‘We Did it in the Past, We Can Do it Again!’: Inducing Collective Transilience in the Face of Climate Change

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Abstract

Climate change is having detrimental impacts on current society, hence there is a pressing urge to adapt to these consequences. Research has proposed that collective transilience, namely people's perceived capacity to persist, adapt flexibly, and positively transform as a community in the face of climate change, is relevant for encouraging collective forms of adaptation to climate change. The aim of this experimental study is to investigate whether collective transilience can be induced. We tested whether past reminders of successful adaptation to climate change have an effect on collective transilience, adaptation intentions (collaborative, collective action and individual), information-seeking behaviour, and well-being. Additionally, we expect that collective transilience mediates the relationship between the manipulation and adaptation intentions, information-seeking, and well-being. To test the hypotheses, we conducted an online experiment (N = 186) with three conditions, where the emphasis on the Dutch capacity to adapt in the past was manipulated (adapt and positively transform, adapt and bounce back, control). Results showed no direct effects of the manipulation on collective transilience, adaptation intentions, information-seeking, and well-being. Exploratory analyses showed that collective transilience predicted higher general well-being and that when using a successful manipulation sample the past reminders, unexpectedly, significantly decreased collaborative adaptation intentions. Yet, collective transilience did not mediate this effect. Thus, we found no support for the assumption that being reminded of past adaptive capacities could aid adaptation efforts in the present. Possible explanations and future research directions are discussed.

Keywords: climate change adaptation, transilience, past reminders, experiment.

‘We Did it in the Past, We Can Do it Again!’: Inducing Collective Transilience in the Face of Climate Change

Climate change is posing irreversible and detrimental effects on current society, such as extreme weather events, droughts and floods (IPCC, 2022). Such effects also pose threats to people’s safety, health, and well-being (Kjellstrom & McMichael, 2013; Liu et al., 2020). Hence, there is a pressing urgency to find ways to adapt to the changing climate (IPCC, 2022; Fedele et al., 2019). Adaptation to climate change is defined as “any adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities” (IPCC, 2014). In general, adaptation measures are taken by governmental institutions, however the success of adaptation measures, plans, and policies at a local level depends on local communities accepting and implementing them (Schweizer et al., 2013). It is important for citizens and communities to implement adaptation measures, since the impacts of climate change will be experienced on this local level (IPCC, 2014; Parry et al., 2017). Thus, collective adaptation is necessary to account for the localised impacts and to be able to reach change on a larger scale (Adger, 2010; Bamberg et al., 2015; Parry et al., 2017).

In this study, we understand collective adaptation as comprising two elements. First, collaborative adaptation refers to working together with other people to implement adaptation measures, e.g., in a community (Reser & Swim, 2011). Examples include establishing and executing plans to make the environment of the community greener or checking up on vulnerable people within the community during a heat wave. Second, collective adaptation can also include political collective action to improve the conditions of the community, such as voting for a green party, signing petitions, or joining a demonstration to ensure adaptation measures will take place (Van Zomeren & Iyer, 2009).

In order to implement such adaptation behaviours, people need to perceive themselves and their community as having the adaptive capacity to do so (Brown & Westway, 2011). Interestingly, a recent paper proposed that people's perceived adaptive capacity in the face of climate change entails more than just the capacity to 'bounce back', avoid harm, and recover what we have, a frequently used concept known as *resilience* (cf. Davoudi et al., 2013; McEvoy et al., 2013). Specifically, the authors propose a novel construct, *transilience*, to capture people's perceived capacity to persist, adapt flexibly, and positively transform in the face of climate change (Lozano Nasi et al., 2022a). Note that the capacity to persist is the component that most closely resembles the concept of resilience, but that transilience incorporates two additional components (Lozano Nasi et al., 2022a).

Collective transilience reflects the extent to which people perceive that 'we as a community' can persist, adapt flexibly, and positively transform in the face of climate change (Lozano Nasi et al., 2022b). Initial research has shown that higher collective transilience increased how likely people are to engage in collective adaptation behaviours, individual adaptation behaviours, and to support climate adaptation policies (Lozano Nasi et al., 2022b). Furthermore, transilience has been found to increase general well-being (Lozano Nasi et al., 2022), presumably through fostering more positive emotions that play a key role in increasing coping resources in the face of negative events (Tugade et al., 2004). Considering the negative impacts of climate change on people's physiological and psychological health (e.g., through stress, anxiety or depression; Kjellstrom & McMichael, 2013; Liu et al., 2020), enhancing and keeping well-being in the face of climate change is crucial. Based on the above, the aim of this study is to investigate whether we can induce collective transilience, which can be extremely

valuable for encouraging adaptation to climate change and keeping well-being in the face of the threats posed by the consequences of climate change.

Collective Transilience in the Face of Climate Change

As mentioned previously, collective transilience entails three components: persistence, adaptability and transformability (Lozano Nasi et al., 2022b). For collective transilience to be high, first, it is key that people perceive that they, as a community, can persist in the negative adversities that climate change poses (persistence). This is relevant because people need to perceive that their community has the resources to cope with climate change risks and can carry on in the face of it. Second, it is crucial that people perceive that they, as a community, have *many* options to adapt to the consequences of climate change (adaptability). This allows people to move more flexibly between options, when necessary, which can enable adaptation in the long term (Linquiti & Vonortas, 2012). Finally, it is key that people perceive that they, as a community, can positively transform by adapting to the consequences of climate change (transformability). This reflects that people perceive they can, besides reducing negative impacts, evolve and exploit benefits by dealing with the consequences of climate change, for instance through innovations and learning new things. Consequently, collective transilience brings a novel perspective to collective adaptation to climate change as it incorporates the aspect of positive transformation and it provides a comprehensive way to assess the collective perceived adaptive capacity in the face of climate change (Lozano Nasi et al., 2022b).

Past Adaptations to Climate Change

One way to foster collective transilience could be to remind people of successful adaptations in the past. Recent research has provided examples of past collective adaptations to changing climates and has proposed that these examples can aid present day adaptation to

climate change (Degroot et al., 2021). Through combining methods of archaeology, geography, history and palaeoclimatology they shed new light on two periods in time where climatic changes were thought to be devastating for society. The case studies showed that communities were able to adapt and sometimes even benefit from these climatic changes. For instance, when temperature fluctuations reduced food availability, introducing agricultural innovations and cultivating different crops helped to avoid famines and promoted higher yields than before (Hutamaa & Helma, 2016; Taavitsainen et al., 1998). Furthermore, shortages in regional products caused by climate change encouraged setting up better trade networks that allowed people to exchange goods, knowledge, and practices (Degroot, 2018; Zappia, 2014). However, the proposition that such past examples can aid present day adaptation (Degroot et al. (2021) needs to be formally tested. Literature has indeed indicated that the past is important for how people perceive themselves, their capabilities and their future (Marschütz et al., 2020; Karniol & Ross, 1996). Therefore, we want to investigate whether reminding people of successful past adaptation to climate changes enables people to feel more capable of doing so now.

