borie-Holtz, D., Gaby, K., Langer, S., & Schneider, B. (2019). Bringing the heat home: Television spots about local impacts reduce global warming denialism. *Environmental Communication - A Journal Of Nature And Culture*, *13*(6), 740–760. https://doi.org/10.1080/17524032.2018.1455725

Rubio Juan, M., & Revilla, M. (2021). Support for mitigation and adaptation climate change policies: Effects of five attitudinal factors. *Mitigation and Adaptation Strategies for Global Change*, *26*(6), 28. https://doi.org/10.1007/s11027-021-09964-3

Sacchi, S., Riva, P., & Aceto, A. (2016). Myopic about climate change: Cognitive style, psychological distance, and environmentalism. *Journal of Experimental Social Psychology*, *65*, 68–73. https://doi.org/10.1016/j.jesp.2016.03.006

Scannell, L., & Gifford, R. (2013). Personally relevant climate change: The role of place attachment and local versus global message framing in engagement. *Environment and Behavior*, *45*(1), 60–85. https://doi.org/10.1177/0013916511421196

Schattman, R. E., Caswell, M., & Faulkner, J. W. (2021). Eyes on the horizon: Temporal and social perspectives of climate risk and agricultural decision making among climate-informed farmers. *Society & Natural Resources*, 1–20. https://doi.org/10.1080/08941920.2021.1894283

Scheel, A. M., Tiokhin, L., Isager, P. M., & Lakens, D. (2020). Why hypothesis testers should spend less time testing hypotheses. *Perspectives on Psychological Science*, 1–12. https://doi.org/10.1177/1745691620966795

Schipper, E. L. F., Dubash, N. K., & Mulugetta, Y. (2021). Climate change research and the search for solutions: Rethinking interdisciplinarity. *Climatic Change*, *168*(3–4), 18. https://doi.org/10.1007/s10584-021-03237-3

Schoenefeld, J. J., & McCauley, M. R. (2016). Local is not always better: The impact of climate information on values, behavior and policy support. *Journal of Environmental Studies and Sciences*, *6*(4), 724–732. https://doi.org/10.1007/s13412-015-0288-y

Schuldt, J. P., Rickard, L. N., & Yang, Z. J. (2018). Does reduced psychological distance increase climate engagement? On the limits of localizing climate change. *Journal of Environmental Psychology*, *55*, 147–153. https://doi.org/10.1016/j.jenvp.2018.02.001

Schwartz, S. H. (2012). An overview of the Schwartz theory of basic values. *Online Readings in Psychology and Culture*, *2*(1). https://doi.org/10.9707/2307-0919.1116

Shackley, M. J. (2021). Localizing discussions of climate change effects may not increase students' willingness to engage in pro-environmental behavior. *Interdisciplinary Journal of Environmental and Science Education*, *17*(4), e2257. https://doi.org/10.21601/ijese/11149

Shehata, A., Johansson, J., Johansson, B., & Andersen, K. (2022). Climate change frame acceptance and resistance: Extreme weather, consonant news, and personal media orientations. *Mass Communication and Society*, *25*(1), 51–76. https://doi.org/10.1080/15205436.2021.1967998

Shrum, T. R. (2021). The salience of future impacts and the willingness to pay for climate change mitigation: An experiment in intergenerational framing. *Climatic Change*, *165*(1–2), 18. https://doi.org/10.1007/s10584-021-03002-6

Shwom, R., Dan, A., & Dietz, T. (2008). The effects of information and state of residence on climate change policy preferences. *Climatic Change*, *90*(4), 343–358. https://doi.org/10.1007/s10584-008-9428-7

Singer, E., & Couper, M. P. (2017). Some methodological uses of responses to open questions and other verbatim comments in quantitative surveys. *Methods*, *data*, 20 Pages. https://doi.org/10.12758/MDA.2017.01

Singh, A. S. (2016). *Cultural worldview, psychological distance, and Americans' support for climate mitigation and adaptation policy*. The Ohio State University.

Singh, A. S., Zwickle, A., Bruskotter, J. T., & Wilson, R. (2017). The perceived psychological distance of climate change impacts and its influence on support for adaptation policy. *Environmental Science & Policy*, *73*, 93–99. https://doi.org/10.1016/j.envsci.2017.04.011

Soliman, M., Alisat, S., Bashir, N. Y., & Wilson, A. E. (2018). Wrinkles in time and drops in the bucket: Circumventing temporal and social barriers to pro-environmental behavior. *SAGE Open*, *8*(2). https://doi.org/10.1177/2158244018774826

Sparkman, G., Lee, N. R., & Macdonald, B. N. J. (2021). Discounting environmental policy: The effects of psychological distance over time and space. *Journal of Environmental Psychology*, *73*. https://doi.org/10.1016/j.jenvp.2020.101529

