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Not all boomers: temporal orientation explains inter- and intra-cultural variability in the link between age and climate engagement

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Abstract
Some previous work suggests that older adults, relative to younger adults and teenagers, are less engaged with climate change; yet, this pattern is not consistently found across all countries or populations. Here, we consider whether temporal orientation might act as a boundary condition for age effects on climate change engagement. We assess whether cultural (study 1) and inter-individual (study 2) differences in temporal orientation moderate the tendency for older adults to be less engaged with climate change than younger adults. Study 1 ($N = 44{,}387$) reveals that among European countries, countries with a greater long-term orientation tend to show a weaker (i.e., less negative) relationship between age and the salience of climate change (i.e., cognitive engagement with the topic). Study 2 ($N = 798$) demonstrates that in the USA, the negative relationship between age and climate action intentions becomes smaller in magnitude (i.e., less negative) among those higher in consideration of future consequences, but increases in those higher in consideration of immediate consequences. These findings support the notion that it is a confluence of age and present orientation (and low future orientation) that that drives age-related declines in climate engagement.

Keywords Climate change engagement · Temporal orientation · Consideration of future consequences · Socioemotional selectivity theory · Age

A society grows great when old [er adults] plant trees whose shade they know they shall never sit in. – Greek proverb

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In 2019, the meme "OK Boomer" was popularized among teenagers and young adults to express frustration about their perception that older adults (i.e., from the Baby Boomer generation), who hold disproportionate power and wealth relative to younger generations (New America 2019), are out of touch with the realities of the modern world and are not adequately engaged with solving major societal issues, such as climate change. Public opinion data suggests a kernel of truth in this stereotype: at least in the USA, age is associated with reduced climate change concern and engagement (Hamilton 2011; McCright 2010; Reinhart 2018). One possible explanation for this relationship could be that older adults do not believe that they will be personally affected by the issue. Indeed, previous work suggests that older adults (relative to younger adults) are less likely to perceive that the issue will pose a serious threat in their lifetimes (Reinhart 2018). Thus, on average, older adults might be more likely to prioritize issues perceived to affect them in the present instead of seemingly less pressing issues such as climate change that might appear to have fewer implications for their personal lives (Hurlstone et al. 2020). Here, we suggest a different possibility — that the age gap, rather than being driven by all older adults, is moderated by *temporal orientation*,[1] which is the extent to which a person directs their thoughts toward, and chooses actions based on, immediate or future concerns (Lee at al. 2017; Maglio and Trope 2019).

The extent to which people integrate future concerns into present decision-making can vary across both individuals and cultures. For example, although there is a negative relationship between age and climate change concern in the USA (Reinhart 2018), there are many notable counterexamples of older American adults who prioritize taking action on climate change. Many environmental activist groups considered 78-year-old Senator Bernie Sanders to have the strongest climate action platform of any of the 20+ major candidates in the 2020 US Democratic presidential primary (e.g., Herndon 2020). Similarly, many other prominent voices in the environmental movement are middle-aged or older, including former politician Al Gore (age 73 in 2021), 350.org founder Bill McKibben (age 60 in 2021), and billionaire activist Tom Steyer (age 64 in 2021). There is also cross-cultural variation in the relation between age and climate engagement: the negative relationship between age and climate engagement is reduced or even reversed in some regions (e.g., Eastern Europe; Poortinga et al. 2019).

This manuscript uses temporal orientation to extend past work on age and climate engagement. Specifically, we predict that age interacts with the extent to which a person focuses on the present or future (i.e., temporal orientation) to influence engagement with climate change. This proposed relationship is derived in part from *socioemotional selectivity theory*, which suggests that older (vs. younger) adults are more likely to consciously tune out negative information unless that information is emotionally meaningful to them (Carstensen et al. 1999). Thus, because future-oriented (vs. present-oriented) older adults tend to ascribe greater meaning to future-oriented concerns such as climate change, we propose that they are more likely to engage deeply with climate change. Below, we explore this notion in greater detail.

[1] Here, we use the temporal orientation broadly to encompass a host of related constructs. Some constructs focus on the distinction between an individual's concern with the immediate versus future consequences of their actions (Joireman et al. 2008), while other conceptualizations focus on the distinction between a society's emphasis on honoring tradition and achieving success in the present versus emphasizing the persistence needed for long-term success (Hofstede 2011). For simplicity, we use the broader term temporal orientation to include the variety of ways in which an individual or society's thought can be oriented toward the present or the future.

1 Temporal orientation, age, and climate engagement

Most previous work suggests that older (vs. younger) adults report lower concern about environmental issues (Van Liere and Dunlap 1980; Wiernik et al. 2013), particularly regarding global environmental issues with abstract, diffuse impacts perceived as not directly relevant to their personal lives, such as climate change (Jianguang 1993; McCright 2010; Poortinga et al. 2011, 2019). Here, we argue that the relationship between age and climate change engagement cannot be fully understood without considering individuals' relationship to the future (i.e., temporal orientation). Temporal orientation refers to the tendency to focus the mind toward immediate and concrete concerns, on the one hand, versus future and abstract concerns, on the other (Maglio and Trope 2019). Those focused more toward the present (and less toward the future) spend greater time considering present outcomes (rather than future outcomes), and tend to engage in greater temporal discounting of future outcomes, preferring smaller rewards in the present to larger rewards in the future (Green et al. 1996; Löckenhoff et al. 2011).