Reminders of Past Adaptations for Contemporary Adaptation

Theoretical reasons for the supposed effectiveness of past reminders on adaptation efforts in the present come from narrative studies and psychological literature. First of all, research on citizens' narratives showed that people incorporate historical events and experiences in their interpretation of contemporary climate change (Marschütz et al., 2020). A clear example comes from the Dutch flood prone city of Dordrecht, which is located between rivers, close to the sea, and partly below sea level. Scholars have shown that historical events, such as floods, and the identity of a 'city shaped by water' have influenced the weight citizens attach to climate change related problems (Marschütz et al., 2020). In fact, citizens indicated a strong desire to improve

local resilience through actions they can implement themselves. It appears that people take their past into account to interpret future climate issues, which relates to their intention to adapt. Thus, when provided with reminders about past successful adaptations people could incorporate these in their interpretation of contemporary climate change and their intentions to adapt as well.

Another line of reasoning arises from literature on efficacy, i.e., people's perceived ability as either an individual or a group to successfully perform the behaviours that are necessary to produce a certain outcome (Bandura, 1977; McLoughlin et al., 2021). Importantly, the concept of efficacy resembles the adaptability component of transilience (Lozano Nasi et al., 2022a). Yet, adaptability is about the perception of having multiple options and moving flexibly between those options, whereas efficacy in this context is about the perception of being able to engage in adaptation behaviours (Lozano Nasi et al., 2022a). Hence, collective transilience and efficacy are related, but distinct constructs.

Literature on efficacy can, thus, be a valuable tool in understanding collective transilience and the effectiveness of past reminders. To start with, mastery experiences, which occur when people experience that their behaviour led successfully to the preferred outcomes, are one of the most influential predictors of efficacy (Bandura, 1977). Through interpreting past experiences, people can get to know their own capabilities, which increases feelings of efficacy and encourages people in future behaviour (Bandura, 1977; Lawrence et al., 2014). Indeed, research has shown that feelings of mastery and competency from past flooding experience can increase the perceived efficacy and engagement in adaptation measures (Seebauer & Babcicky, 2020; Tasantab et al., 2022). Secondly, witnessing the experiences and successes of other people can increase one's perceived capability for overcoming similar obstacles as well, known as vicarious learning (Bandura, 1994). Vicarious learning is most likely to occur when the 'model' that

experiences the events is similar, known, or close to oneself (Bandura, 1994; Bubeck et al., 2017). This could entail neighbours, family, friends, or people from the same community or group. To illustrate, flood protective actions from neighbours or family members that experienced floods increased people's perceived efficacy with regards to flood protection as well (Bubeck et al., 2017; Thislethwaite et al., 2018). Taking together the two concepts explained in this paragraph, we propose that people can obtain feelings of mastery by being reminded about societies' past adaptive capacities in the face of climate change, as a matter of vicarious learning.

Fostering Collective Transilience Through Past Successful Adaptations

Historical analyses as well as existing research on narratives and efficacy seem to support the assumption that reminders about successful adaptation in the past can affect how capable people feel about adapting to climate change now. In addition, literature on efficacy messages in the climate adaptation domain can give insight into how these reminders could influence collective transilience. Messages emphasising efficacy (i.e., mentioning that people are able to adapt or work together to adapt) increase feelings of efficacy (Xue et al., 2016; Reynolds et al., 2020), and this can subsequently lead to more adaptation behaviours (Kievik & Gutteling, 2011). More specifically, emphasising efficacy can lead to increased adaptation intentions, through increasing perceived efficacy (Hart & Feldman, 2016; Jugert et al., 2016). Since transilience and efficacy are related, but distinct constructs (Lozano Nasi et al., 2022a), it could be expected that messages emphasising collective transilience, such as reminding people of successful past adaptation and changing for the better, can increase collective transilience as well.

Current Study

Based on the previous reasoning, we want to investigate whether reminders about the capacity to adapt to climate change in the past can foster collective transilience in the face of

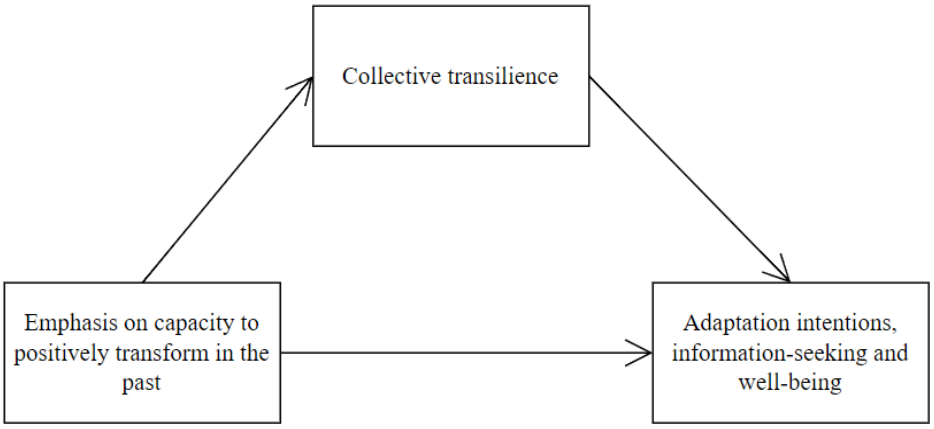
contemporary climate change. This effect has, to the best of our knowledge, not been researched yet. Neither have other studies tried to experimentally induce collective transilience. Therefore, in the present research, we use an experimental design to manipulate past reminders through fake newspaper articles. The articles either emphasise peoples' capacity to positively transform in the face of climate change in the past, emphasise the past capacity to adapt as bouncing back, or have no emphasis on the past capacity to adapt. The emphasis on adaptation as bouncing back serves as an extra control condition, since it is the transformability component in particular that differentiates collective transilience from other constructs. By differentiating in adaptation as bouncing back and positive transformation we can make sure that the effect of the manipulation is due to transformability instead of mentioning that people have been able to adapt to climatic changes in the past.

We hypothesise that emphasising peoples' capacity to positively transform in the face of climate change in the past leads to higher collective transilience, compared to the two control conditions (H1). The bouncing back condition would, nevertheless, lead to higher collective transilience than the control condition. Furthermore, we hypothesise a similar effect for collaborative adaptation intentions, collective action intentions, information-seeking behaviour, and general well-being (H2). Finally, we expect that collective transilience mediates the relationship between the manipulation and collaborative adaptation intentions, collective action intentions, information-seeking behaviour, and general well-being (H3; see Figure 1)[1]. Furthermore, we will exploratively test the effects of the past reminders on individual adaptation intentions.