Spence, A., & Pidgeon, N. (2010). Framing and communicating climate change: The effects of distance and outcome frame manipulations. *Global Environmental Change*, *20*(4), 656–667. https://doi.org/10.1016/j.gloenvcha.2010.07.002

Spence, A., Poortinga, W., & Pidgeon, N. (2012). The psychological distance of climate change. *Risk Analysis*, *32*(6), 957–972. https://doi.org/10.1111/j.1539-6924.2011.01695.x

Stanley, S. K., Klas, A., Clarke, E. J. R., & Walker, I. (2021). The effects of a temporal framing manipulation on environmentalism: A replication and extension. *PLOS ONE*, *16*(2), e0246058. https://doi.org/10.1371/journal.pone.0246058

Stephan, E., Liberman, N., & Trope, Y. (2010). Politeness and psychological distance: A construal level perspective. *Journal of Personality and Social Psychology*, *98*(2), 268–280. https://doi.org/10.1037/a0016960

Stewart, A. E. (2021). Psychometric properties of the Climate Change Worry scale. *International Journal of Environmental Research and Public Health*, 22.

Steynor, A., Leighton, M., Kavonic, J., Abrahams, W., Magole, L., Kaunda, S., & Mubaya, C. P. (2020). Learning from climate change perceptions in southern African cities. *Climate Risk Management*, *27*. https://doi.org/10.1016/j.crm.2019.100202

Strathman, A., Gleicher, F., Boninger, D. S., & Edwards, C. S. (1994). The consideration of future consequences: Weighing immediate and distant outcomes of behavior. *Journal of Personality and Social Psychology*, *66*(4), 742–752. https://doi.org/10.1037/0022-3514.66.4.742

Sweeny, K., Melnyk, D., Miller, W., & Shepperd, J. A. (2010). Information avoidance: Who, what, when, and why. *Review of General Psychology*, *14*(4), 340–353. https://doi.org/10.1037/a0021288

Swim, J. K., & Bloodhart, B. (2018). The intergroup foundations of climate change justice. *Group Processes & Intergroup Relations*, *21*(3), 472–496. https://doi.org/10.1177/1368430217745366

Tabachnik, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). Pearson.

The jamovi project. (2021). *Jamovi* (1.6) [Computer software]. www.jamovi.org

Tibshirani, R., Walther, G., & Hastie, T. (2001). Estimating the number of clusters in a data set via the gap statistic. *Journal of the Royal Statistical Society: Series B (Statistical Methodology)*, *63*(2), 411–423. https://doi.org/10.1111/1467-9868.00293

Tonn, B., Hemrick, A., & Conrad, F. (2006). Cognitive representations of the future: Survey results. *Futures*, *38*(7), 810–829. https://doi.org/10.1016/j.futures.2005.12.005

Trope, Y., & Liberman, N. (2010). Construal-level theory of psychological distance. *Psychological Review*, *117*(2), 440–463. https://doi.org/10.1037/a0018963

Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive Psychology*, *5*, 207–232.

Tvinnereim, E., Laegreid, O. M., Liu, X., Shaw, D., Borick, C., & Lachapelle, E. (2020). Climate change risk perceptions and the problem of scale: Evidence from cross-national survey experiments. *Environmental Politics*. https://doi.org/10.1080/09644016.2019.1708538

van der Linden, S. (2015). The social-psychological determinants of climate change risk perceptions: Towards a comprehensive model. *Journal of Environmental Psychology*, *41*, 112–124. https://doi.org/10.1016/j.jenvp.2014.11.012

van der Linden, S. (2017). Determinants and measurement of climate change risk perception, worry, and concern. In S. van der Linden, *Oxford Research Encyclopedia of Climate Science*. Oxford University Press. https://doi.org/10.1093/acrefore/9780190228620.013.318

Van Lange, P. A. M., & Huckelba, A. L. (2021). Psychological distance: How to make climate change less abstract and closer to the self. *Current Opinion in Psychology*, *42*, 49–53. https://doi.org/10.1016/j.copsyc.2021.03.011

van Valkengoed, A. M., Steg, L., & Perlaviciute, G. (2021). Development and validation of a climate change perceptions scale. *Journal of Environmental Psychology*, *76*, 101652. https://doi.org/10.1016/j.jenvp.2021.101652