Because environmental issues are viewed by most as pressing concerns about the future (but somewhat less so in the present; Miniard et al. 2020) and environmental considerations feature prominently in many individuals' visions of the future (Kantenbacher et al. 2021), it is perhaps unsurprising that those with greater future time orientation are more environmentally engaged (see Milfont et al. 2012 for a meta-analysis). Individuals' tendency to engage in temporal discounting (related to present time orientation, see above) predicts reduced climate action (Jacquet et al. 2013). Furthermore, experimentally priming individuals to consider the future (e.g., asking participants to consider their desired legacy, or making future events feel closer) leads to more future-oriented decisions in an environmental game (Hurlstone et al. 2020), greater donations to environmental causes (Zaval et al. 2015), and greater subsequent (self-reported) engagement in everyday pro-environmental behaviors (Soliman et al. 2018). Leaving a legacy can help individuals cope with concerns of their own mortality, as legacies provide a way to continue to be meaningful even after death—a concern that may be particularly acute for older individuals. These concerns can have an important, positive impact on society, as the desire to leave a legacy can motivate individuals to engage in altruistic behavior that benefits future generations (Fox et al. 2010; Wade-Benzoni 2006).

In short, having a long-term temporal orientation appears to make future outcomes seem more relevant and meaningful. Temporal orientation is not just an individual trait, however. It can also vary across cultures, as some cultures place more emphasis on the present and immediate gratification (e.g., the US), whereas other cultures place more emphasis on the future and leaving a legacy for future generations (e.g., Germany; many East Asian countries; Hofstede 2011).

2 Aging effects on climate engagement

Temporal orientation may influence climate change attitudes because it can affect the extent to which future events or issues feel meaningful. The meaningfulness of issues is particularly relevant for older adults because they tend to avoid negative information if it is not perceived to be emotionally meaningful for them. *Socioemotional selectivity theory* (Carstensen et al. 1999) posits that as individuals age, and thereby perceive that they have less time left to live, they tend to increasingly prioritize deriving emotional meaning and well-being, rather than expanding their horizons or acquiring knowledge. This tendency, on average, leads older

individuals to consciously avoid seemingly unnecessary emotional discomfort by attuning less to abstract future threats that are seemingly unlikely to affect them during their lifetime. Instead, the theory argues that with age, most tend to increasingly narrow their focus to goals that are emotionally meaningful to them, such as maintaining positive social relationships with loved ones. Consistent with this theory, older adults, relative to younger adults, report lower levels of negative emotions, anxiety, and depression (Lawton et al. 1993), and show better memory for positive stimuli than negative stimuli in laboratory settings (the *positivity effect*; Charles et al. 2003). These findings may reflect Charles et al.' (2003) observation that when asking older adults how they regulate their emotions in difficult times, a remarkably consistent response was "I just don't think about [problems or worries]" (p 311). These developmental psychology findings parallel social psychological work on empathy as a motivated process (Cameron and Payne 2011), which demonstrates that in some situations individuals consciously choose to avoid empathizing with mass suffering.

Socioemotional selectivity theory argues that it is not negative stimuli per se that older adults are avoiding, but rather negative stimuli that do not have emotional meaning for the individual. For example, an older adult might find helping their grandchild deal with a successful situation to be emotionally meaningful. Although offering such help might be stressful and evoke negative emotions, at the same time, it might provide a meaningful experience that has the potential to strengthen a valued relationship (Carstensen et al. 2003). More generally, the positivity effect found in lab settings may be nullified, or even reversed, in individuals from cultural backgrounds where negative emotions are also considered emotionally meaningful, such as East Asian cultures (Fung et al. 2008, but also see Kwon et al. 2009). This work also aligns with work on the motivated rejection of empathy (Cameron et al. 2019), which demonstrates that people are less likely to avoid empathizing with those suffering when they believe that the negative emotions they might experience are worth the costs. Extending these perspectives to climate change, older adults, despite their lower tendency to engage with climate change overall, might be likely to engage with climate change to the extent that they find the issue emotionally meaningful.

Temporal orientation may influence the extent to which individuals find climate change emotionally meaningful. As noted above, being temporally oriented toward the future seems to predispose individuals to ascribe greater meaning to abstract-seeming, long-term concerns such as climate change. Based on the notion that older (vs. younger) adults are more likely to avoid engaging with concerns that lack emotional meaning, it follows that the relationship between age and (reduced) climate engagement might be strongest for those who orient more toward the present than the future, and weaker or possibly even reversed for those who orient toward the future rather than the present. Similarly, we propose that the negative relationship between age and climate engagement that has been demonstrated in US samples might be weaker within cultures that have a more future-oriented cultural orientation.

3 Bidimensionality of temporal orientation

When considering the proposed interaction between age and temporal orientation on climate engagement, it may be helpful to consider previous work suggesting that temporal orientation may be a bidimensional construct (Joireman et al. 2008). In particular, one type of temporal orientation known as *consideration of future consequences* is theoretically and statistically separable into two negatively related yet distinct dimensions representing consideration of the

future and the present. This bidimensionality has fostered two distinct theoretical explanations of how temporal orientation influences the effects of other predictors of decision-making. The *buffering model* suggests that considering the future buffers against the effects of risk factors of irresponsible decisions. For example, alcohol intoxication increases individuals' aggressive behavior, but less so among those who highly consider future consequences (Bushman et al. 2012). Considering age and climate engagement, the buffering model would propose that considering future consequences can lead older adults to view addressing climate change as more emotionally meaningful, buffering against the age-related tendency to consciously avoid engaging with topics that foster negative emotions. In contrast, the *susceptibility model* suggests that greater consideration of the present increases the effect of risk factors toward irresponsible decisions. For example, compulsive buying tendencies are not strongly correlated with the tendency to accumulate credit card debt (an outcome with low impact in the present but high impact in the future), except among those high in consideration of immediate consequences (Joireman et al. 2010). Considering age and climate engagement, the susceptibility model would propose that a focus on immediate consequences leads to the promotion of emotionally meaningful goals related to the present, potentially crowding out future-oriented topics such as climate change and increasing the likelihood that such topics will be consciously ignored. Distinguishing between which model (or both) explains age-related decreases in climate engagement, though seemingly subtle, is practically relevant, in part because it helps provide input into whether facilitating engagement with climate change among older individuals can best be facilitated by increasing consideration of the future, or decreasing the sway of present temptations (Joireman and King 2016).