[1] A preregistration is available via AsPredicted.com (https://aspredicted.org/V51_5Q4).

Figure 1

Proposed Mediation Model.



Method

Participants and Design

The study was an online experiment and participants were recruited online via personal social networks (e.g., WhatsApp, Facebook, LinkedIn and Twitter) and in collaboration with the social networks of Climate Adaptation Services (CAS, n.d. b). Participants lived in the Netherlands and were able to understand Dutch, as the experiment was administered in Dutch. Participation was voluntary and participants did not receive any compensation in return.

In total, 259 participants filled in the survey. Data cleaning[2] resulted in a final sample of N = 186 (for demographic characteristics, see Table 1). The sample had enough power, since an a priori power analysis using G*Power version 3.1.9.7 (Faul et al., 2007) had shown that 159 participants were needed to detect a medium effect (ANOVA with 3 groups: f =.25, α = .05,

[2] First, 72 participants were deleted for failing the attention check (an additional item asking participants to choose option 3) or stopping the survey before the attention check. Second, one participant failed the reading comprehension check, where participants had to indicate in a multiple choice question the main message of the text. Finally, no participants were deleted based on straightlining. In total, 73 participants (29.19%) were deleted, resulting in N = 186.

power = .80). In addition, the required sample size for a mediation model with small-medium effects is $N = 162$ (Fritz & MacKinnon, 2007).

Table 1

Demographic Characteristics for Participants (N = 179)[3].

Characteristic	*n*	%
Gender		
Woman	114	63.68
Man	64	35.75
Other	/	/
Rather not specify	1	0.56
Age[a]		
18-24	64	35.75
25-34	67	37.43
35-44	12	6.70
45-54	21	11.73
55-64	10	5.59
65-74	2	1.12
75>	3	1.68
Living in the Netherlands		
Yes	178	99.44
No	1	0.56
Dutch nationality		
Yes	170	94.97
No	9	5.03
Educational level		
Primary school	/	/
High school	3	1.68
Vocational training	4	2.23
College	35	19.55
University	137	76.54

[a]Age was measured categorically to increase anonymity.

Procedure and Independent Variable

This study was created and conducted with Qualtrics. After giving their informed consent, participants read a text describing climate change risks occurring in the Netherlands (see

[3] $N = 179$ due to 7 participants that did not fill in the demographic questions.

Appendix A). Then, they were randomly assigned to one of three conditions: positive transformation, bouncing back, and control (see Table 2). Participants in the bouncing back and positive transformation conditions were presented with fake newspaper articles that functioned as reminders about adaptation in the past. Participants in the control condition did not receive any additional text.

Table 2

Overview of the Conditions and the Accompanied Materials.

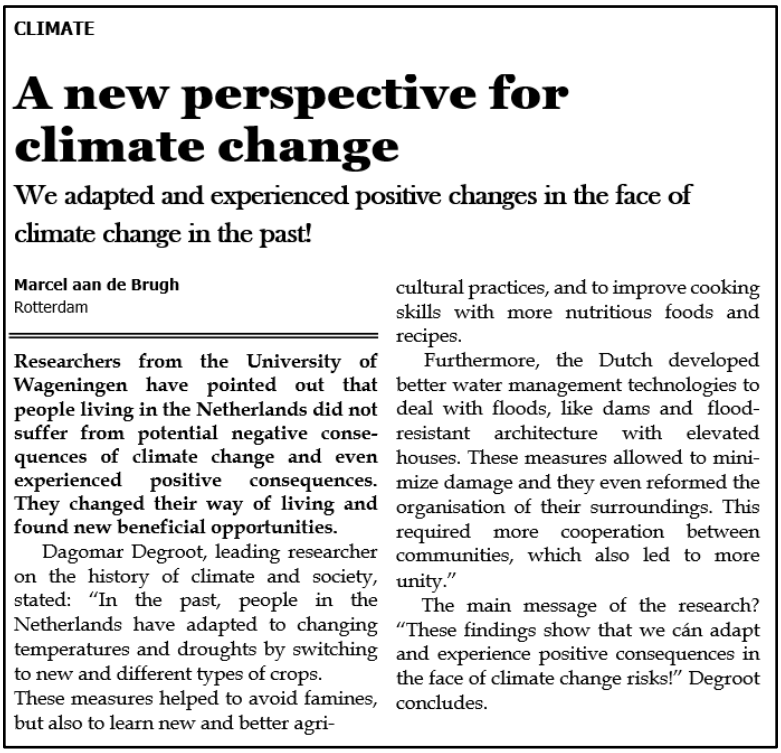
Condition	Positive transformation (n = 58)	Bouncing back (n = 62)	Control (n= 66)
Materials	Description of climate change risks + Article with emphasis on past adaptation as positive transformation	Description of climate change risks + Article with emphasis on past adaptation as bouncing back	Description of climate change risks

The newspaper articles were written about ‘the Dutch’ in order to keep the reference group and audience as similar as possible, which is an important aspect of learning through witnessing the experiences of others (Bandura, 1994; McLoughlin, 2021). As the audience of the study could be anyone in the Netherlands, ‘the Dutch’ was be a shared group that they could all, to a certain extent, identify with. The article in the positive transformation condition emphasised the capacity of the Dutch to adapt in the face of climate change in the past, focussing on adaptation as being able to positively benefit from these adaptations and transforming society (see Figure 2). In the bouncing back condition, participants were presented with an article that emphasised the capacity of the Dutch to adapt in the face of climate change in the past, focussing

on adaptation as minimising harm and bouncing back to preserve what they have. The content of the two articles was kept as similar as possible (see Appendix B).

Figure 2

Material for the Newspaper Article in the Positive Transformation Condition.



CLIMATE

A new perspective for climate change

We adapted and experienced positive changes in the face of climate change in the past!

Marcel aan de Brugh
Rotterdam

Researchers from the University of Wageningen have pointed out that people living in the Netherlands did not suffer from potential negative consequences of climate change and even experienced positive consequences. They changed their way of living and found new beneficial opportunities.

Dagomar Degroot, leading researcher on the history of climate and society, stated: "In the past, people in the Netherlands have adapted to changing temperatures and droughts by switching to new and different types of crops. These measures helped to avoid famines, but also to learn new and better agricultural practices, and to improve cooking skills with more nutritious foods and recipes.

Furthermore, the Dutch developed better water management technologies to deal with floods, like dams and flood-resistant architecture with elevated houses. These measures allowed to minimize damage and they even reformed the organisation of their surroundings. This required more cooperation between communities, which also led to more unity."

The main message of the research? "These findings show that we cán adapt and experience positive consequences in the face of climate change risks!" Degroot concludes.

