REGULAR ARTICLE

Worldviews about change: Their structure and their implications for understanding responses to sustainability, technology, and political change

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Abstract
People hold different perspectives about how they think the world is changing or should change. We examined five of these "worldviews" about change: Progress, Golden Age, Endless Cycle, Maintenance, and Balance. In Studies 1–4 (total $N = 2733$) we established reliable measures of each change worldview, and showed how these help explain when people will support or oppose social change in contexts spanning sustainability, technological innovations, and political elections. In mapping out these relationships we identify how the importance of different change worldviews varies across contexts, with Balance most critical for understanding support for sustainability, Progress/Golden Age important for understanding responses to innovations, and Golden Age uniquely important for preferring Trump/Republicans in the 2016 US election. These relationships were independent of prominent individual differences (e.g., values, political orientation for elections) or context-specific factors (e.g., self-reported innovativeness for responses to innovations). Study 5 ($N = 2140$) examined generalizability in 10 countries/regions spanning five continents, establishing that these worldviews exhibited metric invariance, but with country/region differences in how change worldviews were related to support for sustainability. These findings show that change worldviews can act as a general "lens" people use to help determine whether to support or oppose social change.

KEYWORDS
innovation, politics, social change, sustainability, worldviews

1 | INTRODUCTION

Speculation about how the world is changing and should be changing has fascinated people throughout history. Philosophers and historians, novelists and artists, have all reflected on where society has come from and where it is heading, often as a comment on the social changes needed in their present society (Olusoga, 2021). While some have focused on envisaging the ultimate *outcomes* of change (e.g., utopias and dystopias; Carey, 1999), they have also speculated about *trajectories* of societal change (e.g., "progress"—proposing that society generally improves over time; Gray, 2004). In this research we were interested in laypeople's understandings of these trajectories of change.

In particular, we wanted to know if everyday people hold general beliefs or worldviews about trajectories of change, and whether these worldviews correspond to those commonly used in philosophy, history, and other disciplines. *Worldview* is an umbrella term that describes a general understanding or orientation used as a broad frame or "lens" to make sense of experience, which may include descriptive (what is) and prescriptive (what should be) elements (Johnson et al., 2011; Koltko-Rivera, 2004). This term has been used to describe many general beliefs or orientations, such as beliefs that the world is competitive, dangerous, alive, or enticing (Clifton et al., 2019; Sibley et al., 2007), beliefs in equality or hierarchy (Xue et al., 2014), religious beliefs (van den Bos et al., 2006), or beliefs that effort produces rewards (Chen et al., 2016).

In this research our overarching goal was to identify if worldviews about trajectories of change, which we will term *change worldviews*, matter for understanding why people support (or oppose) policies and innovations that have the potential to bring about widespread social change. We focused on five worldviews that represent basic patterns of change. Three are prominent among historians—even called the "three great historical paradigms" (Hardin, 1993, p. 23): *Progress*, indicating improvement over time; *Golden Age*, indicating decline from an idyllic past; and *Endless Cycle*, indicating continual oscillation between alternate states without overall change (just as we pass through seasons year upon year). A fourth, *Balance*, was identified from systems analysis, prominent in fields such as ecology, that invoke homeostatic processes where systems react to shocks and extremes in ways that keep the system in a moderate or balanced state. The fifth worldview represents a counterpoint of no change, with an emphasis instead on *Maintenance*—maintaining things in their current state. We explain each of these worldviews in more detail below.

The rationale for thinking everyday people might hold these worldviews about change is suggested by common sayings (at least in English) that seem to reflect these worldviews. Examples include the following: "You can't stop progress" (Progress); "Ah, the good old days" (Golden Age); "The more things change, the more they stay the same" (Endless Cycle); "Everything in moderation" (Balance); and "If it ain't broke, don't fix it" (Maintenance). This suggests that many people are likely to at least be aware of these worldviews. However, they may not make the same distinctions. For example, people might view Progress and Golden Age as opposing ends of a single improve–decline dimension, or they may fail to distinguish Endless Cycle and Maintenance because both suggest underlying stability. Moreover, our conceptualization of change worldviews does not imply mutual exclusivity—people might endorse multiple independent worldviews or see some worldviews as aligned. For instance, change towards a more balanced state may be seen as consistent with progress. Finally, these dimensions might (or might not) reflect more descriptive or prescriptive beliefs about change (how society is changing or how it should be changing). These issues of distinctiveness and overlap seem best addressed empirically, so we aimed to examine the "lay" structure of these change worldviews.

Our interest in change worldviews is based on believing they may act as general lenses that colour people's perceptions and responses to potential social change. When considering whether to support or oppose new social policies or technological innovations, or deciding who to vote for in elections, people are likely to consider how policies, innovations, or political parties might result in wider change in society (Bain et al., 2013; Fernando et al., 2020). But such impacts on society can be highly uncertain and difficult to judge, so people may also partly rely on their broader worldviews about where society is (or should be) heading, to help interpret the impact of policies, innovations, and political parties. That is, if people vary in whether they think society overall is getting better, or worse, or out of balance, they may view the same innovation or policy in a different light.

As an example, consider technological innovations such as social robots (humanoid robots used to perform social and care functions traditionally done by humans). When considering whether to support or oppose the roll-out of social robots across society, people may draw on what they know about that technology, but also their broader worldviews about change. Those who think society generally improves (Progress) may feel more supportive of social robots and other technologies because innovations are a sign of society improving. In contrast, those with a Golden Age worldview may see social robots as a step away from the good old days when it was humans who provided care to humans. Those who think society is fine as it is (Maintenance) may also oppose social robots and other innovations because they will create change when no change is needed or desired. Those with an Endless Cycle worldview might be apathetic (neither supporting or opposing), as whatever improvement (or decline) it creates will be seen as ephemeral.

The relevance and importance of different change worldviews is likely to vary across contexts. For example, many sustainability policies are explicitly focused on

avoiding the extreme situation of humans overshooting the earth's long-term resource capacities (Rockström et al., 2009; Steffen et al., 2018). Thus, a Balance worldview may be particularly relevant for supporting sustainability because it is about moderation and avoiding extremes. In contrast, those endorsing Endless Cycle might oppose environmental sustainability policies, such as addressing climate change, because seeing the world as changing cyclically might predispose them to thinking climate change might naturally reverse over time.

Although we think such associations are plausible, this research is exploratory because we do not yet understand the extent to which people hold these change worldviews, nor how they are structured. Thus, our aim was to map the structure of change worldviews and their associations with people's reactions in different social change contexts to identify the domains and issues where they are likely to be more (or less) relevant. We also developed items that expressed more descriptive worldviews (how the world is or is not changing) and more prescriptive worldviews (how the world should or should not change).

Before describing our studies, we first provide more theoretical background about these worldviews, and why we expect them to be distinct from major social psychological constructs such as political orientation and values.

2 | THEORETICAL BACKGROUND

Four of the change worldviews are represented in Figure 1 (Balance is described separately as it cannot be represented in the same way). Figure 1 represents general beliefs that over time the world is improving (Progress), declining (Golden Age), or unchanging (Endless Cycle, Maintenance). Endless Cycle and Maintenance differ in whether there are cyclical patterns of change around a stable baseline (Endless Cycle) or a complete lack of change (Maintenance). Figure 1 shows linear patterns of change for visual simplicity, but our measures do not require linearity. For example, when measuring Progress we ask people whether society is getting better over time, which allows for linear, exponential, or rapid improvements followed by plateaus.

2.1 | Progress

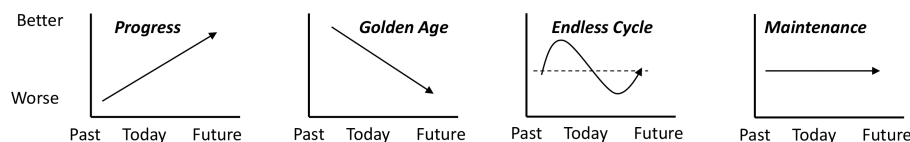Progress represents the view that society is improving over time (Gray, 2004; Hardin, 1993; Nisbet, 1994). It is believed to be a prevalent worldview in modern Western society, permeating religious and secular thought since the industrial revolution (Israel, 2010). Progress has been recognized by some social psychologists as an important construct, with most focusing on how believing in progress helps emotional regulation (Rutjens et al., 2009, 2010). Linked to Enlightenment philosophy, progress refers to a process but also invokes a desired goal—moving closer to perfection, which in capitalistic societies may be influenced by ideas of material abundance (Gray, 2004; Israel, 2010).

2.2 | Golden Age

Golden Age represents the view that society is declining, especially in comparison to an idealized past (Bell, 2003; Hardin, 1993). Scholars have argued that this worldview may be more prominent during economic decline (e.g., Japan; Hirai, 2013), or where a nation's international power is waning (e.g., Russia; Umbach, 2000). Within psychology, this idea overlaps with constructs such as "national nostalgia" that predicts opposition to immigration (Smeekes et al., 2015). In invoking a declining trajectory of change, it can also imply a goal (to become more like the superior state of the past).

