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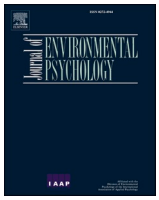

A systematic review of the psychological distance of climate change: Towards the development of an evidence-based construct

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ABSTRACT

The construct of psychological distance has gained traction as an explanation of why climate change is difficult to act on; it often feels far removed, with impacts arising in remote locations to other people or in an uncertain future. However, recent studies and narrative reviews have pointed out inconsistencies in the conceptualisation, operationalisation and results regarding the psychological distance of climate change, with research evidently struggling to develop the construct and determine its place in explaining and promoting pro-environmental behaviour. This paper presents a systematic review of the literature aimed at building an evidence base on which to develop research on psychological distance. Following a systematic search of three databases, 73 records with 84 individual studies were identified, which measured or manipulated the concept in relation to climate change. We find that psychological distance in the context of climate change is a dynamic, context-specific, multidimensional construct, with a wide variety of approaches to measurement and manipulation. Current theorising (primarily Construal Level Theory) is insufficient in describing the diversity and complexity of distance in the climate-change context. Based on the reviewed studies, we give recommendations for the measurement and manipulation of the construct. However, our overarching suggestion is to focus on specific contexts in which distance plays a role in climate-change cognition and action, such as the perception of impacts, policy or behaviour. We discuss how describing distance within these contexts can help researchers to understand current findings, to disentangle different components of distance beliefs and to incorporate theory and insights from related perspectives.

1. Introduction

Psychological distance (PD) is frequently mentioned as a barrier to climate-change action (Van Lange & Huckelba, 2021), relating to the notion that some aspects of climate change feel far away and are difficult to prioritise in everyday decision-making. Consequently, it is often recommended to move climate change psychologically closer to people to promote action (CRED, 2009; Van Lange & Huckelba, 2021). In this article we review PD within the context of climate change, rather than in relation to general pro-environmental scenarios (e.g., Reczek, Trudel, & White, 2018). This distinction is important, since decisions relating to climate change tend to be more complex and global than other environmental decisions (e.g., consumer behaviour, recycling).

PD was developed as part of Trope and Liberman's (2010) construal level theory (CLT). The theory states that we are able to think about things, events and objects we do not experience directly by forming mental construals. These construals become more abstract when an object is perceived to be distant from the self, and more concrete when an object is seen as proximal. This psychological distance can occur along four dimensions, which are assumed to be positively related to each other: spatial distance (physical locations); social distance (happening to/with others); temporal distance (in the future); and hypothetical distance (involving uncertainty). Whether an object is seen as distant or proximal affects the information used in decision-making. For example, concrete information, like costs and benefits, are more influential when a participant feels close to an issue. Comparatively, feeling distant results in more abstract value judgements, such as political ideology (Trope & Liberman, 2010). CLT therefore suggests that PD changes the way we make decisions, albeit not necessarily claiming that making an issue proximal results in increased action (Brügger, Dessai, Devine-Wright, Morton, & Pidgeon, 2015). Importantly, PD is assumed to be a transient state rather than a stable belief, changeable upon new information or a different mindset.

Evidence for PD's effectiveness on climate-change perception and

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action remains inconsistent, despite increased research. Some correlational studies have linked PD to climate-change action, yet differ regarding the operationalisation of PD and its relation to other variables (e.g., Spence, Poortinga, & Pidgeon, 2012; Wang, Hurlstone, Leviston, Walker, & Lawrence, 2019). Experimental studies manipulating PD have shown mixed success in changing pro-environmental behaviours. For example, reducing distance towards climate change has shown more (e.g., Jones, Hine, & Marks, 2017), less (e.g., Halperin & Walton, 2018) and no (e.g., Mildenberger, Lubell, & Hummel, 2019) alteration in pro-environmental behaviour and policy support. Moreover, the success of manipulations is inconsistent, producing varying successes in PD changes (Brügger, Morton, & Dessai, 2016; Chu & Yang, 2020b; Rickard, Yang, & Schuldt, 2016).