The presented facts and examples were fictitious, although the main ideas were based on an existing article on the history of climate and society (Degroot et al., 2021). Hence, Dagomar Degroot was presented as the main researcher. To increase credibility, the Dutch University of Wageningen was advanced as a source due to its renowned research position in climate sciences. The newspaper articles were translated from English to Dutch and reviewed by experts in climate change adaptation and transilience.

Once participants had read the text(s), they were asked to answer a series of questions about collective transilience, collaborative and individual adaptation intentions, collective action intentions, general well-being, and demographic characteristics. Lastly, they were provided with the possibility to seek more information about adaptation measures through a website link. The duration of the experiment was around 15 minutes. At the end, a debriefing informed participants that the content of the articles was not real and explained the real purpose of the study.

Measures

All measures were rated on Likert-scales ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) and total scores were calculated as means, unless otherwise indicated.

Collective Transilience

Collective transilience was measured through the Collective Transilience Scale (Lozano Nasi et al., 2022b), which consists of 12 items (4 items per component, see Appendix C), e.g., 'By adapting to this, we, Dutch people, can find new opportunities.'. Participants were asked to consider how they thought that Dutch people are dealing with the confrontation with climate change risks. The items were aggregated to form a reliable scale (α = .88).

Adaptation Intentions

All items assessing the different adaptation intentions (collaborative, collective action and individual) were created for the purpose of this study (see Appendix C). They were based on the categories of adaptation behaviour from Van Valkengoed and Steg (2019a) to encompass all types of adaptation behaviours. Participants were asked to consider, on a 7-point Likert scale (1: *very definitely no* to 7: *very definitely yes*), how likely it is that they would implement specific adaptation measures within the next year.

Collaborative. Collaborative adaptation intentions were measured with 4 items, e.g., 'I intend to… contribute, together with other Dutch people, to a plan for the redevelopment of my neighbourhood/city/village to reduce flood risks.'. The items formed a reliable scale (α = .76).

Collective Action. Collective action intentions were measured with 2 items, e.g., 'I intend to… take political action, e.g., voting for climate parties, to ensure that Dutch society suffers as little as possible from the risks of climate change.'. The reliability was acceptable with a Spearman-Brown coefficient of .70 (Eisenga et al., 2012).

Individual. Individual adaptation intentions were measured with 6 items, e.g., 'I intend to… collect rainwater by disconnecting my drainpipe or by storing it underground to prevent water shortage in dry periods.'. The items were aggregated into a reliable scale (α = .72).

General Well-Being

To measure general well-being, the Satisfaction with Life Scale (SWLS; Diener et al., 1985) was used. Participants were asked to rate 5 items, e.g., 'So far I have gotten the important things I want in life.' (see Appendix C). A sum score of all the items indicated the total score (minimum = 5, neutral = 20, maximum = 35; Diener et al.,1985). Two independent translators translated the scale from English to Dutch and comparisons of both versions established the final translation for the survey. The SWLS showed an acceptable reliability (α = .77).

Information-Seeking Behaviour

Participants were given the opportunity to click on a link to a website about climate change adaptation (Climate Adaptation Services, n.d. a). A description informed participants about what they could find on the website, such as information about adaptation measures. As seeking information is one category of adaptation behaviour (Van Valkengoed & Steg, 2019a), this measure can indicate actual adaptation behaviour. It can be a valuable additional measure,

because people often fail to perform behaviour despite having high intentions to do so, also known as the intention-behaviour gap (Sheeran & Webb, 2016). A dummy variable was created that coded as 1 when participants clicked on the link and 0 when participants did not click.

Manipulation Check

A multiple choice question at the end of the survey asked participants to select one of four options to the question: 'Based on the text that you have just read, which of the answers below is true? Research has shown that…'. Three of four answer options related back to the respective conditions: positive transformation ('we could adapt to climate change and positively change because of it'), bouncing back ('we could adapt to climate change and preserve what we had'), and control ('we are being confronted with climate change'). The fourth option 'we cannot adapt to climate change' was in any case incorrect.

Results

Manipulation Check

First, we checked if the manipulation worked as expected. Frequency tables revealed the number of participants per condition that failed the manipulation check by not indicating the right main message corresponding with the text(s) they had read. In the positive transformation condition 13 out of 56 (23.21%) participants indicated the wrong answer, in the bouncing back condition it was 27 out of 60 (45%) and in the control condition it was 6 out of 63 (9.52%). In total, 46 of 179[4] participants (25.7%) failed the check, despite participants succeeding the reading comprehension check right after the text(s). Due to this high number, exploratory analyses reported below investigated our hypothesis with a successful manipulation sample.

[4] The measures of well-being, information-seeking and the manipulation check have a sample of 179 participants due to seven incomplete survey results.

H1: Emphasising Positive Transformation Leads to Higher Collective Transilience

To test for the effect of the manipulation on collective transilience, a one-way ANOVA[5] was conducted. Results showed no significant difference of collective transilience between the positive transformation, bouncing back or control conditions, as shown in Table 2. In fact, collective transilience was the lowest in the positive transformation condition. Thus, reminding people about past adaptive capacities to positively transform did not increase collective transilience in the present, compared to emphasising past adaptive capacities to bounce back or no emphasis on past adaptive capacity.

H2: Emphasising Positive Transformation Leads to Higher Intentions, Well-Being and More Information-Seeking Behaviour

Three one-way ANOVAs were conducted to investigate the direct effects of the manipulation on collaborative adaptation intentions, collective action intentions, individual adaptation intentions, and general well-being. The results showed no significant difference in the mean scores on all the dependent variables between conditions, as shown in Table 2. Thus, when people are reminded about the Dutch capacity to adapt and positively transform in the past they did not show higher intention to engage in collaborative adaptation behaviours or collective actions, compared to reminders about the Dutch capacity to adapt and bounce back or receiving no reminders at all. Neither did the reminder of positive transformation increase the intention to engage in individual adaptation behaviours, compared to the other conditions. Lastly, the reminders about positive transformation did not increase well-being, compared to the other conditions.

[5] The assumptions for ANOVA were met for all dependent variables in H1 and H2.

Table 2

Means, Sums, Standard Deviations and One-way ANOVA Results.

	Positive transformation (n = 58)		Bouncing back (n = 62)		Control (n = 66)				
	M	*SD*	*M*	*SD*	*M*	*SD*	*F*(2,183)	*p*	n^2
Collective transilience	5.10	0.92	5.35	0.92	5.34	0.70	1.59	.21	.02
Collaborative AI	3.92	1.24	3.80	1.40	4.24	1.21	1.97	.14	.02
Collective action AI	4.64	1.40	4.41	1.76	4.55	1.73	0.29	.75	< .01
Individual AI	4.55	1.03	4.33	1.14	4.38	1.16	0.64	.53	< .01
	S	*SD*	*S*	*SD*	*S*	*SD*	*F*(2,176)		
Well-being	26.13	4.41	26.75	3.95	26.25	4.40	0.33	.72	< .01

Note. AI = adaptation intentions.