2.3 | Endless Cycle

Endless Cycle represents the view that that change is cyclic and ephemeral, but with underlying stability in the system. Examples are the yin-yang concept in Chinese philosophy, where the dominance of one element leads to the rise of its opposite (Fang, 2012), and samsara, shared by Buddhism and Hinduism, involving the view of life as a repeating cycle (Aronson, 2004; Milner, 1993). Some research on representations of history have examined beliefs about history being cyclic, but these have used a single item and focused on nation-level comparisons of their effect in terms of single themes (e.g., attitudes toward national war; Páez et al., 2016) rather than on their psychological structure. As change is ephemeral, Endless Cycle does not clearly imply a goal.

2.4 | Maintenance

Maintenance subscribes to the notion of an unchanging world (differing from the oscillations of Endless Cycle),

FIGURE 1 Representations of four change worldviews.

emphasizing maintaining stability and a goal to preserve the current way of life. Within psychology, this corresponds to some extent with system justification theory (Jost et al., 2004), where people support society's stability even to their own disadvantage. It also accords with beliefs about cultural collective continuity (Sani et al., 2007), which highlight the stability of cultural values and traditions over time.

2.5 | Balance

Balance invokes a different perspective on change, focusing on achieving the so-called middle ground. It relates to a process of change where systems constantly adapt and react to shocks or extremes, adjusting over time to work towards keeping the system within a moderate range, or balanced (Lovelock, 2003). It is informed by the principle of homeostasis, where systems balance a range of needs and interests over time to avoid extremes (Mukerjee, 1966). It has a long history, invoked as a guiding philosophy in ancient Greece (Kahn, 2003), typified by Aristotle's (1967) golden mean where virtue was defined as achieving moderate levels of characteristics that lie between deficiency and excess. Similar ideas are important in several Asian religions and philosophies, including the Confucian idea of harmony (Li, 2006), and the Middle Way in Buddhism and other religions (Hartshorne, 1987; Nisbett et al., 2001). The goal of achieving a moderate state as an ideal is something many people endorse (Hornsey et al., 2018). A key difference between Balance and Endless Cycle is that Balance emphasizes change towards an optimal or satisfactory state, whereas Endless Cycle implies no underlying change.

3 | COMPARISON TO SOCIAL PSYCHOLOGICAL CONSTRUCTS

One potential critique of change worldviews is that they may just be proxies for already prominent individual difference constructs such as political orientation or values. While this is ultimately an empirical question (examined in the studies below), here we offer some reasons why change worldviews are conceptually distinct from such constructs.

3.1 | Political orientation

Change worldviews such as Progress and Maintenance might be seen as proxies for political orientation. Liberals often claim to work for progressive causes, and conservatives want to conserve (maintain) what they already have. However, change worldviews can cross-cut political ideology. For Progress, a liberal endorsement of progress might invoke how science and technology can help solve the world's problems, whereas a so-called small-government conservative invokes progress through entrepreneurship and allowing individuals to advance their own interests (Fuller, 2011).

This also applies to other change worldviews such as Golden Age. Some conservatives may want to return to a golden age of the past where people conformed more to traditional values and norms. But liberals who emphasize restoring local communities and restoring nature may also be guided by their images of what society has lost compared to the past. For Balance, liberals might desire a balance between economic and social goals, and conservatives may invoke notions such as Adam Smith's invisible hand or principles of supply and demand to reflect their view that the economy and society are self-balancing systems that achieve optimal outcomes for all.

In short, it is possible to see how liberals and conservatives can hold each of these worldviews. Our contribution provides measures of change worldviews to assess the extent of their overlap with political orientation, and to establish whether change worldviews predict responses to social policies and innovations independently of political orientation.

3.2 | Values

Values are abstract principles that vary in importance that people use as guides for their lives across contexts (Schwartz, 1994). The importance of individual values can be summarized using a circumplex reflecting compatibility and competition between specific values, underpinned by two basic dimensions—a greater focus on the self (self-enhancement) versus on others (self-transcendence), and a greater focus on preserving the present (conservation) versus embracing change (openness to change).

Values can provide a good test of the independent contribution of change worldviews to understanding responses to social policies and innovations. This is because both constructs are relatively general, both are expected to apply across situations, and one of the basic dimensions of values references change (openness to change vs. conservation; which might be linked to Progress and Maintenance). However, they differ in meaningful ways. The most important is the difference in focus on self or the world. Values are focused on importance for the self (e.g., how much creativity [openness to change] or national security [conservation] is important to me) whereas change worldviews describe general patterns or axioms about change (e.g., is the world getting better or worse?). Change worldviews also assess constructs unrelated to value importance (e.g., change as an endless cycle). We include measures of values in several studies to examine overlap with change worldviews, and to establish whether change worldviews are associated with responses to policies and innovations independently of values.

3.3 | Dialectical and holistic thinking

Dialectical and holistic thinking reflects a constellation of beliefs, more prevalent in countries influenced by Chinese cultural traditions such as Taoism, that accepts contradiction (e.g., that two seemingly contradictory statements can both contain truth); seeing existence as dynamic and not static; and a holistic view of existence that everything is connected (Nisbett et al., 2001; Peng & Nisbett, 1999). These beliefs can be theoretically linked to Endless Cycle (e.g., dynamic oscillation over time between the forces of yin and yang) and Balance (reconciling contradiction by choosing the moderate path between extreme positions).

However, measures of dialectical thinking have had a different focus. To date, the dominant (and seemingly only dedicated) measure of dialectical thinking, the Dialectical Self Scale (DSS; Spencer-Rodgers et al., 2004), focuses on perceptions of the self, treats dialectical thinking as a unidimensional construct, and assesses change in terms of contextual variability (e.g., "I often find that my beliefs and attitudes will change under different contexts," "I am the same around my family as I am around my friends"). Applications of the DSS have focused on individual outcomes (e.g., self-views, self-variation, self-concept; Spencer-Rodgers et al., 2010), and while the measure has been adapted to apply to a collective (Church et al., 2012), it does not measure specific change worldviews such as Endless Cycle or Balance.

Similarly, the most widely-used measure of holistic thinking, the Analysis-Holism Scale (Choi et al., 2007) also has a different focus on change. Its Perception of Change dimension focuses on whether change is predictable and variable, not on specific trajectories of change.

Thus, our research complements research on dialectical and holistic thinking by identifying beliefs about different trajectories of change that apply in general and not just to the self, and to beliefs about trajectories of change. In Study 5 we examine whether these specific beliefs about change are relatively more prevalent in Asian than in Western countries.

3.4 | Other worldviews

Other approaches to measuring worldviews have contained items relevant to some change worldviews, albeit not focused on the specific change worldviews we examine. For example, research on dangerous and competitive social world views (Duckitt et al., 2002) includes items describing society as becoming more lawless, bestial, and less respectable over time (aligned with a Golden Age worldview), as well as an item describing the social world as safe and stable (aligned with a Maintenance worldview). However, these are treated as opposing items of the same scale (dangerous social world view) rather than considering whether they are distinct in structure or prediction. Thus, our approach provides a much more nuanced

approach to examining social worldviews relating to change.

Subsequent to Study 4 in this manuscript, research was published on primal world beliefs (Clifton et al., 2019) that aimed to identify a broad range of worldviews. The broadest worldview was that the world is good, which was broken down into three dimensions involving viewing the world as Safe, Enticing, and Alive, and further into 22 subscales (Clifton et al., 2019; Clifton & Yaden, 2021). Two of the 22 lower-level subscales focus on change: Progressing (vs. declining) is conceptually related to Progress and Golden Age; and Changing (vs. static) focuses on the magnitude of change rather than patterns of change, although one item referring to the world staying the same is conceptually related to Maintenance.

Perhaps because of the approach of spanning a wide range of different little worldviews, primal world beliefs research has paid little attention specifically to the nature and structure of worldviews about change. For example, Clifton et al. (2019) treat Declining as the opposite of Progressing (measured as a single scale), that leads to resisting change (conceptually linked to our Maintenance worldview) and thus a conservative political orientation. This combines three worldviews about change (Progress, Golden Age, Maintenance) that we propose (and show) are separable and are have different relationships with social issues, and theoretically it is unclear why it would be predicted that people would want to resist change when they believe the world is declining (and meta-analyses have failed to identify an overall association between Progressing and conservatism; Clifton & Kerry, 2023).

So far, research on the Progressing (vs. declining) subscale has been restricted to predicting conservative ideology, showing no overall effect (Clifton & Kerry, 2023). In contrast, our approach provides a more nuanced and detailed understanding of beliefs about trajectories of change, and we examine both relationships with political orientation and show the relevance of change worldviews to responses to a broad range of social issues, identifying relationships even after controlling for political orientation.