Recent papers have pointed out these inconsistencies, calling for researchers to reconsider how PD is utilised in climate-change research (Brügger, 2020; Brügger, Dessai, et al., 2015; Maiella et al., 2020; Wang, Hurlstone, Leviston, Walker, & Lawrence, 2021). It has been suggested that CLT is often misapplied, as the theory was originally developed to understand straightforward decision-making involving transient notions of distance, and is now being applied to stable distance beliefs (Brügger, 2020; Wang et al., 2021). Additionally, inconsistencies in results may be due to whether PD is measured towards climate change as a general, broad concept (e.g., Jones et al., 2017) or towards specific aspects of climate change such as a particular point in time (e.g., Soliman, Alisat, Bashir, & Wilson, 2018), with the latter more coherent with situations CLT was originally developed to describe. In essence, we do not know whether PD towards climate change is a stable or malleable belief, which aspects of climate change it may explain and how best to measure it.

The knowledge base on which to evaluate the concept of PD is currently difficult to establish. Past reviews are narrative (Brügger, 2020; Van Lange & Huckelba, 2021; Wang et al., 2021) or, when systematic, either do not include evidence from recent years (McDonald, Chai, & Newell, 2015) or focus on general pro-environmental behaviour (Maiella et al., 2020). We address these gaps via a systematic review of research applying PD to climate-change cognition and behaviour. Our aim is to describe how PD is used in relation to climate change, particularly paying attention to the lack of consensus between the methodologies deployed and results obtained across studies. This will allow us to map the field and propose avenues for future study. Our central questions can be summarised as follows:

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?

It is important to note that the review is not restricted to applications of CLT but includes any instances of PD identified as such in the literature. Recent work has proposed separating PD from CLT, and it is thus possible that the concept has been used independently. Further, potential misalignments with CLT might mean that a discussion of findings within CLT or other theories could limit our capacity to understand different patterns in the empirical evidence. Therefore, we prioritise describing the phenomena represented in the eligible studies before attempting to fit them within existing theories, as well as new frameworks (Eronen & Bringmann, 2021; Scheel, Tiokhin, Isager, & Lakens, 2020).

2. Method

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.

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 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.

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. Assessing the quality of evidence and the risk of bias

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

Table 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

such as randomised control trials (Moher, Liberati, Tetzlaff, Altman, & ThePRISMA Group., 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 describe the experimental designs and methods of manipulation, emphasising manipulation checks.

Our search strategy may be biased towards published records, which are more likely to include statistically significant results. The grey literature indexed in the above databases (e.g., theses) aims to counter this issue. Given the large number of eligible studies, we decided against searching for literature outside of databases, since our selected studies are sufficiently broad to enable us effectively to describe and interpret all key methods and results. Other potential biases impacting the design of the review, study selection and information synthesis will be discussed subsequently.

3. Results

Fig. 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.

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 timepoint; 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.

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.

3.1.1. Qualitative studies and text analysis

The seven qualitative and one text analysis study are summarised in Table 2.