Based on the above, we advance the following hypotheses:

> **Hypothesis 1 (H1)**: *Age will be negatively associated with climate change engagement.*
> **Hypothesis 2 (H2)**: *The proposed relationship in H1 will be moderated by temporal orientation such that among those who consider either (a) the future more or (b) the present less in decision-making (or live in cultural contexts that promote considering the future more and the present less), age-related differences in climate engagement will be less pronounced.*

4 Present research

In two studies, we examine whether temporal orientation moderates the relationship between age and climate change engagement. As noted above, temporal orientation varies at both the cross-cultural level and the individual levels, which we explore separately in studies 1 and 2, respectively. Study 1 involves a cross-national examination of country-level temporal orientation, considering whether European countries that have a longer-term orientation have a weaker (i.e., less negative) relationship between age and salience of climate change. Study 2 examines temporal orientation at the individual level in a US sample, assessing whether American adults that have a longer-term orientation have a weaker relationship between age and intentions to engage in climate action. Study 2 further separates temporal orientation into consideration of (a) future consequences and (b) immediate consequences, consistent with the bidimensionality of this construct noted above. In both studies, we control for political orientation because it is related to both temporal orientation (Joireman and Liu 2014) and climate engagement (Hornsey et al. 2016).

5 Study 1

Study 1 combined publicly available online data from multiple sources to explore whether countries that are more future-oriented (vs. less future-oriented) show weaker relationships between age and climate change engagement. In study 1, we operationalize climate change engagement in terms of issue salience (reflecting cognitive engagement).

5.1 Methods

Country-level data on temporal orientation was collected using long-term orientation from Hofstede's cultural values index (Hofstede 2013; Hofstede and Minkov 2013). Measures from Hofstede's index have been previously used by cross-cultural researchers assessing cultural differences in environmental engagement (e.g., Eom et al. 2016). Other measures were taken from the European Social Survey data (European Social Survey Round 8 Data 2016), which examines 23 countries (all in Europe plus Israel, total $N = 44{,}387$). In order to maximize representativeness of the teenage and adult public residing in private households for each country, the European Social Survey researchers conduct face-to-face interviews with samples selected by multistage strict random probability methods based on sampling frames of individuals, households, and addresses. We used the data from round 8 because the other rounds of this survey did not ask participants about climate change. Focusing solely on European countries (and Israel) reduces variance in other country-level cultural predictors which could confound the results, such as collectivism and socio-economic status (Eom et al. 2016, 2018). In terms of statistical power, simulation studies (Scherbaum and Ferreter 2009) suggest a rule of thumb that studies seeking to assess cross-level interactions should examine at least 30 groups (in this case, countries) and 30 observations per group; by this metric, our dataset was slightly underpowered at the country level. This is unfortunately a common limitation of cross-cultural research which often has to rely on an inherently limited set of upper-level groups, including other research using the European Social Survey dataset (e.g., Poortinga et al. 2019).

Participants' ages were directly reported ($M = 49$, SD = 19, range = 15–100). Political orientation was assessed via a single-item measure asking participants to place themselves on a 0 "left" to 10 "right" scale ($M = 5.16$, SD = 2.24). To control for the effects of political orientation when assessing the effects of long-term orientation (which was measured at the country level), we needed a country-level measure of political orientation, which we obtained by averaging participants' data for each country to obtain an average political score for that country.[2] The issue salience of climate change was assessed via a two-item composite measure ($\alpha = .69$, $M = 3.01$, SD = 0.89) creating by averaging (1) affective salience of climate change ("How worried are you about climate change?") on a 1 "not worried at all" to a 5 "extremely worried" scale, and (2) cognitive salience of climate change ("How much have you thought about climate change before today?") on a 1 "not at all" to 5 "a great deal" scale. We excluded participants who had previously indicated that they believed that the world's climate was "definitely not changing" ($N = 978$, 2% of the sample).[3]

[2] We conducted supplemental analyses examining the following country-level moderators: (1) average education level, (2) GDP per capita, and (3) population density (with the latter two taken from 2016 World Bank data). None of these variables significantly moderated the age-climate salience relationship.

[3] Results are similar if these participants are included.

5.2 Results

We conducted multilevel modeling analyses using the *lme4* (Bates et al. 2014) package in *R* (R Core Team 2020), with *lmerTest* (Kuznetsova et al. 2015) enabled to assess statistical significance. We centered each individuals' age relative to the average age of the country in which they lived. Analyses below are similar if this centering process is not conducted.