4 | THE PRESENT RESEARCH

In this research we develop the first measures to assess the extent to which people endorse change worldviews, their demographic associations including political orientation, and their relevance to responses in diverse social change contexts. Study 1 establishes initial measures of these worldviews, identifies basic demographic associations, and provides a first examination of their associations with sustainability policies and behaviours. Study 2 refines the change worldview measures for use in later studies. Study 3 applies change worldviews to responses to innovations

(Study 3a: social robots; Study 3b in-vitro meat), controlling for demographics and values. Study 4 examines political voting preferences, focusing on the 2016 US election, controlling for beliefs about specific impacts of the election outcome (e.g., on the economy) and other common explanations for the Trump/Republican victory. In this study we also describe a replication with the 2019 United Kingdom election to identify general and specific associations with voting. In Study 5 we examine change worldviews and responses to sustainability across 10 countries/regions drawn from five continents. Together, these studies show that change worldviews constitute a distinct set of beliefs that uniquely predict responses across various (but not all) contexts.

5 | STUDY 1: THE STRUCTURE AND MEASUREMENT OF CHANGE WORLDVIEWS, AND THEIR IMPLICATIONS FOR SUSTAINABILITY

The main aim of Study 1 was to identify the factor structure of items we developed to measure change worldviews. Items were created at an abstract level, using broad statements about change to achieve conceptual separation between worldviews and context-specific judgements. Different items emphasized change processes or the goals of change to identify whether they factored together (e.g., for Progress, believing that the world is getting better [process] or we should be trying to make the world better [goal]). We were particularly interested in whether there were strong correlations with political orientation, which would suggest that some change worldviews might function as proxies for liberal/conservative ideology. We also correlated measures with demographics to help understand who was more likely to hold each worldview.

The second aim was to examine implications for people's attitudes towards sustainability. While sustainability is commonly associated with the environment, it is a broader concept that spans environmental, economic, and social goals and trade-offs (Bain et al., 2019; Purvis et al., 2019). Therefore, we assessed people's attitudes and intentions that spanned environmental sustainability (pro-environmental behaviour), social sustainability (activities to reduce the chance that social issues like inequality will lead to social unrest, e.g., corporate social responsibility [CSR] where companies pursue socially-beneficial outcomes beyond private profit), and economic sustainability (e.g., supporting austerity policies to keep economic debt at levels that can be maintained into the future). As sustainability is often focused on finding optimal trade-offs between competing interests, we expected a Balance change worldview would be most strongly related to endorsement of sustainability policies and behavioural intentions.

5.1 | Method

This exploratory study was conducted in 2013 and was not pre-registered. Study 1 materials were collected as part of a larger survey (titled "Personal views and ideals") to be used for several student and academic projects but combined to use limited research resources more efficiently. Change worldviews items were a core element and shown to all participants, and approximately three-quarters of participants completed the sustainability measures (with others completing a student experiment on consumer decision-making). Participants also rated their ideals for themselves and society. After these measures, subsets of participants were randomly assigned to pilot different experimental manipulations/primes of the change worldviews (e.g., visual and linguistic priming, parables, mottos—these were ineffective). These permutations resulted in 19 versions of the survey, but the change worldview measure was always completed before all other measures except ideals.

5.1.1 | Participants

Our target sample was 1000 participants to provide two $n=500$ subsamples to conduct exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) on change worldviews. Sample size considerations were not straightforward because these are new measures, so the factor structure and strength of loadings could not be clearly predicted. Instead we relied on general heuristics, with a sample of 500 described as "very good" for EFA (Tabachnick & Fidell, 2001). For CFA, we based our sample size on finding at least three items per factor with relatively low minimum loadings for items (>0.4), for which sample sizes above 400 are recommended (Jackson et al., 2013).

We aimed to recruit 1100 US-based participants from Amazon's Mechanical Turk, expecting to exclude about 10% due to non-attentive responding. In total, 1327 participants commenced the survey and 1088 completed it. We randomly allocated participants to EFA or CFA subsamples using a median split on a variable created using the uniform random variable function in SPSS. We then applied exclusions based on two indicators of non-attentive responding: (a) "flat-line" pattern-responding, exhibited by no variation in ratings for the change worldviews items; and (b) long survey completion time (>1 h). Exclusions were lower than expected, resulting in a final sample of 1068 with 538 participants in Study 1a (EFA; 56% female; age, $M=33$, $SD=12$) and 530 in Study 1b (CFA; 52% female; age, $M=33$, $SD=12$).

5.1.2 | Materials

5.1.2.1 | Change worldviews

We generated an item pool to represent the five change worldviews. Some change worldviews seemed relatively

clear (Golden Age, Endless Cycle) and we struggled to generate non-redundant items beyond the four we used. It was easier to generate more items for Progress, Maintenance, and Balance. In all, we used 31 items, with 4–7 items per construct (see Table 1). Ratings were made on a 7-point scale labelled −3 (*Strongly Disagree*), −2 (*Disagree*), −1 (*Somewhat disagree*), 0 (*Neither agree nor disagree*), 1 (*Somewhat agree*), 2 (*Agree*), and 3 (*Strongly agree*). Item order was randomized across participants.

5.1.2.2 | Responses to sustainability issues

5.1.2.2.1 | Pro-environmental intentions.
This group of items assesses intentions to engage in 11 domestic pro-environmental behaviours, such as avoiding using cars or air-conditioning and using low-energy lighting, adapted from previous research (Bain et al., 2012, 2016; McDonald et al., 2013). Participants were asked how often they intended to engage in these behaviours, with intentions assessed on a 5-point scale from 1 (*Never*) to 5 (*Always*), plus an "na" (not applicable) option. One participant was excluded based on missing/na ratings for more than half the items. Scale reliability was very good ($\alpha = 0.81$).

5.1.2.2.2 | Human utilization of nature.
This 10-item subscale from the Environmental Attitudes Inventory (Milfont & Duckitt, 2010) reflects believing nature is primarily a resource for achieving human economic goals, and can be considered a measure of opposition to environmental sustainability. A sample item is "The question of the environment is secondary to economic growth." Ratings were made on a 7-point scale from 1 (*Strongly disagree*) to 7 (*Strongly agree*), including five reversed items, with very good reliability ($\alpha = 0.83$).

5.1.2.2.3 | Reducing population growth.
This 10-item scale is also from the Environmental Attitudes Inventory (Milfont & Duckitt, 2010), and used the same rating scale as Human utilization of nature. In the Environmental Attitudes Scale it is labelled "Support for population growth policies," but was relabelled here to make it clearer that higher scores represent support for reducing population growth (sample item: "We should strive for the goal of 'zero population growth'"; $\alpha = 0.92$).

5.1.2.2.4 | Corporate social responsibility.
This measure was adapted from a 12-item measure of CSR expectations (Kolkailah et al., 2012), using the same 7-point disagree–agree scale as for change worldviews. We omitted an item focusing on obligations towards shareholders/suppliers (as we do not consider this part of CSR), and split a compound item about community responsibility ("It is the responsibility of non-Governmental organizations to help the community and society, not companies"), into three items reflecting different types of organizations ("responsibility of non-Governmental organizations…"; "responsibility of

Government…"; "*not* the responsibility of companies…"). A factor analysis (principal axis) revealed a single factor, but four items least conceptually related to CSR showed low loadings (<0.5), and their omission resulted in an 8-item scale with good reliability ($\alpha = 0.84$; sample item: "Companies must play a role in our society that goes beyond the mere generation of profits").

5.1.2.2.5 | Government intervention.
Two items from the General Social Survey (Smith et al., 2019) focused on the extent to which the US government should act to address standards of living and income inequality. The standards of living item was "Some people think that the government in Washington should do everything possible to improve the standard of living of all poor Americans. Other people think it is not the government's responsibility, and that each person should take care of himself. Where would you place your own view on this scale?" This was rated on a 7-point scale labelled at each end (from *Government should do everything to improve the standard of living of all*, to *Each person should take care of themselves*). The income inequality item was "Some people think that the government in Washington ought to reduce the income differences between the rich and the poor, perhaps by raising the taxes of wealthy families or by giving income assistance to the poor. Others think that the government should not concern itself with reducing these income differences between the rich and the poor. Where would you place your own view on this scale?" This was also rated on a 7-pont scale labelled at each end (from *Government ought to reduce the income differences between the rich and the poor*, to *Government should not concern itself with reducing income differences between the rich and the poor*). After reversing the first item, ratings of the two items were highly correlated ($r = 0.70$) and were combined for analysis.

5.1.2.2.6 | Global financial crisis approval.
Six items (one reversed) were developed for this study to index a positive attitude towards the global financial crisis (GFC), using the same 7-point disagree–agree scale as for societal change worldviews. Items assessed different aspects of this issue including its consequences (e.g., "For all its short-term harm, the GFC was necessary to make the economy more stable"). A principal axis EFA indicated a single factor, but one item was omitted due to low loading (<0.5), resulting in a 5-item scale ($\alpha = 0.82$).

5.1.2.2.7 | Austerity support.
Also developed for this study, six items (2 reversed) indexed support for economic austerity measures (e.g., "I think greater austerity is necessary for the good of American society"), using the same 7-point disagree–agree scale as change worldviews. A principal axis EFA indicated a single factor. Four items loaded above 0.5 on this factor and these items were used in the scale ($\alpha = 0.86$).