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

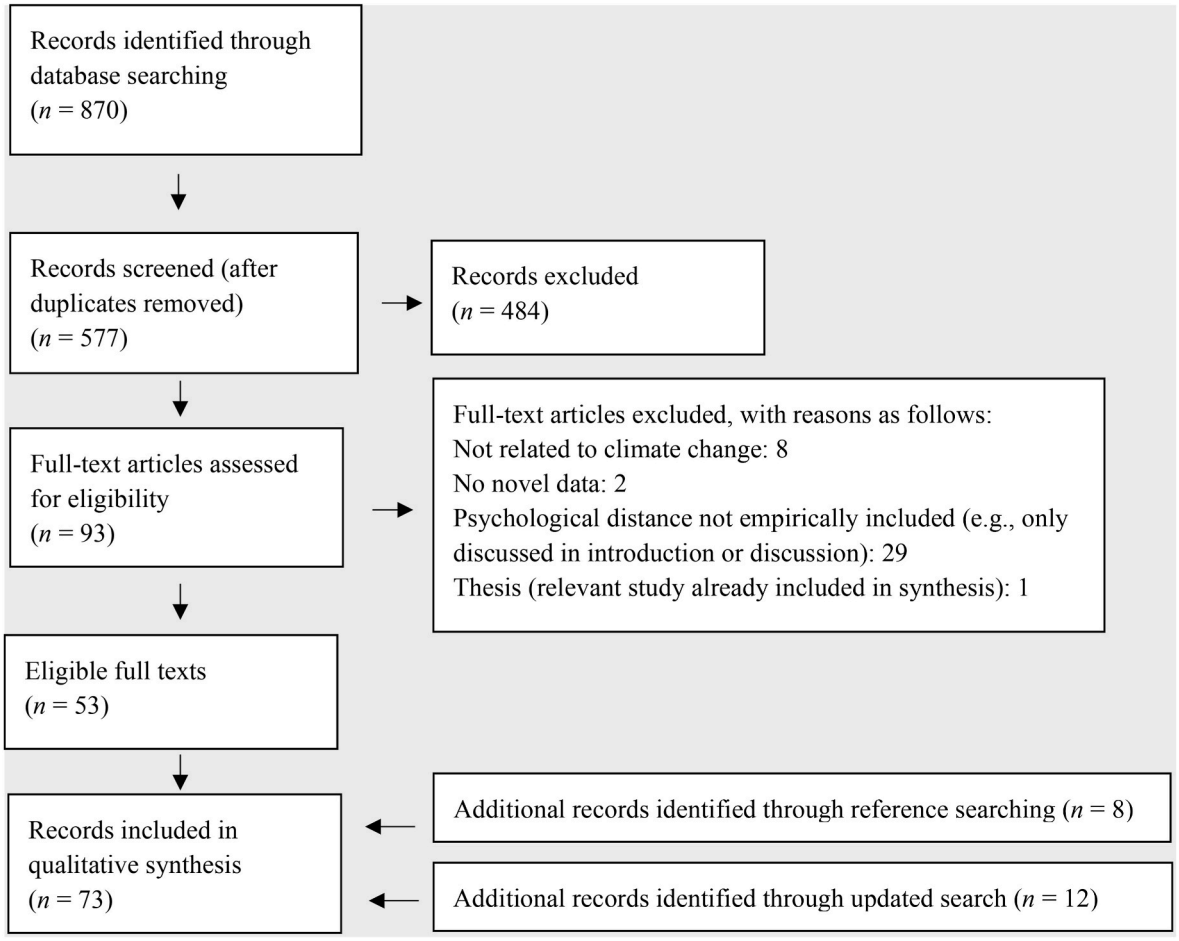

Fig. 1. *Screening and selection process, adapted from PRISMA flowchart* (Moher et al., 2009).

Table 2
Study characteristics of qualitative studies and text analysis.

Study	Design	Sample	Conclusions regarding PD
Coulter, Serrao-Neumann, and Coiacetto (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, Döring, and Ratter (2017)	Free association statements	46 German and 46 Taiwanese students	PD prevalent concept, especially spatially. Climate change seen as relatively distant.
de Guttry, Süsser, and Döring (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 and 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, Price, and Bishop (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, Caswell, and Faulkner (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.

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 linked, 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.

3.1.2. *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 3).

3.1.2.1. 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 $\alpha = 0.68$ 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

Table 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 and 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, Yazdanpanah, and Mahmoudi (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, Lindemann, and Böl (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, and Dessai (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, Tobias, and Monge-Rodríguez (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 and avalanches? Your neighbourhood, your area, (…), rich countries, the whole world)	Both proximal and distant (impacts seen as severe for most places both local and global)	NA
Carmi and 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 and 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, Yu, Yu, and Chang (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 and 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, Brügger, and Eyer (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),	Spatially and socially distant, temporally and hypothetically proximal	NA

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Table 3 (*continued*)

Study	Sample	Measurements: PD measurement style, *dimensions* (number of items; example item).	Descriptive levels of PD	Additional variables (related to PD with asterisk)[b]
		hypothetical (3; I wonder if climate change is a serious threat at all).		
Katz, Shealy, and Godwin (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, Dowlatabadi, and Mcdaniels (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 and 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, Riva, and Aceto (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, Zwickle, Bruskotter, and Wilson (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, Marks, and Dobromir (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	Four dimensions assessed with two measures: PD1 adapted from Spence et al. (2012), α = 0.93. PD2: from McDonald,	PD1: proximal PD2: temporally and hypothetically proximal,	Behaviour Identification Form, Response Category Width, political identification, perceived behavioural control,