We examined whether countries higher in long-term orientation showed a weaker (less negative) relationship between age and climate salience using the following multilevel model:

$$\text{Climate salience} = \beta_{0c} + \beta_{1c}(\text{Age}_{ci}) + e_{ci} \quad (1)$$

The equation indicates that for each individual i residing in country c, climate salience$_{ci}$ is modeled as a function of a person specific intercept, $_{0c}$, their age (relative to the average age of their country in the sample), $_{1c}$, and residual differences, e_{ci}. Country-specific coefficients were simultaneously modeled as a function of country-level predictors as modeled in the following equation,

$$\beta_{0c} = \gamma_{00} + \gamma_{01}(\text{long–term orientation}_i) + \gamma_{02}(\text{political orientation}) + u_{0c} \quad (2)$$

$$\beta_{1c} = \gamma_{10} + \gamma_{11}(\text{long–term orientation}_i) + \gamma_{12}(\text{political orientation}) + u_{1c} \quad (3)$$

In these equations, γ_{01} and γ_{02} describe how country-level differences in long-term orientation and political orientation predict climate salience, and γ_{11} and γ_{12} describe how country-level differences in long-term orientation and political orientation predict differences between countries in the relationship between age and climate salience. γ_{00} and γ_{10} are sample-level parameters describing the prototypical country in the sample. Random effects (u_{0c} and u_{1c}) were allowed to covary but were orthogonal to the residual error, e_{ci}. The interaction terms, γ_{11} and γ_{12}, were added in step 2 after main effects were assessed. A model comparison test suggested that adding interaction terms improved model fit, $\chi^2(2) = 5.99$, $p = .05$.

Supporting H1, age negatively predicted climate salience, $b = -.05$, SE = .02, $t(22.12) = -3.01$, $p = .007$, $\eta^2 = .003$.[4] Yet, supporting H2, this effect was moderated by the countries' temporal orientations, $b = .04$, SE = .02, $t(20.49) = 2.42$, $p = .02$, $\eta^2 = .002$. As shown in Fig. 1, among countries with more long-term temporal orientations, the negative relationship between age and climate salience was smaller in magnitude. The effect of age was not moderated by the average political orientation of the country, $b = .07$, SE = .09, $t(20.25) = 0.75$, $p = .46$, $\eta^2 < .001$.

5.3 Discussion

Study 1 results show that at least within Europe (and Israel), county-level temporal orientation moderates the relationship between age and climate salience. These results also provide a theoretical explanation for Poortinga et al.' (2019) findings that the negative relationship between age and climate engagement shows significant variance across the European

[4] Predictors in multilevel models (vs. OLS regression) tend to explain a lower proportion of the total variance because multilevel models have variance at multiple levels and thus more total variance (Snijders and Bosker 2011).

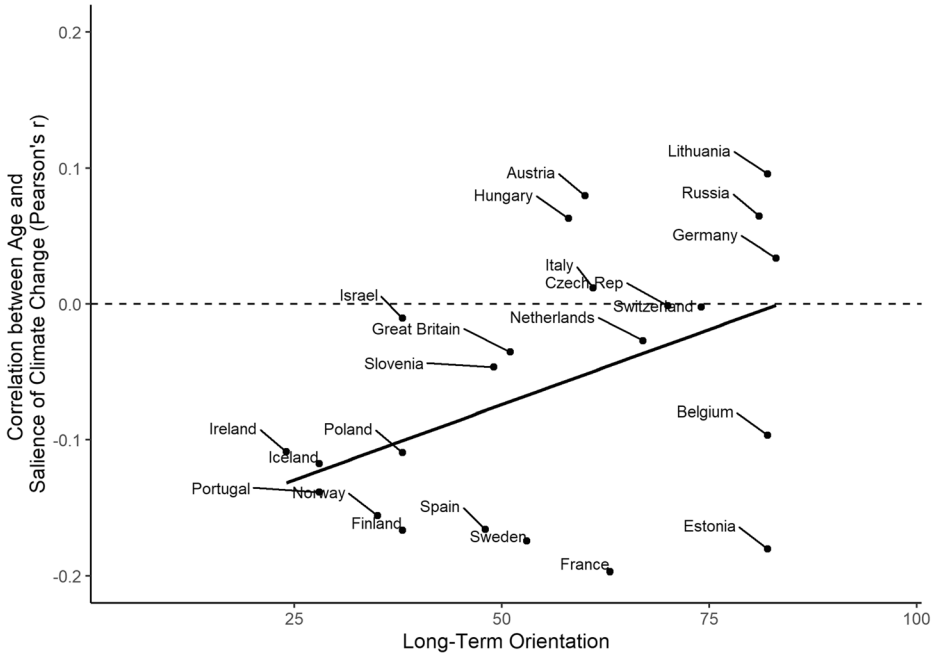

Fig. 1 Results from study 1: Regression results and scatterplot showing the association between country-level long-term orientation and the within-country correlation between age and climate salience

continent. Our results suggest that this variance can be explained in part by cross-cultural differences in temporal orientation.

Visually examining the figure shows that long-term orientation does not predict all of the cross-national variance in this relationship. Among the countries studied here, there appears to be a fairly consistent negative relationship between age and salience of climate change. However, the figure virtually suggests a significant amount of heterogeneity in this relationship among countries that are higher in long-term orientation (LTO). The remaining differences may in part reflect differences in other cultural values, such as collectivism, egalitarianism, harmony, and uncertainty avoidance (Eom et al. 2016; Kasser 2011). Furthermore, among countries higher in long-term orientation, various idiosyncratic factors may heighten or lower the emotional meaningfulness of climate change. For example, in Austria, data was collected during a presidential election year in which the Green Party candidate received a majority of the votes (Smale 2016). The salience of this election and the popularity of a candidate belonging to an overtly pro-environmental party may have raised the meaningfulness of environmental issues among older adults and explained the positive relationship between climate change salience and age in Austria. Conversely, Estonia is a country that is heavily dependent on shale oil extraction for energy and jobs (International Energy Agency 2013). This economic and cultural reliance on fossil fuels could create additional discomfort when considering the possibility of reducing dependency on fossil fuels (a major component of climate action), which perhaps explains the sharply negative relationship between climate change salience and age in Estonia despite the high long-term orientation of the country. However, there are likely numerous possible explanations for countries that diverge from the general trend; future work is needed to explore these speculations.