Since information-seeking behaviour was measured as a binary variable, a Pearson's chi-square test of independence[6] was used to test for the differences between the experimental conditions on information-seeking. Sample sizes of both categories were skewed, with 'clicked' (n = 17) and 'not clicked' (n = 162), and the results showed no significant association between the different experimental conditions and information seeking, $X^2(2) = .85$, $p = .66$. Thus, emphasising the capacity to positively transform in the past did not make it more likely for people to seek out online information about adaptation behaviour than reading about the adaptive capacity to bounce back or no such emphasis.

Exploratory Analyses with Successful Manipulation Sample

Exploratory one-way ANOVAs only included participants that succeeded the manipulation check (N = 133) to investigate differences between these and the original results. The exploratory results are shown in Table 3 and reveal no changes in significance for collective transilience, collective action intentions, individual adaptation intentions, and well-being.

[6] The assumptions were met and all expected cell frequencies were greater than five. Hence, the sample size was adequate to run the analyses.

However, the results of collaborative adaptation intentions do change to a significant difference of mean scores between the positive transformation, bouncing back, and control conditions. Planned contrasts further revealed that participants in the control condition had higher collaborative adaptation intention scores (M = 4.31, SD = 1.19) than participants in the bouncing back and positive transformation conditions, $t(130) = -2.74$, $p = .007$, Cohen's $d = -.96$. Furthermore, there was no significant difference in collaborative adaptation intention scores between the bounce back (M = 3.64, SD = 1.33) and positive transformation conditions (M = 3.79, SD = 1.19), $t(130) = .51$, $p = .61$, Cohen's $d = .12$. Thus, being reminded of the Dutch adaptive capacity to positively transform or bounce back in the face of climate change lowered participants' intentions to engage in collaborative adaptation behaviours, in comparison to when they read about the risks of climate change in the Netherlands.

Table 3

Means, Sums, Standard Deviations and One-way ANOVA Results for the Successful Manipulation Sample.

	Positive transformation (n = 43)		Bouncing back (n = 33)		Control (n = 57)				
	M	*SD*	*M*	*SD*	*M*	*SD*	*F*(2,130)	*p*	n^2
Collective transilience	5.12	0.89	5.36	0.88	5.30	0.70	0.94	.39	.01
Collaborative AI	3.79	1.19	3.64	1.33	4.31	1.19	3.79	.03*	.06
Collective action AI	4.55	1.39	4.67	1.71	4.71	1.52	0.14	.87	< .01
Individual AI	4.49	1.03	4.32	1.07	4.5	1.01	0.37	.69	.01
	S	*SD*	*S*	*SD*	*S*	*SD*	*F*(2,130)		
Well-being	26.44	4.69	25.61	4.43	25.86	4.39	0.36	.70	.01

Note. AI = adaptation intentions. * $p < .05$

Although the effect of the manipulation on collaborative adaptation intentions was not in the hypothesised direction, we explored if the relationship between the conditions and collaborative adaptation intentions was mediated by collective transilience. Therefore, a simple mediation analysis using the PROCESS macro version 4.1 (Hayes, 2022) was conducted with a 95% confidence interval and 5000 bootstrap samples. As 'condition' is a categorical variable, PROCESS was instructed to create sequential dummy variables where the control condition was compared to the bouncing back condition (X1) and the bouncing back condition was compared to the positive transformation condition (X2). The mediation analysis showed a significant total effect of X1 on collaborative adaptation intentions, while X2 was non-significant (see Table 4). In line with the ANOVA results, this means that the collaborative adaptation intentions were significantly lower in the control condition, compared to the bouncing back condition. Simultaneously, there was no difference in intentions between the bouncing back and positive transformation conditions. The same pattern was found for the direct effects of X1 and X2 on collaborative adaptation intentions (see Figure 3). This means that even when controlling for collective transilience there still is a significant difference in collaborative adaptation intentions when comparing the control to the bouncing back condition. Finally, the indirect effects of condition on collaborative adaptation intentions through collective transilience were not significant[7] for X1 (b = .01, SE = .05, 95% CI [-.05, .16]) as well as X2 (b = -.05, SE = .07, 95% CI [-.25, .02]). Collective transilience did, thus, not mediate the relationship between the conditions and collaborative adaptation intentions. More specifically, the control condition did not lead to more collaborative adaptation intentions through collective transilience, compared to the bouncing back and positive transformation conditions.

[7] A significant indirect effect would be determined by the absence of zero in the confidence intervals. Both indirect effects in this study include zero.

Table 4

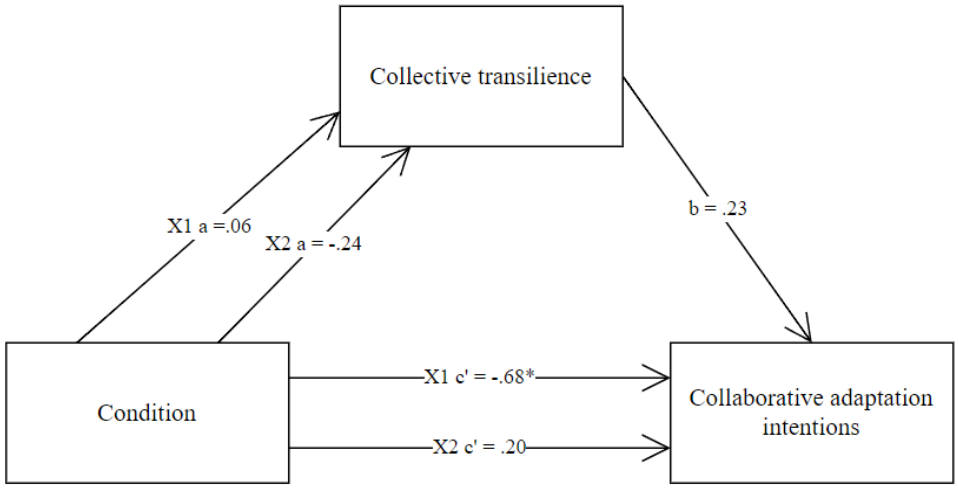
Mediation Estimates of Condition and Mediator Collective Transilience on Collaborative Adaptation Intentions.

		95% CI				
	b	Lower	Upper	*df*	*t*	*p*
Path a						
X1	.06	-.29	.41	130	.35	.73
X2	-.24	-.61	.13	130	-1.27	.21
Path b	.23	-.03	.49	129	1.72	.09
Direct effect						
X1	-.68	-1.20	-.15	129	-2.54	.01*
X2	.20	-.36	.76	129	.71	.48
Total effect						
X1	-.66	-1.19	-.13	130	-2.47	.01*
X2	.15	-.41	.71	130	.52	.61

Note. * $p < .05$

Figure 3

Mediation Model.