Van Valkengoed, A. M., Steg, L., & Perlaviciute, G. (2023). The psychological distance of climate change is overestimated. *One Earth*, *6*(4), 362–391. https://doi.org/10.1016/j.oneear.2023.03.006

van Zomeren, M., Leach, C. W., & Spears, R. (2012). Protesters as "passionate economists": A dynamic dual pathway model of approach coping with collective disadvantage. *Personality and Social Psychology Review*, *16*(2), 180–199. https://doi.org/10.1177/1088868311430835

van Zomeren, M., Spears, R., & Leach, C. W. (2010). Experimental evidence for a dual pathway model analysis of coping with the climate crisis. *Journal of Environmental Psychology*, *30*(4), 339–346. https://doi.org/10.1016/j.jenvp.2010.02.006

Verplanken, B., Marks, E., & Dobromir, A. I. (2020). On the nature of eco-anxiety: How constructive or unconstructive is habitual worry about global warming? *Journal of Environmental Psychology*, *72*, 101528. https://doi.org/10.1016/j.jenvp.2020.101528

Verplanken, B., & Whitmarsh, L. (2021). Habit and climate change. *Current Opinion in Behavioral Sciences*, *42*, 42–46. https://doi.org/10.1016/j.cobeha.2021.02.020

Vesely, S., Masson, T., Chokrai, P., Becker, A. M., Fritsche, I., Klöckner, C. A., Tiberio, L., Carrus, G., & Panno, A. (2021). Climate change action as a project of identity: Eight meta-analyses. *Global Environmental Change*, *70*, 102322. https://doi.org/10.1016/j.gloenvcha.2021.102322

Wang, S., Hurlstone, M. J., Leviston, Z., Walker, I., & Lawrence, C. (2019). Climate change from a distance: An analysis of construal level and psychological distance from climate change. *Frontiers in Psychology*, *10*, 230. https://doi.org/10.3389/fpsyg.2019.00230

Wang, S., Hurlstone, M. J., Leviston, Z., Walker, I., & Lawrence, C. (2021). Construal-level theory and psychological distancing: Implications for grand environmental challenges. *One Earth*, *4*(4), 482–486. https://doi.org/10.1016/j.oneear.2021.03.009

Wang, S., Leviston, Z., Hurlstone, M., Lawrence, C., & Walker, I. (2018). Emotions predict policy support: Why it matters how people feel about climate change. *Global Environmental Change*, *50*, 25–40. https://doi.org/10.1016/j.gloenvcha.2018.03.002

Wharton, C. V. (2020). *Manipulating the psychological distance of climate change: Key dimensions and their effects on various mitigation behaviours* [Bachelor's Thesis]. University of Warwick.

Wiest, S. L., Raymond, L., & Clawson, R. A. (2015). Framing, partisan predispositions, and public opinion on climate change. *Global Environmental Change*, *31*, 187–198. https://doi.org/10.1016/j.gloenvcha.2014.12.006

World weather attribution. (n.d.). *World weather attribution*. https://www.worldweatherattribution.org/

Wozniak, A. (2021). *The event-centered nature of global public spheres: The UN climate change conferences, Fridays for Future, and the (limited) transnationalization of media debates*. 27.

Wullenkord, M. C., & Ojala, M. (2023). *Climate-change worry among two cohorts of late adolescents: Exploring macro and micro worries, coping, and relations to climate engagement and well-being* [Preprint]. PsyArXiv. https://doi.org/10.31234/osf.io/g9pm7

Wullenkord, M. C., & Reese, G. (2021). Avoidance, rationalization, and denial: Defensive self-protection in the face of climate change negatively predicts pro-environmental behavior. *Journal of Environmental Psychology*, *77*, 101683. https://doi.org/10.1016/j.jenvp.2021.101683

Xu, Z., Cao, Q., & Li, S. (2020). The role of psychological distance in influencing pro-environmental behavior spread: Perceived justice enforceability as a moderator. *Frontiers in Psychology*, *11*, 567093. https://doi.org/10.3389/fpsyg.2020.567093

Yang, J. Z., Rickard, L. N., Liu, Z., & Boze, T. (2020). Too close to care? A replication study to re-examine the effect of cued distance on climate change engagement. *Environmental Communication*, 1–11. https://doi.org/10.1080/17524032.2020.1777181

Yarkoni, T. (2022). The generalizability crisis. *Behavioral and Brain Sciences*, *45*, e1. https://doi.org/10.1017/S0140525X20001685

YouGov, & Sky. (2021). *YouGov / Sky Survey Results*. https://docs.cdn.yougov.com/gkct8b2i0l/Sky_ClimateChange_210331.pdf

Yu, T.-Y., Yu, T.-K., & Chao, C.-M. (2017). Understanding Taiwanese undergraduate students' pro-environmental behavioral intention towards green products in the fight against climate change. *Journal of Cleaner Production*, *161*, 390–402. https://doi.org/10.1016/j.jclepro.2017.05.115

Zwickle, A. (2015). *Communicating environmental risks*. The Ohio State University.