6 Study 2

Study 2 examines whether the pattern identified in study 1 also applies when temporal orientation is evaluated at the individual (vs. country) level. We surveyed US adults, a country which falls somewhat below average (relative to countries assessed in study 1) on the cross-cultural measure of long-term orientation (Hofstede and Minkov 2013). However, in study 2, we assessed differences in temporal orientation using the bidimensional *consideration of future consequences* scales (Joireman et al. 2012), which has been previously used as a predictor of climate engagement–related outcomes (climate change belief and willingness to pay; Joireman and Liu 2014) and separately examines consideration of future consequences (CFC-F) and consideration of present consequences (CFC-I). Consideration of future consequences has more of a behavioral focus than the cultural measure of long-term orientation measure used in study 1; however, the constructs are similar in that they assess the tendency for individuals or cultures to consider the future.

We also made two additional changes to the study design. First, reflecting the focus of the consideration of future consequences measures as focused on behavioral outcomes, we assessed behavioral intentions to engage in climate action, rather than salience of climate change. Second, we heightened salience of climate change by asking participants to first complete a writing task involving consideration of climate change before completing survey questions.

6.1 Methods

6.1.1 Participants

We used Dynata (formerly SSI), a market research firm, to recruit 1180 US adult participants. Dynata uses quota sampling to recruit samples whose demographic profiles closely mirror those of the target population (in this case the US adult public). Using Dynata reduces low-quality responses common in studies that instead use Amazon's Mechanical Turk (MTurk) for recruitment (Ahler et al. 2019). We selected a fairly large sample size because we were unsure of what effect size to expect, and detecting statistical interactions requires a much larger sample than the main effects (Giner-Sorolla 2018). After eliminating participants who took less than half of median time (501 s) to complete the survey (a key identifier of those who rushed through the survey; Leiner 2019; Malhotra 2008; $N = 321$, 25% of sample) and those who reported that did not believe climate change was occurring ($N = 61$, 6% of sample), our sample contained 798 participants.[5] A power analysis using G*Power 3.1 (Faul et al. 2007) indicated that our sample had 81% power to detect a "small" effect in a regression (defined as $\eta^2_p = .01$; Cohen 1988).

Demographically, participants roughly reflected the US adult population (US Census 2014). Participants were 375 men, 479 women, and 2 participants who identified as transgender. Participants' ages ranged from 18 to 98 (median = 48). Participants identified as 73% White, 16% Black or African American, 2% American Indian or Alaska Native, 4% Asian, 1% Native Hawaiian or Other Pacific Islander, and 2% "Other." Hispanic/Latino identification was

[5] Results were similar if excluded participants were included.

asked in a separate question; 10% of participants identified as such (5% chose not to answer). Politically, participants identified as 40% Democrat, 22% Republican, 31% Independent, 3% Libertarian Party, 1% Green Party, and 1% "Other" (10% chose not to answer).[6]

6.1.2 Procedure

Participants completed an online survey in which they were first primed to think about climate change via a writing task, then completed survey measures listed below as part of a battery of measures (some were used in another project).

6.1.3 Measures

Age Age was calculated by subtracting participants' self-reported birth year from 2019 (M = 47, SD = 17, median = 48, range = 18–97).

Temporal orientation We measured temporal orientation using the *consideration of future consequences* scale (specifically, the CFC-14; Joireman et al. 2012), which divides consideration of future consequences into *future* (CFC-F, e.g., "I consider how things might be in the future, and try to influence those things with my day to day behavior."; $\alpha = .88$) and *immediate* (CFC-I, e.g., "My behavior is only influenced by the immediate (i.e., a matter of days or weeks) outcomes of my actions."; $\alpha = .92$) subscales on −3 to +3 Likert scales. As shown in Table 1, the two subscales were only weakly negatively correlated, empirically supporting their bidimensionality.

Political orientation (covariate) Political orientation was measured via averaging two items assessing social and economic conservatism on −3 "very liberal" to +3 "very conservative" scales ($\alpha = .89$).

Climate action intentions Participants indicated their intentions to engage in three forms of climate action (e.g., "How likely would you be to volunteer or donate money to an organization working to reduce climate change" on −3 "very unlikely" to 3 "very likely" scales; $\alpha = .87$; derived from Swim et al. 2019).

6.2 Results

Table 1 shows zero-order correlations between measures. As shown, there is only a weak, nonsignificant negative correlation between age and consideration of future consequences (CFC-F), and a weak-to-moderate, negative correlation between age and consideration of immediate consequences (CFC-I). This suggests that younger adults consider the immediate consequences of their actions somewhat more (on average) than older adults when making decisions, but consider future consequences approximately equally to older adults.

[6] Nationally, representative polling of US adults (rather than registered or likely voters) typically shows that more Americans identify as Democrat than as Republican (Pew Polling 2020). However, our numbers have somewhat more Democrats than the public, in part because those excluded for climate change denial were disproportionately Republican.