TABLE 1 Factor analyses of items measuring change worldviews (Studies 1 and 2).

"We want to know about your general views about the world and how it works. Please rate the extent to which you agree or disagree with the statements below"	Exploratory factor analysis (Study 1a, n=538)					Confirmatory factor analysis (Study 1b, n=530)					Exploratory factor analysis (Study 2, n=198)				
	Factor loadings					Standardized loadings					Factor loadings				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Progress															
In the long-run, everything moves in the direction of improvement	0.67					0.78					0.72				
All things have a natural inclination to progress and improve	0.60					0.72					0.72				
As a general principle, everything builds and improves on what has gone before	0.56					0.71					0.79				
Progress is a law of nature that cannot be resisted	0.56					0.63					0.53				
You cannot stop progress – in fact we should do all we can to speed it up	0.59					0.55					—	—	—	—	—
People should do all they can to speed up progress	—	—	—	—	—	—	—	—	—	—	0.45				
People should focus on getting the best of everything	0.56					—	—	—	—	—	—	—	—	—	—
An important goal in life is to get better and better	0.48					—	—	—	—	—	—	—	—	—	—
"More is better than less" is a useful basic outlook on life	0.41					—	—	—	—	—	—	—	—	—	—
You can never have too much of a good thing	0.39		−0.50			—	—	—	—	—	—	—	—	—	—
Golden Age															
Things will never again be as good as they used to be		0.69					0.79					0.74			
The world has passed its peak—overall, things now are on the decline		0.67					0.73					0.54			
When I think about the past, it seems preferable to contemplating the future		0.45					0.50					0.60			
I wish we could go back to the "good old days"		0.68					0.75					0.81			0.33
Endless Cycle															
Even when there seems to be a lot of change, underneath things stay basically the same				0.59					0.68					0.84	
The world works in an endless cycle—in the long-run, nothing changes fundamentally				0.56					0.61					0.51	
History usually repeats itself with little real advance			0.43	0.42					0.69					0.65	
I agree with the saying that "The more things change, the more they stay the same"				0.60					0.56					0.58	
Maintenance															
In general, I like keeping things just as they are		0.59					0.70								0.58
When things are good, I do not see the need to try to make them better		0.56					0.56								0.50
Maintaining things just as they are can be even more rewarding than changing them		0.51					0.61								0.58

TABLE 1 (Continued)

"We want to know about your general views about the world and how it works. Please rate the extent to which you agree or disagree with the statements below"	Exploratory factor analysis (Study 1a, *n*=538) Factor loadings					Confirmatory factor analysis (Study 1b, *n*=530) Standardized loadings					Exploratory factor analysis (Study 2, *n*=198) Factor loadings				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
I think "If it ain't broke, do not fix it" is an important principle in life		0.55					0.61								0.59
There's too much emphasis on change—there should be more emphasis on stability		0.54					0.69								0.50
Change should only occur when there's a really good reason for it		0.50				–	–	–	–	–	–	–	–	–	–
Nothing should change for change's sake		0.49													
Balance															
*In general, it's important to maintain a balance between having too much and too little				0.65					0.66		0.71				
"Everything in moderation" is a great guiding principle for life				0.56					0.69		0.74				
*We should always try to achieve a state of "balance"	–	–	–	–	–	–	–	–	–	–	0.59				
*I agree with the saying "nothing in excess"	–	–	–	–	–	–	–	–	–	–	0.78				
Everything in this world should try to achieve a state of "balance"				0.55					0.55		–	–	–	–	–
You can have too much of even the best things				0.56					0.40		0.44				
There are always forces moving us towards a state of equilibrium or harmony	0.42					–	–	–	–	–	–	–	–	–	–
An ongoing task in life is to find the best trade-off between competing demands						–	–	–	–	–	–	–	–	–	–
In general, people should strive for the "middle ground"						–	–	–	–	–	–	–	–	–	–
The best way to live life is to find a middle balance between extremes											0.71				

Note: Boldfaced numbers indicate loadings on the expected factor, and non-boldfaced numbers indicate cross-loadings. In exploratory factor analysis, loadings below 0.32 are omitted as they represent negligible loading/cross-loading (Tabachnick & Fidell, 2001). Dashes mean an item was not used in the study. *Italicized* items were used in Study 1. Boldfaced items were used in the 20-item measure (4 items per scale). Items with * were used in the short 15-item measure (3 items per scale) in the cross-cultural Study 5.

5.1.2.2.8 | Demographics

We obtained basic demographic information (age, gender, education, political orientation). For political orientation, participants rated themselves on a 7-point scale labelled 1 (*Extremely liberal*), 2 (*Liberal*), 3 (*Slightly liberal*), 4 (*Moderate/middle of the road*), 5 (*Slightly conservative*), 6 (*Conservative*), and 7 (*Extremely conservative*).

5.1.3 | Procedure

These measures were rated as part of a larger study. At the beginning, all participants rated change worldviews and a measure of their personal and societal ideals (Hornsey et al., 2018). After these measures, participants were randomly assigned to one of two projects—the main project focused on the sustainability measures above (*n*=795: Study 1a, *n*=402; Study 1b, *n*=393), and a smaller undergraduate student project focusing on CSR in a specific company. Here we report the results for the main project.

After making these ratings we piloted ways to manipulate the salience of different change worldviews, but manipulations were unsuccessful and are not reported. Demographic information was obtained at the end. The survey took <20 min to complete on average (Study 1a: *M*=19 min, SD=9; Study 1b: *M*=18 min, SD=8).

5.2 | Results

We first report the EFA and CFA of change worldviews, then their associations with demographics and responses to sustainability issues.

5.2.1 | Exploratory factor analysis—Study 1a

Principal axis factoring was used to examine the structure of worldviews. Eight factors had eigenvalues greater than 1, but a scree plot suggested a five-factor structure (see Figure S1), supported further by parallel analysis (O'Connor, 2000) where the eigenvalue for the fifth factor (1.34) was the last factor to exceed the 95th percentile of the corresponding eigenvalue from a randomized dataset (1.32; see Study 1 in Appendix S1 for details). Therefore, a five-factor solution was chosen, explaining 48% of the variance.

Item loadings after varimax (orthogonal) rotation are shown on the left side of Table 1. The overall factor structure was clear, with most items loading on the expected factors (>0.5), only two cross-loadings (>0.32 on more than one factor), one Balance item loading weakly on a different factor (0.42), and some items loading poorly on all factors (<0.32). We note that Progress and Golden Age were distinct factors, as were Maintenance and Endless Cycle, suggesting people did make similar distinctions to those found in academic disciplines.

5.2.2 | Confirmatory factor analysis—Study 1b

Selection of items for the CFA applied two criteria to the items in Study 1a: (a) a minimum of four and maximum of five items per factor; and (b) loadings of 0.5 or above from the EFA. These criteria conflicted for two items (one each for Golden Age and Endless Cycle), where the fourth item loaded above 0.4 but not 0.5, and we decided to include these items in the CFA. This resulted in analysing 22 items (italicized in Table 1: 4 for Balance, Golden Age, and Endless Cycle; 5 for Progress and Maintenance).

Confirmatory factor analysis was performed in Amos Version 24 using the generalized least squares function, with one case with missing data deleted to allow modification indices to be computed. Errors were not allowed to correlate, providing a conservative estimate of model fit. Hoelter's critical N indicated that the sample size was adequate ($N(05) = 346$). The model did not fit the data perfectly, $\chi^2 = 359.88$, $p < 0.001$, but this measure is sensitive to large samples and the normed χ^2 (χ^2/df) was 1.81, meeting the recommended value of <2 (Kline, 2005). The root mean square error of approximation (RMSEA) showed excellent model fit (0.04; 90% confidence interval [CI: 0.03, 0.05]). However, the model performed poorly on the comparative fit index (CFI), which was 0.78 (when ideally it would be at 0.95 or above; Lai & Green, 2016), which can be attributed to the baseline model also having relatively good fit (baseline model RMSEA = 0.08). Further exploratory analyses based on modification indices did not achieve acceptable model fit on the CFI. Explanations for

discrepancies in fit indices are complex and often do not follow assumptions common among psychologists (Lai & Green, 2016). In this case we proceeded with interpreting this model because several indicators reflected good fit, and we note here that CFA results were consistently more acceptable in later studies.

For the CFA, standardized estimates relating items to their corresponding factors are shown in the middle section of Table 1. Each item loaded strongly on its corresponding factor, with one exception. The fourth Balance item ("You can have too much of even the best things") showed a weak standardized estimate (0.40). Estimates for relations between factors ranged from −0.27 (between Progress and Golden Age) to 0.66 (between Golden Age and Maintenance). The latter suggests that Golden Age and Maintenance may show greater overlap than suggested by the EFA.