Note. c' = direct effect. * $p < .05$

Lastly, an exploratory chi-square test of independence[8] for the successful manipulation sample showed no change in significance compared to the full sample with regards to the association between the conditions and information-seeking behaviour, $X^2(1) = 1.29$, $p = .26$. Emphasising the capacity to positively transform or bounce back did not increase participants' tendency to click on a link to an adaptation website, compared to the control condition.

Collective Transilience as Predictor

The results of the main analyses did not reveal a significant mean difference between experimental conditions and all dependent variables (collective transilience, collaborative adaptation intentions, collective action intentions, individual adaptation intentions, well-being and information-seeking. Therefore, additional exploratory analyses were conducted to test if we could find similar predictive effects of collective transilience as previous research on transilience has found (Lozano Nasi et al., 2022a; Lozano Nasi et al., 2022b). Linear regression analyses[9] assessed whether collective transilience predicts collaborative adaptation intentions, collective action intentions, individual adaptation intentions and well-being. Furthermore, a binary logistic regression assessed if collective transilience predicts information-seeking behaviour.

Adaptation Intentions

The simple linear regressions showed that collective transilience did not explain a significant amount of variance in collaborative adaptation intentions ($F(1,184) = 1.03$, $p = .31$, $R^2 = .01$), collective action intentions ($F(1,184) = 0.29$, $p = .59$, $R^2 = .002$) and individual adaptation intentions ($F(1,184) = 1.12$, $p = .29$, $R^2 = .01$). Thus, the more people perceive that they, Dutch people, are able to persist, adapt flexibly and positively transform in the face of climate change,

[8] The assumption that all expected cell frequencies were greater than five was not met. Hence, the bouncing back and positive transformation conditions were collapsed into one group.
[9] The assumptions were met for all analyses.

did not predict the extent to which people intended to engage in collaborative, collective action or individual adaptation behaviours.

General Well-Being

The linear regression model where well-being was regressed on collective transilience scores revealed a positive effect of collective transilience, $F(1,177) = 5.52$, $p = .02$, $R^2 = .03$. The regression coefficient (Beta = .17, $B = .90$, $SE = .38$, 95% CI [0.14, 1.66]) showed that higher collective transilience corresponds with higher general well-being. Thus, the more people perceive that they, Dutch people, are able to persist, adapt flexibly and positively transform in the face of climate change, the more satisfied they are with their lives.

Information-Seeking Behaviour

The binary logistic regression[10] results showed that the model was not significant (χ^2 (1) = .26, $p = .61$), meaning that collective transilience did not explain a significant amount of the variance in information-seeking behaviour. Thus, higher collective transilience did not predict the likelihood that participants clicked on the link to the adaptation website.

Discussion

In this study, we investigated the effect of reminding people of successful adaptations to climate change in the past on collective transilience and on adaptation intentions (collaborative, collective action and individual), information-seeking behaviour, and general well-being. Specifically, we used an experiment where emphasising the Dutch capacity to adapt and positively transform in the face of climate change in the past (positive transformation condition) was compared to emphasising the Dutch past capacity to adapt and bounce back in the face of

[10] The absence of outliers assumption was violated and results should be interpreted with care. The model identified participants that had clicked on the link as outliers, presumably due to skewed sample sizes of both categories ('clicked' $n = 17$, 'not clicked' $n = 162$). However, these participants are important for this research and were not excluded.

climate change (bouncing back control condition), and to the absence of any of such emphasis (control condition). We hypothesised that emphasising the capacity to positively transform in the past would lead to higher collective transilience, compared to the control conditions. In addition, we expected that emphasising the capacity to positively transform in the past would lead to higher collaborative adaptation intentions, collective action intentions, individual adaptation intentions, general well-being, and more information-seeking behaviour. Lastly, we hypothesised that the effects of the manipulation on adaptation intentions (collaborative, collective action and individual), information-seeking behaviour, and general well-being were mediated by collective transilience.

First of all, the results of the main analyses could not support H1 and showed that reminders of positive transformation did not lead to enhanced collective transilience, compared to reminders of bouncing back and no reminders. Second, this study could not support H2 either, as the results did not show that the positive transformation condition led to higher intentions to engage in collaborative adaptation, collective action, and individual adaptation. Neither did emphasising positive transformation lead to more information seeking or higher general well-being, compared to the control conditions. Third, due to the absence of evidence for H1 and H2, the hypothesised mediation effect could not be tested. Instead, exploratory analyses using the successful manipulation sample showed a significant change in the effect of the manipulation on collaborative adaptation intentions, yet this was not in the expected direction. Collaborative adaptation intentions were lower, instead of higher, in the positive transformation and bouncing back condition. Further mediation analyses showed no significant indirect effect and we cannot conclude that collective transilience mediates the relationship between the manipulation and collaborative adaptation intentions. In conclusion, this study cannot provide evidence for the

proposition that reminding people of the Dutch capacity to adapt and positively transform can induce their perceived capacity to persist, adapt flexibly and change for the better in the face of climate change. Neither can we conclude that this leads to more adaptation intentions, information-seeking, or higher general well-being.

Interestingly, the mean scores of collective transilience over the three conditions were relatively high, yet they were the lowest in the positive transformation condition. This was the case for both the full sample as well as the exploratory successful manipulation sample. Although the differences in collective transilience were minimal between conditions, it is possible that participants interpreted the examples presented in the positive transformation condition as less achievable for them or as a community. The examples included agricultural innovations, building dams, and flood-resistant architecture. In contrast, the bouncing back examples referred to storing food or ringing church bells as a warning system for floods. Participants may have felt that the positive transformation examples were better suited for governmental organisations or science.

Furthermore, an explanation for the absence of a manipulation effect could be that using the reference group of 'Dutch people in the past' might not be as effective for vicarious learning as was presumed. We had reasoned that the reminders of past adaptations could function as a form of vicarious learning, i.e., that 'witnessing' examples of past successful adaptations would increase the perceived capacity for adapting to contemporary climate change through experiencing a feeling of mastery. This could create a feeling of "We were able to adapt in the past, we can do it again!". Indeed, watching other people overcoming similar obstacles can increase people's perceived capacity to overcome such obstacles as well (Bandura, 1994; Bubeck et al., 2017). However, vicarious learning is most likely to occur when the 'model' that

experiences the events is similar, known, or close to oneself (Bandura, 1994; Bubeck et al., 2017). Since Degroot et al. (2021) found past adaptation examples at a society level and the audience for this experiment could be living anywhere in the Netherlands, 'Dutch people' were chosen as the necessary shared group for all participants (McLoughlin, 2021). 'Dutch people in the past' are unfortunately not known to people in the present. Therefore, the reference group could have been too far from participants to function as a model for vicarious learning. Further research could test different ways to foster collective transilience through vicarious learning by using reference groups that are closer or known to participants.