Table 1 Study 2 means, standard deviations, and correlations with confidence intervals

Variable	*M*	*SD*	1	2	3	4
1. Age	47.21	16.65				
2. CFC-F	0.91	1.04	-.03 [-.10, .04]			
3. CFC-I	-0.48	1.31	-.20** [-.27, -.13]	-.16** [-.23, -.10]		
4. Political conservatism	-0.14	1.73	.16** [.10, .23]	-.15** [-.22, -.08]	.07* [.00, .14]	
5. Climate action intentions	0.15	1.74	-.13** [-.20, -.06]	.59** [.54, .63]	-.08* [-.14, -.01]	-.33** [-.39, -.27]

Note. *M* and SD are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. * indicates $p < .05$. ** indicates $p < .01$

6.2.1 Age and climate action intentions

We first explored the relationship between age and climate action intentions in a bivariate regression. While running diagnostic tests, a studentized Breusch-Pagan test (confirming homoskedascity; Breusch and Pagan 1979) revealed heteroskedascity, $\chi^2(1) = 16.37$, $p < .001$, suggesting that variance in climate action intentions was not constant among those of different ages. Thus, we examined the relationship between age and climate action intentions using location-scale regression (Rigby and Stasinopoulos 2005), using the *mgcv* package (Wood 2015) in R. Location-scale regression allows both mean outcome values (similar to a normal regression) and the variance in the outcome measure to vary as a function of predictors. Supporting H1, age was negatively associated with climate action intentions, $b = -.013$, SE = .004, $z = -3.39$, $p < .001$, estimated[7] $\eta_p^2 = .02$. However, as shown in Fig. 2, this linear relationship was qualified by the standard deviation of the outcome measure also increasing with age, $b = .005$, SE = .002, $z = 3.19$, $p = .001$. Follow-up tests using the *car* package (Fox et al. 2018) in R, which statistically compared decreases in the mean to increases in the standard deviation to examine whether the two were statistically different, suggested that those 1SD above the mean on climate action intentions (relative to their age), climate action intentions did not significantly decline with age, although there was a marginally significant downward trend, $b = -.008$, $\chi^2(1) = 3.34$, $p = .07$. In contrast, those 1SD below the mean on climate action intentions (relative to their age) showed a sharp decrease in climate action intentions with age, $b = -.018$, $\chi^2(1) = 20.46$, $p < .001$.

6.2.2 Temporal orientation, age, and climate action intentions

We conducted a multi-step linear regression model to examine (1) the main effects of temporal orientation and (2) the interaction between temporal orientation and age. We control for political orientation, and in step 2, the interaction between political orientation and age (see "Supplemental analyses" for a visualization of the interaction between political orientation and age on climate action intentions).[8] Studentized Breusch-Pagan tests revealed that

[7] Effect size was estimated using standard OLS regression.

[8] Results are similar, and somewhat larger in magnitude, if political orientation is not included. Supplemental analyses showed that the age-climate relationship was not moderated by (a) gender, (b) education, or (c) income.

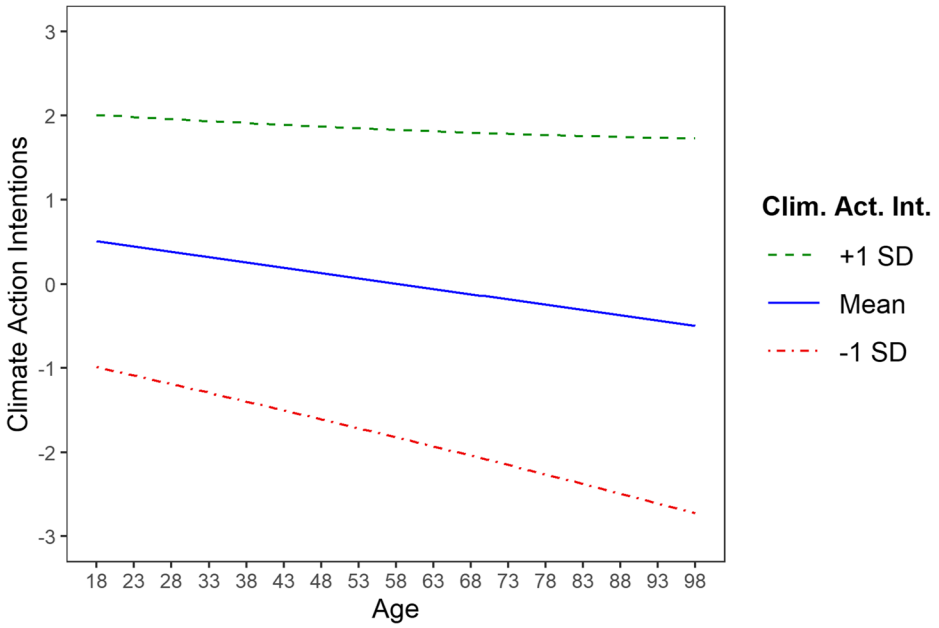

Fig. 2 Location-scale model from study 2: Climate action intentions decreased on average, but increased in variation, with age

heteroskedascity was no longer statistically significant in either model step, $\chi^2(4) = 8.33$, $p = .08$; $\chi^2(7) = 13.13$, $p = .07$, suggesting that OLS regression would be appropriate for these analyses (See Table 2 for full regression results).

Interaction tests and floodlight analyses using the Johnson-Neyman technique (Spiller et al. 2013) suggested evidence for both buffering and susceptibility hypotheses (supporting both H2a and H2b). Supporting the *buffering hypothesis*, CFC-F interacted with age to predict climate action intentions, $b = .006$, SE = .003, $t(782) = 2.33$, $p = .02$, $\eta^2_p = .01$. As visually depicted in Fig. 3a, floodlight analyses (examining each interaction separately) revealed that age only negatively predicted climate action intentions ($p < .05$) for those near or below the midpoint on CFC-F (below 1.07, 58% of the sample). Supporting the *susceptibility hypothesis*, CFC-I interacted with age to predict climate action intentions, $b = -.01$, SE = .002, $t(782) = -4.40$, $p < .001$, $\eta^2_p = .02$. As visually depicted in Fig. 3b, floodlight analyses revealed that age only negatively predicted climate action intentions for those near or above the midpoint on CFC-I (above −0.64, 54% of the sample). Indeed, for those extremely low in CFC-I (less than −2.03, 11% of the sample), age *positively* predicted climate action intentions. Unexpectedly, for younger respondents (39 and younger, 36% of the sample), CFC-I was *positively* related to climate action intentions.