Based on these findings, scales of the five worldviews were created using the average for items selected for the CFA except for the Balance item "You can have too much of even the best things" due to its low loading. This resulted in 5-item scales for Maintenance and Progress, 4-item scales for Golden Age and Endless Cycle, and a 3-item scale for Balance. Table 2 reports the descriptive statistics and correlations for the sample as a whole. Reliabilities were good for all scales except Balance, which was marginally acceptable. While interpretation of mean differences is somewhat ambiguous due to differences between items, we note that Balance was the most strongly endorsed worldview and Golden Age the least endorsed (but also showed the greatest variation). Correlations between 0.4 and 0.5 between Golden Age, Endless Cycle, and Maintenance suggested substantial overlap, although not redundancy. Progress showed the least overlap with other worldviews.

Table 2 also shows that societal change worldviews were not strongly related to political orientation, age, or gender (most correlations were below 0.1), although many were statistically significant due to the large sample size. The strongest correlation showed more politically conservative participants endorsed Golden Age beliefs ($r = 0.26$), but this still reflects <7% shared variance and all other correlations were $r = 0.16$ or lower. This is initial evidence that change worldviews are not just proxies for political orientation.

5.2.2.1 | *Responses to sustainability*

Table 3 reports associations between change worldviews and responses to sustainability issues in each subsample. Boldfaced correlations were significant in both subsamples, indicating replication. Significant correlations were weak-to-moderate (the highest was 0.32, representing 10% shared variance). Balance showed the most consistent associations, being significant for six of the eight issues in both samples for measures spanning all aspects of sustainability. Progress, Golden Age, and Maintenance showed significant associations, consistent across subsamples, for

TABLE 2 Reliabilities, descriptive statistics, and intercorrelations for change worldview scales (Studies 1a and 1b combined).

				Intercorrelations				Correlations with demographics		
	Reliability (α)	M	SD	1	2	3	4	Age	Gender[a]	Liberal– conservative political orientation
1. Progress	0.77	0.84	0.97					−0.14***	−0.04	−0.10**
2. Golden Age	0.79	−0.32	1.19	−0.13***				0.07*	0.01	0.26***
3. Endless Cycle	0.72	0.19	0.96	−0.01	0.45***			0.07*	0.06	0.11***
4. Maintenance	0.76	0.19	0.96	−0.05	0.50***	0.42***		0.06*	0.02	0.16***
5. Balance	0.68	1.39	0.90	0.25***	0.13***	0.23***	0.26***	0.07*	0.16***	−0.08*

Note: N = 1068.

[a]Point-biserial correlation, females coded with higher value.

*p < 0.05; **p < 0.01; ***p < 0.005.

at least one issue, but these were for social and economic issues. Only Endless Cycle did not show consistent significant correlations with any issue.

As a set of beliefs, change worldviews were most relevant to support for CSR, which was endorsed more by those with stronger Balance worldviews and endorsed less by those with stronger Golden Age and Maintenance worldviews. In contrast, relationships were very weak/inconsistent for population control and austerity even though these might plausibly be related to Balance—population control to balance human needs and natural resources, and austerity to balance government finances.

To establish whether change worldviews explain responses beyond associations with demographic variables, for each issue we conducted hierarchical regressions entering demographics (age, gender, political orientation) at the first step, and change worldviews at the second step (detailed results are reported in Table S2). In summary, people's responses were generally related to political orientation, but in both subsamples change worldviews explained significant additional variance for environmental intentions, utilization of nature, CSR, and GFC approval. They explained significant additional variance for government intervention in Study 1a, and for population control in Study 1b. The patterns of relationships were generally consistent with the correlations in Table 3. Only political orientation and Balance showed consistently significant associations across samples when controlling for other variables.

5.3 | Discussion

A five-factor structure of change worldviews was supported strongly in the EFA, and received good but not universal support in the CFA. We identified a reasonably consistent set of items to measure each change worldview, although reliability for Balance was a little lower than desired. While change worldviews could involve both processes and goals, Progress and Endless Cycle items that

loaded more strongly tended to be more about processes, Balance and Maintenance more in terms of goals, and Golden Age spanned processes and goals.

The Balance worldview was most consistently associated with responses to a broad range of sustainability issues. It may be that sustainability issues are seen as failures of balance—perhaps where the interests of some people or groups have taken priority over others, whether it be humans over nature (giving rise to pro-environmental intentions) or companies over communities (and thus support for CSR), as well as believing governments can intervene to restore these imbalances (endorsing government intervention). These relationships may reflect common public beliefs that achieving sustainability involves managing competing interests and goals (Bain et al., 2019).

Golden Age and Maintenance were associated with lower support for CSR, suggesting people with these worldviews see CSR as an undesirable departure from the present and past ways that business operated. Although the Golden Age measure does not specify a timeframe, this association could evoke a mid-1990s "greed is good" neoliberal economic era, also consistent with Golden Age being associated with opposition to government intervention.

Weak relationships for Endless Cycle were not unexpected. Endless Cycle evokes a more passive view of change that may leave little room for individual agency. But we were surprised that Progress was not more prominently associated with people's responses, and was even associated with relative endorsement of the GFC. It may be that this crisis was seen as important for progress through creating more stable conditions for progress in the future, with the behaviour of banks and large corporations at the time being impediments to longer-term progress. But we also note that the sustainability topics we focused on were mostly about constraint (e.g., reducing population growth, economic austerity) rather than advancement. Progress might be more strongly associated with issues involving "pushing the boundaries" to solve problems, such as adopting new technologies to address

TABLE 3 Correlations between societal change worldviews and responses to social issues (Study 1a and 1b).

| | Environmental | | | | | | Social | | | | | | Economic | |
| | Pro-environmental intentions | | Human utilization of nature[a] | | Reducing population growth | | Corporate social responsibility | | Government intervention | | GFC approval | | Austerity support | |
Study	1a	1b	1a	1b	1a	1b	1a	1b	1a	1b	1a	1b	1a	1b
Change worldview														
Progress	0.04	0.10*	−0.10*	−0.09	−0.03	0.06	0.05	0.22***	0.06	0.04	0.17***	0.19***	0.05	−0.07
Golden Age	0.02	0.08	0.24***	0.07	−0.07	−0.02	−0.18***	−0.28***	−0.18***	−0.12*	0.08	−0.03	−0.01	0.07
Endless Cycle	0.03	0.09	0.11*	0.07	−0.02	−0.12*	−0.09	−0.12*	−0.05	−0.06	0.10*	0.03	0.01	0.02
Maintenance	−0.11*	0.06	0.17***	0.03	−0.07	−0.13*	−0.15***	−0.15***	−0.15***	−0.10	0.09	0.09	−0.05	0.07
Balance	0.21***	0.23***	−0.19***	−0.30***	−0.02	0.06	0.30***	0.32***	0.20***	0.14***	0.16***	0.22***	0.07	−0.01

Note: Study 1a, $n=402$; Study 1b, $n=393$. Correlations significant in both studies are boldfaced.

Abbreviation: GFC, global financial crisis.

[a]For this scale higher scores indicate lower sustainability as it means placing lower priority on environmental concerns.

*$p<0.05$; **$p<0.01$; ***$p<0.005$.

sustainability issues. We explore this in Study 3b when we examine support for and opposition to in-vitro meat.

Overall, this study shows that change worldviews represent a coherent set of beliefs, and that Balance beliefs were especially related to people's views about sustainability. But some issues with items and reliability suggested a need for scale refinement, which was the focus of Study 2.

6 | STUDY 2: REFINING THE CHANGE WORLDVIEWS MEASURE

In this study we aimed to refine the change worldview measures to create reliable 4-item scales for each dimension. Most changes involved improving the less reliable Balance scale by removing, rephrasing, and adding items, and we made minor changes to improve clarity (see Table 1). A subsidiary aim was to assess discriminant validity, so we correlated change worldviews with common individual difference measures including personality, values, satisfaction with life, and affect. We summarize those findings below, with details in Appendix S1 for Study 2.

6.1 | Method

This exploratory study was not pre-registered. We aimed to recruit 200 US adult participants through Amazon's Mechanical Turk. This target sample size was based on Study 1 showing a clear factor structure with relatively strong loadings, for which samples of 150–200 have been claimed to be adequate for EFA (Guadagnoli & Velicer, 1988; Tabachnick & Fidell, 2001), but it was also constrained by budget limitations. Two hundred twenty-three participants began the survey and 205 completed (92% completion rate). Three were excluded as non-US citizens, and four were excluded for flat-line pattern-responding on change worldview items. This resulted in 198 participants (40% male; age: $M=37$, SD=13). Participants completed an online survey with the revised change worldviews items shown in Table 1, rated using the same scale as in Study 1. They also completed individual difference measures assessing personality, values, satisfaction with life, affect, and individualism–collectivism (details in Appendix S1).

6.2 | Results

Due to item changes and additions we performed EFA, using principal axis factoring with varimax (orthogonal) rotation. Both a scree plot and parallel analysis supported a five-factor solution (see Appendix S1 for Study 2), explaining 63% of the variance with item loadings shown on the right side of Table 1. Loadings on the expected factors were strong. Only one cross-loading (0.33) was observed, but this item loaded strongly on the intended factor (>0.8) and was retained.