In addition, it is possible that the format chosen for the manipulation (i.e., a fake newspaper article) was not engaging enough. Research shows that informational strategies that include images or use video material tend to capture more attention (Chen & Thomas, 2020; Guo et al., 2020). In fact, the results from the manipulation check suggest that many participants had not retained the main message of their text(s) until the end of the survey, despite all succeeding the reading comprehension check straight after the text(s). This was especially the case in the adaptation and positive transformation conditions, suggesting that a more engaging message may be necessary for participants to remember the message more clearly. In this study, we used a newspaper article to increase credibility of the presented information. Further research could attempt to make the manipulation more engaging by adding a picture or graphic (Guo et al., 2020), or by explaining it in a documentary or video lecture (Chen & Thomas, 2020). Moreover, our sample turned out to be quite young. Young people, generally, get their news information from (social) online media instead of a newspaper, hence further research could experiment with social media posts or online articles to better suit the audience.

Another explanation for the absence of an effect of past reminders is that there was no completely neutral control condition. Every condition in this study received the climate change risk text, which was meant to spark a sense of urgency. In fact, risk perception is a well-known predictor of adaptation behaviour, where higher perceived risk is related to more adaptation behaviours (Van Valkengoed & Steg, 2019b). It is, however, the combination of the risk appeal (climate change risk text) with a more positive appeal regarding capability (newspaper articles) that creates the most effective climate messages (McLoughlin, 2021). We reasoned that receiving the combination of the risk text and newspaper articles would, therefore, be more effective than receiving the risk text alone. Nevertheless, the additional effect of the past reminders may have been too weak, compared to the risk text, to lead to more collective transilience, adaptation intentions, information-seeking behaviour, or well-being.

In a similar vein, the unexpected pattern for the effect of the manipulation on collaborative adaptation intentions could be explained by the past reminders leaving people with a too positive perspective on adaptation to climate change. Research on mental contrasting shows that in order for people to engage in active goal pursuit they need to mentally contrast the desired future with the reality, and thereby identify the obstacles that the reality poses (Oettingen, 2012). When obstacles are not identified, the desired future becomes a positive fantasy that results in less effort and performance (Oettingen & Mayer, 2002). Indeed, desired behaviour needs to be made as concrete as possible, including the steps necessary to reach it (Evans & Hardy, 2002). Although the past reminders were meant to give participants a feeling of high expectancy to reach adaptation to climate change, they did not present participants with information about obstacles nor how to overcome them. Thus, they may have left participants feeling too positive (e.g., eliciting a false sense of safety) that made them less inclined to collaboratively adapt to

climate change, compared to the control condition where increased risk perception presumably led to higher intentions.

It can be interesting for research to look into the effects of mental contrasting regarding climate change by using future-focused messages, since the desired outcome for our future would be to adapt (and positively transform) to climate change. Recent research in the mitigation domain suggested that the possibility to imagine a positive sustainable future is related to people's willingness to engage in pro-environmental action (Wright et al., 2021). Hence, future-focussed messages may also help people to believe that a future where we have adapted and positively transformed in the face of climate change is highly achievable. Mentally contrasting this future with the present and identifying the obstacles on the way (Oettingen, 2012), may induce more collective transilience, adaptation behaviour or well-being than the past reminders.

Collective Transilience as a Predictor

Given that we could not find support for the main hypotheses, we used exploratory analyses to assess the predictive ability of collective transilience. However, we could not show that higher collective transilience leads to with higher adaptation intentions (collaborative, collective action, or individual) or more information-seeking behaviour. This was in contrast with some of the findings from previous research (Lozano Nasi et al., 2022b). Remarkably, we did find that higher collective transilience leads to higher general well-being. This suggests that when people perceive that ‘we, as a community, are able to persist, adapt flexibly, and positively transform in the face of climate change’, they can be more satisfied with their lives. Previous research only focussed on (individual) transilience and general well-being (Lozano Nasi et al., 2022a). Hence, the relation with collective transilience is a novel finding that adds to the importance of transilience in enhancing well-being in the face of climate change. The

consequences of climate change on society as we know it are challenging us to not succumb to the adversities. The relationship between transilience and well-being can be promising for establishing a future where people and communities feel good about their situation and prospects with climate change.

Methodological differences with Lozano Nasi et al. (2022b) could account for the absence of an effect on adaptation intentions in this study, as the reference groups in the collective transilience and adaptation intention scales were different for both studies. Lozano Nasi et al. (2022b) assessed collective transilience at the local community level (i.e., we, people of this neighbourhood), while we used a reference group of a more national community level (i.e., 'we, Dutch people'). The same reference groups were used in the adaptation intentions scales, where both studies measured the adaptation behaviours at a local community level (neighbourhood, village, city). However, it is possible that the reference group of 'Dutch people' was not as meaningful for participants when it comes to adaptation behaviours, as those generally take place in the neighbourhood, community, or around their homes. 'Dutch people' may, therefore, be less realistic compared to a reference group at a local community level. Thus, it is reasonable that the differences between both studies' measures account for the variable effects, highlighting the importance of ensuring that the reference group and the applicability of the measures are close to the participants' experience (Bandura, 1994; Bubeck et al., 2017).

Furthermore, the demographic composition of our sample was not representative of the population in the Netherlands. In fact, 64% of the participants were female, 73% were younger than 35 and 76% had a university education. In addition, a larger sample size is needed to better estimate the effects in the population and increase power (Asiamah et al., 2017; Field, 2017), especially considering that the effect sizes of this study were small instead of the predicted

medium effects. Further research should aim for a larger and more representative sample in order to draw more reliable and generalisable conclusions.

Implications for Science and Practice

Lozano Nasi et al. (2022b) were the first to attempt to capture the perception that we, as a community, can persist, adapt flexibly and positively transform in the face of climate change. However, the contradicting findings between this study and Lozano Nasi et al. (2022b) show that more research is needed to establish a full understanding of collective transilience, how to measure it and how to induce it. Regarding measuring collective transilience, the current study showed that choosing the right reference group is an important factor in administering the Collective Transilience Scale (Lozano Nasi et al., 2022b). The introduction of the scale asks participants to consider how they think people in the reference group are dealing with the confrontation with climate change risks. This is meant to reflect how they, as part of that reference group, think about their communities' collective transilience. However, these considerations might be difficult for participants, especially when they have to make assumptions about broad reference groups. A smaller reference group can make it easier for participants to rate the items, since there is more chance that they either belong to that group, know group members or that the group consists of people similar to themselves. The collective transilience scale can, thus, be sensitive to different circumstances regarding audiences and reference groups, which complicates administering the scale. Therefore, more knowledge on the optimal circumstances is crucial to be able to use the scale in a reliable manner.