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Table 3 (*continued*)

Study	Sample	Measurements: PD measurement style, *dimensions* (number of items; example item).	Descriptive levels of PD	Additional variables (related to PD with asterisk)[b]
	representative of Australian population)	Newell, & Brewer, 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 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).	socially and spatially distant	scepticism*, Consideration of Future Consequences*, place attachment*, environmental worldview*, PEB at individual level* and community level
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, Cao, and Li (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, Yu, and Chao (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 most at risk to the negative consequences of climate change? Myself and my family, (…), people who are unlike me)	Temporally proximal, spatially far, socially moderate	Personal relevance*, concern about health effects of climate change*

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.

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 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.

3.1.2.2. Descriptive levels of psychological distance. Studies 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). 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, suggesting a need to assess these dimensions together, or to hold one dimension fixed (i.e., impacts at certain time-point) to align participants' reference frames.

3.1.2.3. Associations of psychological distance with other concepts. In addition to the descriptions here, individual studies with significantly associated constructs are marked in Table 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.

3.1.3. 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 CLT, it is assumed that dimensions are positively related; in the climate-change context, however, it seems that this is not the case. 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. It is possible that these findings 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.

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 4) are mostly located in Western countries ($n = 45$), followed by 6 East Asian samples. Consequently, results will be generalisable primarily to these populations.

3.2.1. 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

Table 4
Study characteristics of experimental studies.

Study	Sample	Manipulation	Design	Manipulation check	Additional variables[c]
Bashir, Wilson, Lockwood, Chasteen, and Alisat (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, $\eta_p^2 = .09$	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, $\eta^2 = .05$, 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 and 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 and 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 and 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 and 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). $p = .08$, $\eta^2 = .01$[a]	Policy support, PEB intentions, concrete* and abstract* emotions, trait empathy*
Chu and Yang (2020b)	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 $\eta_p^2 = .004$, social $\eta_p^2 = .003$, temporal/hypothetical n.s.	Policy support, PEB intentions*
Chu and Yang (2020a)	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, Takahashi, and Zwickle (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, Hansla, Bergquist, and Nilsson (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, Milfont, and Lawrence (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 and 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, McKnight, Sun, Maung, and Crawfis (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, Navarro, and Fleury-Bahi (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), $\eta^2 = .08$[a]	Risk perception*, place attachment, PD of climate change*
Guillard, Fleury-Bahi, and Navarro (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 and Walton (2018)	655 California residents (online panel)	Contrasting impacts and behaviour (text). Spatial, social Policy frame. Spatial	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*

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Table 4 (*continued*)

Study	Sample	Manipulation	Design	Manipulation check	Additional variables[c]
Hart, Stedman, and McComas (2015)	556 New York property owners (random sample)		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
Johannsen, Lassonde, Wilkerson, and Schaab (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, and Ivarsflaten (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 and 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, $\eta_p^2 = .05^a$, spatial d = .87, $\eta_p^2 = .16^a$.	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 $\eta_p^2 = .16^a$	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, Poortvliet, and Feindt (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 $\eta_p^2 = .06^a$; spatial not measured)	Policy support, ideology*
Rinscheid, Pianta, and Weber (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 and 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 and 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, Rickard, and Yang (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 Policy support, construal level*

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Table 4 (*continued*)

Study	Sample	Manipulation	Design	Manipulation check	Additional variables[c]
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]	
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, Dan, and Dietz (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, Lee, and Macdonald (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 and 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, Klas, Clarke, and Walker (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, Raymond, and Clawson (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, Rickard, Liu, and Boze (2020)	175, 226 Singaporean students (2 convenience samples)	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 1) and Cohen's $d_s = .35$, Hedges $g_s = 0.35$[a] (sample 2)	Risk perception, affective response*, policy support*, PEB intention*, construal level, ideology*, issue salience, environmental 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 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.

(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, another incorporated prior PD beliefs as an additional predictor variable (Singh, 2016). 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.