To select items for the scales we used a combination of loading strength, conceptual spread (preferring items that were less similar to other items in the scale), and face validity. For example, to increase face validity for Maintenance we retained the item that explicitly mentioned maintenance ("Maintaining things…"), rather than an item with slightly stronger loadings. These items are boldfaced in Table 1, with reliabilities, means, and correlations in Table 4. Compared to Study 1, Balance was more reliable but Maintenance was less reliable, although it was also less correlated with other change worldviews than in Study 1. While strictly speaking EFA and CFA should not be performed on the same data, given the mixed findings in Study 1 we note for diagnostic purposes that a CFA on the final 20-items (no correlated errors) again showed good fit for normed χ^2 (1.8) and RMSEA (0.06; 90% CI [0.05, 0.07]), and a CFI (0.90) that was better than in Study 1 although still not excellent.

Here we present a summary of associations between change worldviews and demographic/individual difference constructs (details are provided in Appendix S1, where we also generate profiles of those holding each worldview). Correlations were usually low to moderate ($r_{max} = 0.36$) and the strongest associations were typically with values. Using Schwartz's value model (Schwartz, 1992), those with stronger Progress worldviews placed greater importance on values expressing openness to change (e.g., Hedonism, Self-direction) and outcomes for the self (e.g., Achievement), but also outcomes for others (Universalism). Golden Age and Maintenance were both associated with the same Conservation values (Tradition, Conformity), but Maintenance was also positively associated with Self-enhancement (especially Power). Balance was associated most strongly with Self-transcendence values (Universalism, Benevolence). Endless Cycle was not significantly associated with any value, nor any other individual difference.

Those with stronger Progress and Balance worldviews were also more likely to report greater purpose and meaning in life (Life satisfaction—Flourishing) and were more collectivistic. Those with stronger Progress worldviews reported more positive affect.

As in Study 1, correlations with demographics were generally low. Liberal-conservative political orientation was moderately correlated with Golden Age ($r = 0.21$) and

Maintenance ($r = 0.23$), but not other change worldviews. The strongest correlation was between religiosity and Golden Age ($r = 0.33$).

6.3 | Discussion

Building on Study 1, five change worldviews were again identified, and 4-item scales for each worldview were created. Reliability for Maintenance was lower than desired, but we note that these items showed acceptable reliability in later studies. These change worldview scales showed low to moderate correlations with individual difference and demographic variables, indicating they are distinct from common individual difference constructs. Having settled on this 20-item measure, we returned to examining how these change worldviews matter in social change contexts, focusing first on supporting/opposing innovations.

7 | STUDY 3: CHANGE WORLDVIEWS AND RESPONSES TO INNOVATIONS

In this study we examined whether change worldviews were related to supporting or opposing societal uptake of innovation. Although businesses and governments invest about USD1.7 trillion in research and development (2020 data; http://uis.unesco.org/apps/visualisations/research-and-development-spending/) to expand our capabilities and solve problems more effectively, such innovations are often targets for public resistance and even organized push-back resulting in slow or stalled public uptake. Improving understanding of public responses can help increase public uptake of worthwhile innovations.

While responses to innovations will undoubtedly be influenced by views specific to the technologies involved, we propose that more general change worldviews can also influence how new technologies are perceived. Those with a Progress worldview are more likely to embrace a wide variety of new technologies and innovations because these innovations indicate progress and improvement. In contrast, those with a Golden Age worldview are more likely to oppose innovations as they move society further away from its ideal past, except perhaps where

TABLE 4 Reliabilities, descriptive statistics, and intercorrelations for 4-item change worldview scales (Study 2).

| | Reliability (α) | M | SD | Correlations | | | |
				1	2	3	4
1 Progress	0.78	0.68	1.04				
2 Golden Age	0.81	−0.33	1.39	−0.17*			
3 Endless Cycle	0.77	0.08	1.09	0.00	0.41***		
4 Maintenance	0.64	0.21	1.00	0.04	0.36***	0.34***	
5 Balance	0.80	1.21	0.98	0.15*	0.12	0.17*	0.09

*$p < 0.05$; **$p < 0.01$.

they hold the promise of making society more similar to that past. Beyond these more obvious associations, those with Maintenance may oppose innovations as unnecessary when things are already good, and those with Endless Cycle may be ambivalent about innovations as they may see improvements in technology as unlikely to have long-lasting effects. It is difficult to make predictions about Balance as its relevance is likely to be influenced by whether a technology is viewed as moving society towards or away from a balanced state.

We chose to focus on two emerging technologies—social robots (Study 3a) and in-vitro meat (Study 3b). Each of these technologies have moved past proof-of-concept stages and are in the process of upscaling for wider societal use. Humanoid social robots are starting to be used in people's homes to guide people through healthcare treatment (e.g., weight loss, exercise) and for support and interaction in aged-care, but the ethical and practical implications of their use is hotly debated (Coeckelbergh, 2016; Sparrow, 2016). In-vitro meat (also called "cultured," "clean," "lab-grown," or "synthetic" meat) involves painlessly taking muscle cells from live animals and growing these cells in nutrients to produce meat. Public and consumer research has revealed diverse attitudes to in-vitro meat (Verbeke, Marcu, et al., 2015; Verbeke, Sans, & Van Loo, 2015; Wilks et al., 2019). In-vitro meat is also a technology intended to increase sustainability, so it provides a context where Balance may also be relevant.

We also wanted to test whether change worldviews predicted responses to innovations independently of people's values, to demonstrate that these worldviews can add to our understanding of people's responses beyond this prominent individual difference construct. It is also important to control for whether people are generally more positive about innovations—their self-perceived innovativeness. Innovativeness can vary across domains, but is also a global trait (Goldsmith & Foxall, 2003) with two main dimensions (Goldsmith, 1991)—being willing to try new ideas and inventions (Willing to try), and seeing oneself as creative and liking novelty (Creative). Hence, we examined whether change worldviews predict responses to innovations independently of values and self-perceived innovativeness.

While most attention to innovation in previous research has focused on personal use of technologies by consumers, given our focus on social change we focused more on whether change worldviews may be more relevant to supporting/opposing their wider adoption in society, for example, an individual may not personally want to use a social robot but believe that they should be widely available for those that do. Hence, we asked people to indicate their intentions to act in support of, or opposition to, the broader adoption of these innovations in society. While active support and opposition might be seen as two poles of a continuum, this is not necessarily the case—failing to act in support of a technology may be a psychologically different judgement than actively opposing a technology. Therefore, we measured both support and opposition intentions and conducted factor analyses to determine whether they should be treated as a single factor or as separate scales.

7.1 | Method

This exploratory study was not pre-registered, and the analyses reported are not the full set of measures. This is because these studies were run with students who added a wider range of independent and dependent variables (e.g., for social robots: emotional reactions to social robots, whether social robots should be used in educating autistic children; for in-vitro meat: perceived naturalness of in-vitro meat, and what they would be willing to pay for an in-vitro meat burger). Here we focused on the focal and shared measures across studies—intentions to act to support/oppose the wider uptake of a technology. Participants also completed another individual difference measure relating to their ideal lives, but this was not relevant to this project and was not analysed for this report. The sample size was chosen to be the maximum possible with the funds available at the time.

7.2 | Participants

Participants were recruited through Amazon's Mechanical Turk, with 614 people providing complete data for analyses. Participants in both subsamples had similar demographic profiles (Study 3a: $n = 311$; 44% female; age, $M = 35$, SD = 11; Study 3b: $n = 305$; 44% female; age, $M = 35$, SD = 11).

7.3 | Materials

7.3.1 | Descriptions of innovations

Both innovations were described in detail to ensure all participants had some basic information about them (see Appendix S1). These descriptions included images and diagrams, and for social robots included a short video showing someone interacting with an advanced humanoid social robot. In each description we aimed to convey a neutral description of these technologies, with an emphasis on describing their features and functions without claiming they were good or bad.

7.3.2 | Change worldviews

These were measured using the 20-item measure from Study 2.

7.3.3 | Innovativeness

We used the global innovativeness scale (Goldsmith, 1991), which has two subscales: Willing to try (seven items, e.g., "I am aware that I am usually one of the last people in my group to accept something new" [reversed]) and Creativity (five items, e.g., "I am an inventive kind of person"). These were rated on a 5-point scale labelled 1 (*Strongly disagree*) to 5 (*Strongly agree*). Reliabilities for both scales in both studies were very good (αs > 0.84).

7.3.4 | Values

We used the 10-item Short Schwartz Value Survey (Lindeman & Verkasalo, 2005) that measures the importance of 10 value domains of the circumplex model of values (Schwartz, 1992).