The present study is, to the best of our knowledge, the first to attempt to foster collective transilience and to do so by reminding people of the capacity of the Dutch to adapt and positively transform in the past. Although we did not find support for our hypotheses, this area of research

still constitutes a compelling arena for future studies. Collective transilience is a promising construct in understanding people's perception about climate change and their motivation to adapt to it. Knowledge on inducing collective transilience can aid policy makers to motivate citizens and communities to implement adaptation measures through, for instance, communication methods, campaigns, or interventions. Furthermore, fostering collective transilience can possibly increase acceptance of governmental adaptation policies as well, which could ensure adaptation on a both local and larger scale. Finally, knowledge on collective transilience and how to induce it can be used to help people to cope with the adversities that climate change poses, as it is crucial that people feel good about their lives and prospects in the face of climate change.

Conclusion

This study has not been able to provide support for our hypotheses and show that emphasising the capacity to adapt and positively transform can increase adaptation intentions, information-seeking behaviour, or general well-being through enhancing collective transilience. However, collective transilience is a new construct that has been shown to predict behaviours in previous research (Lozano Nasi et al., 2022a; Lozano Nasi et al., 2022b) and that seems promising in fostering general well-being. It can be an important construct for both science and practice, hence more research is necessary to understand how we can promote the perception that we, as a community, can persist, adapt flexibly, and positively transform in the face of climate change.

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Appendix A

Climate Change Risk Text

In the Netherlands, consequences of climate change are already visible today. In 2018 and 2020, increasing temperatures and droughts in summers lead to water scarcity. People were urged to not water their garden or fill pools and take shorter showers. Also, farmers suffered a failed harvest that influenced food availability in supermarkets. Moreover, the increased frequency of floods and extreme weather events have caused financial and material damage, stress and risks of injuries or even death. For example, the floods in Limburg and Noord-Brabant in July 2021 led to €600 million of damage and people needed to evacuate their homes.

Extreme events like these are expected to happen more frequently in the future and impact households and communities in the Netherlands. Therefore, it is important that people and communities protect themselves to reduce the impact of the inevitable consequences of climate change.

Appendix B

Newspaper Articles

Condition 2: Past Adaptation as Bouncing Back

CLIMATE

A new perspective for climate change

We adapted in the face of climate change in the past!

Marcel aan de Brugh
Rotterdam

Researchers from the University of Wageningen have pointed out that people living in the Netherlands did not suffer from potential negative consequences of climate change. They minimised the damage and preserved their way of living.

Dagomar Degroot, leading researcher on the history of climate and society, stated: "In the past, people in the Netherlands have adapted to changing temperatures and droughts by storing food and keeping it safe. These measures helped to avoid famines.

Furthermore, the Dutch used warning systems to deal with floods, like church bells, to warn citizens to evacuate. These measures allowed them to minimize damage, and to rebuild cities afterwards."

The main message of the research? "These findings show we cán adapt, minimize harm and preserve what we have in the face of climate change risks!" Degroot concludes.

Condition 3: Past Adaptation as Transformation

CLIMATE

A new perspective for climate change

We adapted and experienced positive changes in the face of climate change in the past!

Marcel aan de Brugh
Rotterdam

Researchers from the University of Wageningen have pointed out that people living in the Netherlands did not suffer from potential negative consequences of climate change and even experienced positive consequences. They changed their way of living and found new beneficial opportunities.

Dagomar Degroot, leading researcher on the history of climate and society, stated: "In the past, people in the Netherlands have adapted to changing temperatures and droughts by switching to new and different types of crops.
These measures helped to avoid famines, but also to learn new and better agricultural practices, and to improve cooking skills with more nutritious foods and recipes.

Furthermore, the Dutch developed better water management technologies to deal with floods, like dams and flood-resistant architecture with elevated houses. These measures allowed to minimize damage and they even reformed the organisation of their surroundings. This required more cooperation between communities, which also led to more unity."

The main message of the research? "These findings show that we cán adapt and experience positive consequences in the face of climate change risks!" Degroot concludes.

Appendix C

Measures Overview

Measure	Items and introduction
Collective transilience (Lozano Nasi et al., 2022b)	The following questions are about how you, as a Dutch person, think the Dutch in general deal with the confrontation of the risks of climate change. Specifically, we would like to ask you to think about how the Dutch deal with the risks of flooding, heat waves and other extreme weather conditions in the Netherlands. 1. We, Dutch people, can be brave. 2. We, Dutch people, can be persistent. 3. We, Dutch people, can stay determined. 4. We, Dutch people, can remain strong willed. 5. I think that we, Dutch people, can take different actions to deal with it. 6. I think that we, Dutch people, have several options to deal with it. 7. I believe that we, Dutch people, can find multiple means to deal with it. 8. There are different ways in which we, Dutch people, can cope with it. 9. Coping with the stress caused by it can strengthen us, Dutch people. 10. There can be additional advantages for us, Dutch people, in dealing with it. 11. Dealing with it can make us, Dutch people, grow as a group. 12. We, Dutch people, can learn something good from dealing with it.
Adaptation intentions Collaborative	I intend to … 1. …set up a plan or cooperate together with my neighbourhood/city/village to make our environment greener in order to prevent heat and flooding. 2. …contribute, together with other Dutch people, to a plan for the redevelopment of my neighbourhood/city/village to reduce flood risks. 3. …keep an eye on vulnerable local residents, such as the elderly, to know that they are safe and feeling well during periods of drought or other danger. 4. …to ensure that, together with the neighbourhood/village/city, measures and plans are in place to make evacuation as smooth as possible.

	Collective action	5. …take political action, e.g., voting for climate parties, to ensure that Dutch society suffers as little as possible from the risks of climate change.
		6. …take collective action, e.g., via petitions or demonstrations, to ensure that more attention is paid to climate adaptation.
	Individual	7. …seek for more information about how I can adapt to climate change.
		8. …make my house, garden or balcony more green to prevent heat and flooding, e.g., by removing tiles or constructing a facade garden.
		9. …collect rainwater by disconnecting my drainpipe or store it underground to prevent water shortage in dry periods.
		10. …reduce my water usage in times of drought.
		11. …get insurance for damage to my house or contents caused by floods or extreme weather.
		12. …draw up a migration or evacuation plan, in case flooding or drought makes it too dangerous to continue living in my house and its surroundings.
Satisfaction with Life Scale (Diener et al., 1985)		1. In most ways my life is close to my ideal.
		2. The conditions of my life are excellent.
		3. I am satisfied with my life.
		4. So far I have gotten the important things I want in life.
		5. If I could live my life over, I would change almost nothing.

Note. All measures were administered in Dutch. The SWLS and Collective Transilience Scale were also available in English, hence only the adaptation intention measure was translated to English for the purpose of this report.