3.2.2. *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 $d = 0.45$. 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 some presentations of impacts, for example, scaling maps or graphs, may be more effective in encouraging engagement and action. 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.

3.2.3. *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 et al., 2019; Singh, 2016; Zwickle, 2015) or where participants lived versus elsewhere (Hart et al., 2015; Kyselá et al., 2019). No study tested PD towards the policies, and findings regarding policy support were inconsistent (Hart et al., 2015; Kyselá et al., 2019; Zwickle, 2015). 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 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.

3.2.4. *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 4).

3.2.4.1. 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 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.

3.2.4.2. 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). However, differently framed manipulations might change these results, perhaps explaining why studies using past-future comparisons found 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.

3.2.4.3. 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.

3.2.5. 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, not general PD is 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.

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 is an important concept in the perception of climate change, but that it is also complex, with interlinked dimensions and a dynamic understanding of PD depending on contexts. 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 PD, 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, cross-sectional quantitative studies in particular used PD as a stable construct, relating it to other stable characteristics such as values or ecological worldviews (e.g., Chen, 2020), giving support to observations by Brügger (2020). Within classic CLT, PD is seen as a temporary attitude, and easily changeable (Trope & Liberman, 2010). To investigate stable distance beliefs (and how to change them), other approaches may be more suitable (Brügger, 2020). Second, 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, for example, with current impacts thought to be far away, but future impacts thought to be close.

Trying to propose a unifying measure or theory of PD may run into similar issues as those with CLT. 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. CLT could instead be framed as one of several approaches dealing with different aspects of distance, with other theories better explaining other aspects. 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.

We therefore propose that a way forward is to focus initially on building an empirical base to capture the extent and role of distance in specific aspects of climate change. This can be used as a foundation on which to choose or develop suitable theory, aiming to explain the descriptive evidence that has been collected (Eronen & Bringmann, 2021; Scheel et al., 2020). There are two distinctions that can be made to integrate this bottom-up approach with the reviewed evidence, alternative theories and other related variables. First, there is not one psychological distance, but several types of situations where distance plays a role in climate change perceptions, which should be investigated within their own contexts; second, that there may be multiple components to distance beliefs which must be understood in order to understand "perceived distance". Both distinctions will be explored further below.

4.1. Bottom-up research in action: understanding different types of distances by context

Our contention is that a solid, descriptive evidence base is needed from which to be able to choose or build relevant theory. This means that we need to describe what is happening in relation to the distance of climate change before trying to explain it by applying theories such as CLT. It can, however, be difficult to find a starting point for such research. This review has shown that there are many diverse contexts in which PD is applied, many options for measurement, many alternative theoretical approaches suggested and many relevant associated variables to be included. Cross-sectional and especially qualitative studies show that when applied to climate change, PD may be as multifaceted and complex as the issue itself. Degrees of PD vary with different frames and temporal, spatial, social and hypothetical dimensions appear to be intertwined. Consequently, we argue that a suitable and effective way forward is for researchers to investigate specific contexts of distance.

The following shows what we mean by context, and how focusing on contexts instead of a unitary construct might help in drawing together evidence and theoretical background to conduct bottom-up research. Let us say a researcher is interested in the location of climate change impacts. By letting go of PD as a congruent research field and trying to make sense of its inconsistent findings, a researcher could instead draw together research from different areas to describe people's perception of the locality of climate impacts. In developing such a descriptive account, the research could pose questions such as where people believe climate impacts happen, how they feel towards those locations and whether these feelings are associated with climate concern and action. A more descriptive analysis of these components might facilitate the recognition of helpful theoretical ideas. For example, where people believe climate impacts take place might be influenced by their mental models (Bostrom, 2017) of climate change, but also by their sources of climate information (e.g., media, social circle) and their willingness to take in new information (e.g., through Bayesian updating; Cook & Lewandowsky, 2016). How they feel towards those locations might be impacted by the physical distance between the locations and themselves (often used as PD), but also their familiarity with them (Yang et al., 2020), whether they care about them (Objects of Care, Wang, Leviston, Hurlstone, Lawrence, & Walker, 2018), whether they feel similar to and identify with the people in the impacted places (global identity, e.g., Loy, Reese, & Spence, 2021; Social Identity Approach, e.g., Mackay, Schmitt, Lutz, & Mendel, 2021), as well as personal characteristics such as empathy (e.g., Chu & Yang, 2019) or cognitive styles (e.g., holistic and analytical thinking, e.g., Sacchi et al., 2016).