7.3.5 | Support and opposition

7.3.5.1 | Study 3a (social robots)

We adapted a measure of environmental citizenship (Bain et al., 2016; Stern et al., 1999) that focuses on intentions to engage in political and public behaviours, such as voting for politicians, signing petitions, donations to relevant organizations, and sharing information on social media. Extending the original measures that focused on supporting change (Support scale, e.g., "I would sign a petition to increase government funding of social robot research"), we included matching items to measure opposing political change (Opposition, e.g., "I would sign a petition to stop government funding of social robot research"), with six items per scale. These were rated on a 5-point scale from 1 (*Strongly disagree*) to 5 (*Strongly agree*). EFA (principal axis factoring, varimax rotation) found they were separate dimensions (details in Appendix S1 for Study 3). Both scales were highly reliable (both αs = 0.88) and uncorrelated ($r = 0.01$, $p = 0.883$).

5.3.5.2 | Study 3b (in-vitro meat)

We used 11 items, with 6 measuring Support (e.g., "I would sign a petition in support of the implementation of in-vitro meat in supermarkets/restaurants") and 5 measuring Opposition (e.g., "I would vote for a candidate in an election, at least in part, because he or she was opposed to funding and implementation of in-vitro meat into society"), which were not completely matched. These were rated on a 5-point scale from 1 (*Strongly disagree*) to 5 (*Strongly agree*). Again, EFA indicated these loaded onto separate factors (see Appendix S1 for Study 3), resulting in two highly reliable scales (Support, $\alpha = 0.93$; Opposition, $\alpha = 0.91$), which were moderately negatively correlated ($r = -0.29$, $p < 0.001$).

7.4 | Results

We first used CFA to examine the factor structure of change worldviews using the full dataset (combining Studies 3a and 3b). It fell short of desired fit on normed χ^2 (2.3) but showed very good fit for both RMSEA (0.05; 90% CI [0.04, 0.05]) and CFI (0.95). This further supports a conclusion from Study 2 that the factor structure of change worldviews, although not perfect, is reasonable and usable. Moreover, scales for all change worldviews were reliable (Study 3a; all αs > 0.73; Study 3b; all αs > 0.75).

In Study 3a (social robots), the mean level of intentions to act in support of societal adoption of social robots was below the midpoint of the scale, $M = 2.66$, SD = 0.98, and opposition intentions were even lower, $M = 1.94$, SD = 0.92. In Study 3b (in-vitro meat), support intentions for societal adoption of in-vitro meat were at about the midpoint of the scale, $M = 3.10$, SD = 1.17, and opposition was lower, $M = 1.92$, SD = 1.01. Standard deviations indicate wide variation in intentions to support these technologies, suggesting that, overall, while people did not have strong intentions to actively support the technologies they were even less inclined to actively oppose them.

Table 5 shows the correlations and regression betas for support and opposition for both innovations. Starting with correlations examining support, across both innovations support was higher for those with a Progress worldview. Other variables were correlated with one innovation only. Support for social robots was positively associated with Endless Cycle, and support for in-vitro meat was lower for people with Golden Age and Maintenance worldviews. Of the other constructs, support for both innovations was associated with Innovativeness—Creative (but not Innovativeness—Willing to try), but otherwise support for each innovation was associated with different values and demographic indicators.

Table 5 shows fewer significant associations when independent relationships with support were assessed in regressions. Multicollinearity in both models was acceptable (variance inflation factors [VIFs] < 2.5), and the model explained 21% of the variance for supporting social robots, $F(21,289) = 3.59$, $p < 0.001$, and 20% of the variation for supporting in-vitro meat, $F(21,281) = 3.38$, $p < 0.001$. Being creative continued to be a significant predictor of support for both innovations, and Endless Cycle predicted support for both innovations (even though its correlation with supporting in-vitro meat was nonsignificant). Also diverging from correlation patterns, Progress was significant only for supporting social robots. Other correlations did not translate to significant betas, suggesting some complex overlaps in predicting support for in-vitro meat with these variables.

For opposing these innovations, Table 5 shows more consistent patterns of correlations. Golden Age had the strongest positive correlation with opposing both

TABLE 5 Correlations and regressions assessing support/opposition to social robots (Study 3a) and in-vitro meat (Study 3b).

	Support				Opposition			
	Social robots		In-vitro meat		Social robots		In-vitro meat	
	r	β	r	β	r	β	r	β
Demographics								
Gender (dummy: 1=male)	−0.05	−0.07	−0.10	−0.13*	0.08	0.07	0.03	0.06
Age	−0.08	−0.02	−0.13*	−0.09	0.02	0.01	−0.08	−0.03
Relative income	0.01	0.07	−0.07	−0.15*	−0.05	−0.04	−0.10	−0.02
Liberal–conservative	−0.08	−0.10	−0.19***	−0.13	0.19***	0.04	0.29***	0.16*
Innovativeness								
Willing to try	0.03	−0.03	0.09	−0.15	−0.29***	−0.21***	−0.29***	−0.01
Creative	0.28***	0.20***	0.30***	0.29***	0.07	−0.21***	−0.09	−0.01
Values								
Power	0.25***	0.17**	0.09	0.06	0.11	−0.03	0.24***	0.07
Achievement	0.20***	0.10	0.09	−0.07	0.10	0.04	0.13*	0.04
Hedonism	0.05	−0.01	0.13*	0.05	−0.10	−0.08	0.09	0.00
Stimulation	0.09	−0.07	0.18***	−0.04	−0.08	−0.03	0.06	0.03
Self-direction	−0.03	−0.12	0.12*	−0.06	−0.09	−0.04	−0.15**	−0.04
Universalism	0.08	0.08	0.18***	0.03	−0.21***	−0.12	−0.11	0.03
Benevolence	0.00	0.03	0.09	0.11	−0.06	0.00	−0.10	−0.05
Tradition	0.01	−0.03	−0.14*	−0.10	0.24***	0.05	0.28***	0.02
Conformity	0.07	0.09	−0.08	−0.04	0.19***	0.09	0.28***	0.08
Security	0.06	−0.05	0.01	0.09	0.05	−0.10	0.07	−0.12
Change worldviews								
Progress	0.22***	0.19***	0.17***	0.07	−0.05	−0.02	0.03	0.07
Golden Age	−0.01	−0.01	−0.14*	−0.11	0.37***	0.23***	0.44***	0.30***
Endless Cycle	0.15**	0.14*	0.00	0.14*	0.24***	0.03	0.29***	0.05
Maintenance	−0.04	−0.08	−0.14*	−0.10	0.25***	−0.04	0.28***	0.02
Balance	0.00	−0.07	−0.02	−0.01	0.06	0.00	0.02	−0.03

*$p<0.05$; **$p<0.01$; ***$p<0.00$.

innovations, and Endless Cycle and Maintenance also showed clear positive correlations with opposition. Innovativeness—Willing to try showed significant negative correlations with opposition, but Innovativeness—Creative did not. Opposition was also stronger for Conservatives and those who adhered more to two Conservation-associated values (Tradition, Conformity). Some values showed associations specific to one innovation, with Universalism negatively associated with opposition to social robots, Power/Achievement values positively associated with opposition to in-vitro meat, and Self-direction values negatively associated with opposition to in-vitro meat.

Using regressions to assess independent relationships with opposition, both models explained significant variance: 24% for social robots, $F(21,289)=4.27$, $p<0.001$; and 27% for in-vitro meat, $F(21,281)=4.88$, $p<0.001$ (multicollinearity was identical to the support regression). The single consistent (and strongest) predictor across both innovations was Golden Age. Those who saw themselves as more innovative (both dimensions) were less likely to oppose social robots, but innovativeness did not predict opposition to in-vitro meat. Opposition to in-vitro meat was independently associated with a more conservative political orientation. No values were independent predictors of opposition to either innovation.

7.5 | Discussion

Overall, intentions to support and oppose these innovations showed complex relations, but there was clear evidence that supporting and opposing innovation are different, and different change worldviews mattered for each. Focusing on correlations, those with a Progress worldview showed stronger intentions to support adoption of innovations into society, and those with Golden Age and Maintenance worldviews showed stronger intentions to oppose them. In regressions assessing these

relationships independent of demographics, global innovativeness, and values, Golden Age remained a significant predictor of opposition to innovation, and Progress was a predictor of active support for social robots.

Endless Cycle showed unexpected and difficult-to-interpret relationships. Although we expected it would not be strongly related to either active support or opposition, it showed significant positive correlations with both support *and* opposition to social robots, and opposition to in-vitro meat. Regressions also indicated that it was related to support for in-vitro meat after controlling for other predictors. Although we interpret this finding with some hesitancy, it may be that for these innovations the worldview that things change cyclically might motivate ambivalence (and hence willing to both support and oppose when asked questions about each) rather than indifference.

Just as different change worldviews were important for understanding support and opposition, this was also the case for values and global innovativeness. Correlations showed that those for whom Power and Achievement (Self-enhancement) values are more important showed greater support for social robots, but greater opposition to in-vitro meat. Similarly, different elements of global innovativeness were related to actively supporting or opposing innovation. It appears that the distinction between active support and active opposition is important for understanding responses to innovations. We also note that, beyond political orientation, demographic variables were unrelated to support/opposition to innovation, and even political orientation was less relevant after controlling for psychological variables.