6.3 Discussion

Study 2 replicates and extends the findings of study 1 at the individual level. First, on average, older American adults reported lesser climate action intentions than did younger American adults. We further found that variance in climate action intentions was not homogenous among all ages. Rather, climate action intentions showed greater variability among older adults than younger adults. Exploring this heteroskedasticity revealed that older adults on the higher end

Table 2 Study 2 regression results

Main effects and interactions		
	Climate action intentions	
	Unstandardized coefficient (95% CI)	Standardized coefficient
Step 1: main effects		
Age	−0.008** (−0.014, −0.002)	−0.08
CFC-F	0.94*** (0.84, 1.03)	0.56
CFC-I	0.02 (−0.05, 0.09)	0.01
Political conservatism	−0.23*** (−0.29, −0.17)	−0.23
Step 2: interactions		
Age x CFC-F	0.006* (0.001, 0.012)	0.19
Age x CFC-I	−0.010*** (−0.014, −0.005)	−0.37
Age x Political conservatism	−0.005** (−0.008, −0.002)	−0.32

Note: Main effects are included, but not reported, in step 2. *$p < .05$, **$p < .01$, ***$p < 0.001$

of climate action intentions (i.e., one standard deviation above the mean for their age) were statistically similar in climate action intentions to younger adults on the higher end of climate action intentions, while older adults on the lower end were far lower in climate action intentions than younger adults on the lower end. Although unclear, it is possible that this could reflect a ceiling effect among younger adults.

Second, results provide evidence for both buffering and susceptibility hypotheses: among those who were high in consideration of future consequences or, independently, low in consideration of immediate consequences, there was no relationship between age and climate action intentions. Interestingly, the pattern of results for CFC-I was slightly different than expected: although the interaction was in the expected direction, there was no main effect of

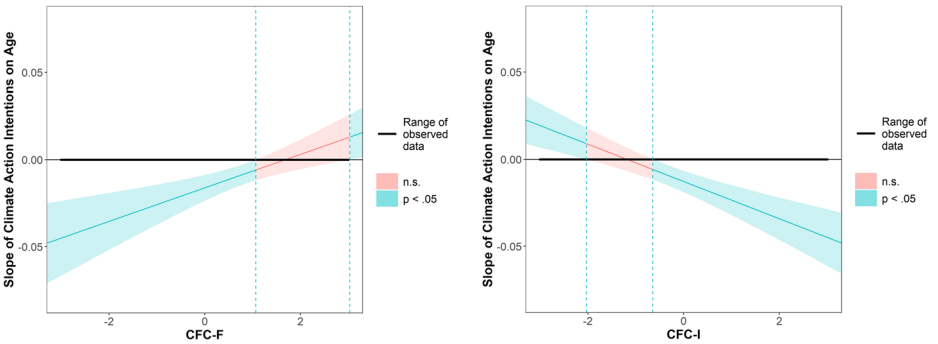

Fig. 3 Results from study 2 demonstrating that the relationship between age and climate action intentions is moderated by CFC-F (**a**) and CFC-I (**b**)

CFC-I predicting reduced climate action intentions. Although, as expected, CFC-I was negatively associated with reduced climate action intentions in older adults, an unexpected pattern emerged for younger adults whereby CFC-I was positively associated with climate action intentions. This could possibly reflect some younger adults' perception that climate change is a problem that is affecting them in the present (as well as the future; see Brügger et al. 2021; Rickard et al. 2016). Nonetheless, more work is needed to examine this possibility.

7 General discussion

Two studies demonstrate the moderating effect of temporal orientation on the relationship between age and climate engagement. Although both studies revealed an overall negative relationship between age and climate engagement, this relationship was moderated by cultural-level and individual-level temporal orientation, such that there was no significant relationship between these two variables among those living in highly future-oriented countries (study 1) or who were themselves highly future-oriented or not very present-oriented (study 2). This work suggests that in contrast to the common framing of antagonism between older and younger generations on climate change (Jones and Davison 2021; Tikkanen 2020), it is not all older adults but rather a certain type of older adults (those focused on the present and not the future) who tend to be disengaged from climate action.

This work points to the potential importance of using of socioemotional selectivity theory to understand how and when older adults are likely to engage with social issues. Our results are consistent with the notion that older individuals with a present- (rather than future-) oriented temporal orientation may be consciously choosing to avoid engaging with climate change. Our work also has potential links to the work on empathy avoidance as a motivated process (Cameron et al. 2019; Cameron and Payne 2011), as it suggests the possibility that older adults may be particularly likely to engage in such empathy avoidance. Future work is needed to elucidate the psychological mechanisms underlying our findings and identify possible boundary conditions (see the "Supplementary information" section for a preliminary analysis of mechanisms). In particular, despite multiple decades of work into socioemotional selectivity theory, future work is still needed to develop a direct measure of emotional meaningfulness that would be helpful to directly understanding the direct to which topics such as climate change are emotionally meaningful to individuals.

The work also extends other work which has suggested potential interrelated avenues for increasing engagement with climate change among older adults. First, encouraging older adults to think about the consequences of their actions in the future (e.g., thinking about the legacy they wish to leave) may be particularly effective at increasing climate change engagement among this population (Hurlstone et al. 2020; Zaval et al. 2015). Second, because older adults tend to increasingly value relationships with close others as they age (Van der Goot et al. 2019), younger adults and even children and teenagers may be particularly well-suited to encourage climate engagement among their older loved ones (Lawson et al. 2019). Third, older adults, in particular, might become more engaged with climate change when the positive affective consequences of engaging are made clear (i.e., when they believe that engaging with climate change will make them feel good; Van der Goot et al. 2019).