As this review shows, people's feelings toward locations will also depend on the assumed timeframe, which must be specified or measured when investigating the spatial dimension of climate impacts. Another example is in the context of policy, where support could be influenced by several factors, such as the location being addressed and the temporal distance of its benefits (Sparkman et al., 2021), but also by variables such as climate justice and fairness (Bergquist, Nilsson, Harring, & Jagers, 2021). Other, currently less represented contexts, could 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 intended to be an exhaustive list. They are suggestions and there are likely many more fields from which relevant insights can be used, identifiable through a review of the literature in relation to a specific research question. Our main purpose here is to show that by thinking within an applied context instead of limiting our purview to a specific theory or construct, it might be easier to identify the different components that are contributing to these aspects of distance so as to combine relevant knowledge to represent these complex situations.

These insights and components are not necessarily novel. However, we see value in reframing them and future research within applied contexts. The studies discussed in this review deliver valuable insights of relevance to many different contexts and the information tabulated within this review might help researchers judge which studies provide information relevant to the context that they are investigating. Likewise, the analysis of methods and findings can give pointers to the complexity and nuance required in measuring these concepts. Rethinking these contributions in a context-driven way might not only help researchers to better understand and utilise findings, but it might also enable them to see more clearly which constructs add explanatory value, thereby homing in on the variables necessary to describe a certain context.

Finally, adopting a bottom-up, descriptive, applied, context-focused approach might help better determine the causal relationships associated with aspects of distance. A common challenge with interventions in psychology is that they try to manipulate a psychological cause such as PD. Because it is usually not possible accurately to manipulate just one psychological variable without accidently causing other variables to change, it can be problematic to conclude that changes in the dependent variable (such as concern) are to be attributed to the psychological variable (such as PD) (Eronen, 2020). The reviewed literature indicates that this might be problematic within PD manipulations: manipulation checks were often unsuccessful and varied in the level of distance they were measuring, showing that the target variable of a manipulation is not always clearly identified. Alternatively, when non-psychological variables are manipulated (such as the location of climate impacts, or a starting point of policy), effects can be more clearly attributed to these non-psychological differences. Being clear about which applied context is being investigated could help researchers to identify what they are measuring or manipulating, advancing an understanding of what phenomena occur in which contexts, rather than perpetuating the current challenge of manipulating hypothesised psychological causes.

4.2. Components of perceived or psychological distance

In addition to reflecting on contexts of interest, researchers might also benefit from thinking about different components into which PD can be divided. We believe there is value in distinguishing between factual 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, Liberman, Trope, & Algom, 2007), using different language to talk about the same persons (Stephan, Liberman, & Trope, 2010), or testing implicit associations between high-distance words (theirs, stranger) and low-distance words (ours, friend) (Bar-Anan, Liberman, & Trope, 2006). In the context of climate change, it might be helpful to acknowledge that, unlike in the CLT scenarios, there is a factual 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 a factual distance belief. How they then perceive those places and time periods will determine how those factual distances are perceived.

Again, both of these components are not necessarily novel and are investigated within the reviewed studies: 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 factual 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 factual 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.

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 in their application of distance research.

4.4. Limitations and risk of biases

This review aimed to assess and summarise many studies involving the PD of climate change to generate promising research questions for this emerging field. Consequently, there are several issues that this review could not address. 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 our call for more research in the identified areas.

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 PD of climate change. Examples include temporal discounting, values such as self-transcendence (Brosch, Stussi, Desrichard, & Sander, 2018), and tools such as episodic future thinking (Bø & Wolff, 2020; P.-S.; Lee, Sung, Wu, Ho, & Chiou, 2020). These concepts, and lessons learned from their applications, should be considered during the development of future research.

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, which 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 factual beliefs about the location and timing of climate impacts, as well as the perception of those places and time periods. Understanding these different components might 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.

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