Our work relied on samples which may have afforded us the ability to detect patterns that much work would overlook. Much of the work examining predictors of climate engagement has studied undergraduate student populations or online sampling strategies (such as MTurk)

which oversample the young and tech-savvy. In contrast, the sampling strategies used across both of the present studies were able to recruit samples whose ages more closely matched the population distribution of adults.

7.1 Limitations and future directions

A limitation of the present work is that we only explore climate engagement in Western countries (Europe, Israel, and the USA). The regions explored in the present work tend to reflect areas that have had historically high per capita emissions and thus are disproportionately to blame for climate change, yet will largely be spared from the worst impacts of climate change relative to many other regions of the world which have contributed less to the problem (e.g., Latin America). Furthermore, residents of some regions of the Global South (e.g., the Peruvian Andes) largely view climate change as an issue occurring in the present, rather than the future (Brügger et al. 2021). Given these differences, it is unclear whether our results would extend to other regions of the world.

Furthermore, it is unclear whether our results are generalizable to other environmental issues. Though there is limited research distinguishing climate engagement from other forms of environmental engagement (see Swim and Whitmarsh 2018 for a review), one study suggests that older Chinese adults were more concerned than younger Chinese adults about *concrete* environmental issues (such as local pollution), but less concerned than younger adults about *abstract or global* environmental issues (such as climate change; Jianguang 1993). Furthermore, given the potential consequences of the threat of climate change, contemplating the topic may induce an existential threat for some, which can modulate pro-environmental responses (Fritsche and Häfner 2012).

Our results are further limited by our use of behavioral intentions rather than measured behavior as the outcome measure in study 2. Supporting using behavioral intentions as a proxy for behavior, a meta-analysis of pro-environmental behavior suggests that intentions to engage in pro-environmental behavior strongly and robustly predict actual behavior (van Zomeren et al. 2008). Furthermore, longitudinal work suggests that the relationship between behavioral intentions and subsequent (self-reported) pro-environmental behavior is not influenced by self-deception or impression management concerns (Vilar et al. 2020). Nonetheless, it is possible that patterns could differ if actual behavior were assessed. For example, given that CFC-I is associated with reduced self-control (Joireman et al. 2008), those high in CFC-I could be less likely than others to follow through with their intentions.

Future work should delve more deeply into the psychological mechanisms by which future orientation moderates age effects on climate engagement (see the "Supplementary information" section for a preliminary mediation analysis showing that a proxy of emotional meaningfulness shows the expected patterns). Work is needed to develop a valid measure of emotional meaningfulness, in part to ensure that the measure assesses the extent to which emotions triggered by climate change (e.g., fear) are meaningful and not the intensity or frequency of the emotions themselves. Similarly, such a measure must be distinct from measures of emotional comfort and perceived goal efficacy (Fung and Carstensen 2004). Perhaps such a measure could be based in part on research investigating the intersection between emotions and values (e.g., Nelissen et al. 2007). Additionally, it seems highly plausible that future-oriented older (vs. younger) adults might be less likely to think about direct future consequences to themselves as they may anticipate not being alive as distant future events unfold. Yet, our work leaves unclear whether future-oriented

older adults tend to be primarily concerned about the effects of climate change on themselves, on others, or whether they are motivated by how they wish to be remembered (i.e., legacy motives; Schultz 2001; Zacher et al. 2011). These distinctions have practical relevance for strategies to engage older adults, as, for example, if future-oriented older adults who engage with climate change are primarily concerned with their legacies, communicators could consider appealing to such legacies in order to engage older adults who are already future-oriented and potentially encourage less future-oriented older adults to focus more on the future (see Hurlstone et al. 2020; Zaval et al. 2015). Thus, researchers should consider conducting qualitative work to better understand how older adults who are already engaged with climate change think about the issue. In doing so, researchers might consider incorporating work on future self-continuity (Hershfield et al. 2011), temporal discounting (Jacquet et al. 2013), legacy motives (Zaval et al. 2015), and responses to existential threats (Fritsche and Häfner 2012).

Future work should also test other predictions of socioemotional selectivity to provide additional evidence for the utility of the theory within this context. For example, while age differences in climate engagement could be due to either age effects (e.g., individuals becoming less engaged as they age) or cohort effects (e.g., individuals who grew up at an earlier time being less engaged than individuals who grew up at a later time), socioemotional selectivity theory proposes that differences between older and younger adults are related to changing priorities that occur with age and therefore should be explained by age effects, rather than cohort effects. Longitudinal work is needed to verify this proposition.

8 Conclusion

The present work demonstrates the synergistic effect of age and temporal orientation on (dis)engagement with climate change. Our results provide a more nuanced picture than previous work as to the relationship between age and climate engagement, and also provide preliminary evidence for a possible psychological explanation as for why (some) older adults may be less likely to engage with the topic: namely, that present-oriented older adults may be especially likely to tune out the phenomenon. Our work also suggests the potential importance of fostering future thinking and promoting more future-oriented (and less present-oriented) older individuals to positions of power. This work sheds light and nuance on the poorly understood age gap that has been identified in climate engagement and demonstrates the importance of better understanding how older adults relate to climate change.

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Author contribution NG, BM, and JV designed the research; BM collected data; NG and JV analyzed the data; NG, BM, and JV wrote the paper.

Declarations

Ethics approval All research was approved by the Institutional Review Board at Texas Tech University. This article does not contain any studies with animals. All procedures involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments.

Consent to participate All survey respondents provided implied consent.

Consent for publication All authors gave consent for publication.

Conflict of interest The authors declare no competing interests.

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