Comparing these findings to Study 1, Balance was not related to responses to innovations, even for in-vitro meat which is a pro-sustainability innovation. We note that the description of in-vitro meat focused mainly on the technology/innovation aspects, with environmental implications mentioned only briefly, which may have meant people focused just on the innovation and not its implications for sustainability. This further suggests that the relevance or salience of change worldviews may differ across domains—describing something as an innovation might activate Progress more easily than Balance, whereas focusing on sustainability may make links to Balance more salient.

Overall, these findings indicate that change worldviews were relevant to responses to innovation, with people endorsing Progress more likely to support innovations and those endorsing Golden Age and Maintenance likely to oppose them. Relationships were difficult to interpret for Endless Cycle, and there were no relationships with Balance. However, apart from Golden Age showing robust independent relationships with opposition, relations between change worldviews (and other constructs, including self-perceived innovativeness) appear to vary across innovations.

8 | STUDY 4: CHANGE WORLDVIEWS AND VOTING

In this study we extended consideration of domains where change worldviews may be relevant by examining a political context—voting. Change worldviews may be important in elections because those who govern shape the policies and priorities for a country's future. In considering who to vote for, people may invoke their beliefs about where society is heading and prefer the political party they feel better represents their preferred change worldview (e.g., those endorsing Maintenance preferring a party they think will try to keep things as they are today).

The 2016 US election was particularly interesting because change worldviews were explicitly invoked in candidates' campaigns. Trump's prominent "Make America Great Again" motto clearly referenced a Golden Age worldview by presenting American society as in decline from an idealized past (with a promise to make the USA more like that past). The Clinton campaign's response, "we don't need to make America great again. America has never stopped being great" (Clinton, 2016), invokes a Maintenance worldview of stability at a high level of "greatness" over time, which ostensibly should be appealing as it also portrays a positive ingroup stereotype. We were particularly interested if people with a Golden Age worldview were more likely to vote for Trump/Republicans, if those with a Maintenance worldview would vote for Clinton/Democrats, and if other change worldviews might also explain voting preferences in this election.

A strong test for the usefulness of these general worldviews is whether they can predict people's responses over and above more contextual and fine-grained beliefs about change. To do this, we also obtained measures of how people thought a Trump/Republican or Clinton/ Democrat government would change society if they won the election. For this we used measures drawn from the "collective futures" framework (Bain et al., 2013) that assesses context-specific beliefs about change in the future with respect to indicators of development (e.g. economic, technological) and dysfunction (e.g. crime, poverty), as well as the character of its people (their warmth, competence, and morality). This framework has been applied to a broad range of social and political contexts including abortion laws and climate change (Bain et al., 2012, 2013, 2016). Essentially, it asks people to consider a specific future state of society (such as Republicans winning the election) and assessing the extent of change (including no change) that would result for development and dysfunction in society (such as improvements in the economy or reduced crime), and for the warmth and competence of people in society (such as whether people would become more or less friendly, skilled, and moral). If general change worldviews explained variance in people's responses beyond these context-specific beliefs about change, this

would underscore the psychological relevance of these context-general worldviews beyond context-specific change beliefs.

We also wanted to understand if change worldviews contributed to voting preferences independent of other major explanations for voting, especially in the 2016 US election. In the build-up to the 2016 US election there was a strong media focus on demographic characteristics of Trump voters, particularly his appeal to poor rural White men (although this has been criticized as too simplistic; Pettigrew, 2017). Other explanations invoked people's motivations to "tear down the system" by electing a Washington outsider, suggesting low endorsement of system justification—people's motivations to maintain a stable society, endorsed even by those disadvantaged in that society (Jost et al., 2004; Jost & Hunyady, 2002). We note that the opposite was subsequently established, with Trump supporters actually endorsing system justification more (Azevedo et al., 2017). However, we retained system justification in our analysis due to this significant association and its potential conceptual overlap with Maintenance.

Another explanation for Trump's success was that his derogation of Muslims, Mexicans, African Americans, women, and other groups appealed to people inclined to prejudice. As social dominance orientation (SDO) underpins wide-ranging prejudice, a preference for Trump/Republicans has been related to endorsing social dominance (Choma & Hanoch, 2017; Pettigrew, 2017).

In a particularly strong test of the explanatory power of change worldviews, we also report analyses controlling for the strength of people's identification as a Republican or Democrat. In our view these identities are essentially proxies for voting intentions—for example, voting for a Republican is the most defining behaviour of someone who identifies as Republican. In political science, however, party identification is often distinguished from voting (Lewis-Beck et al., 2008). It would be a particularly powerful demonstration if change worldviews were related to voting intentions independently of party identification. At the same time, as party identification is likely to be very highly correlated with voting intentions, this may influence other regression coefficients. Hence, we report regressions both with and without political identification.

Finally, we aimed to establish whether these expected associations between change worldviews and voting intentions in the US (Golden Age and voting for conservative parties; Maintenance and voting for more liberal parties) were unique to this US context or represent general associations. To do this, we replicated the study with a UK sample just before the 2019 UK election to predict Labour/Conservative voting preferences. While these samples differ in multiple ways, if both samples show similar patterns of prediction in voting preferences except for Golden Age or Maintenance, this would suggest there

was something distinctive about the importance of these change worldviews.

8.1 | Method

These studies were not pre-registered and additional measures not analysed are described in Appendix S1. Sample sizes reflected the maximum we could obtain within our budget at the time of the study.

8.1.1 | Participants

8.1.1.1 | US sample

Participants were 482 adult US citizens recruited through Amazon's Mechanical Turk (an additional 27 non-US citizens also completed the survey but were excluded). This sample was 55% male with a mean age of 37 (SD = 12). Seventy-five percent classified themselves as White/Caucasian, 9% as African American/Black, 7% as Asian/Pacific Islander, 6% as Latina/Latino, and 3% as multiracial or other ethnicities. On religion, 26% were Protestant, 16% Catholic, 2% from other Christian denominations, 6% from other religions, and 54% said they were non-religious (not religious, atheist, or agnostic). AMT is not a nationally representative sample but is typically more representative than other types of convenience samples (Buhrmester et al., 2011), and similar to online samples that attempt to be nationally representative such as the American National Election Panel Study (Berinsky et al., 2012). In the main text we describe findings without weighting responses to match the US voting population on key demographic variables, and we report analyses using demographic weighting in Appendix S1, which does not change the interpretations. Further demographic information including geographic distribution is contained in Appendix S1.

8.1.1.2 | UK sample

Participants were 327 adult UK citizens recruited through the UK-based survey company Prolific Academic (an additional 23 non-UK citizens also completed the survey but were excluded). This sample was 49% male with a mean age of 45 (SD = 15). Eighty percent classified themselves as White, 8% as Asian/Asian British, 5% as Black/African/Caribbean/Black British, 1% as Arab, and 6% as multiracial or other ethnicities. On religion, 20% were Protestant, 12% Catholic, 1% from other Christian denominations, 9% from other religions, and 58% said they were non-religious (not religious, atheist, or agnostic). We report unweighted findings for this sample.

8.2 | Materials

8.2.1 | Change worldviews

We used the 4-item scales (boldfaced items in Table 1).

8.2.2 | System justification

System justification was adapted from the 8-item general System Justification scale (Kay & Jost, 2003) to focus on political system justification by removing one item relating to economic system justification and adding two political items. This scale had good reliability ($\alpha = 0.86$).

8.2.3 | Social dominance orientation

Social dominance orientation was measured using the 8-item SDO_7 (Ho et al., 2015), rated on a 7-point scale from 1 (*Strongly oppose*) to 7 (*Strongly favour*). This scale was highly reliable ($\alpha = 0.92$).

8.2.4 | Political identification

We used single-item identification scales (Postmes et al., 2012) for each party: "I identify with the [Republican/Democrat] party" (US) and "I identify with the [Conservative/Labour] party" (UK). These were rated on a 7-point scale from −3 (*Strongly disagree*) to +3 (*Strongly agree*).

8.2.5 | Demographics

Participants provided extensive demographic information. Measures used in the regressions are described below.

8.2.5.1 | Relative income
Participants read the following: "The average annual income for households in The United States of America nowadays is about $52,000 [American Census Bureau, 2013]. Considering all of the sources of income of members of your household, is your income…": 1 (*very much above the average*), 2 (*above the average*), 3 (*a little above the average*), 4 (*about average*), 5 (*a little below the average*), 6 (*below the average*), and 7 (*very much below the average*). Scores were reversed so higher ratings reflected higher income.

8.2.5.2 | Ethnicity
In the US sample participants selected their ethnicity from this list of categories: African American/Black, American Indian, Asian/Pacific Islander, Latina/Latino, Multiracial, and White/Caucasian. In the UK sample participants selected their ethnicity from this list of categories: Arab, Asian/Asian British, Black/African/Caribbean/Black British, Mixed/multiple ethnic groups, White. In both studies these categories were displayed in a randomized order across participants, with the option of "other" at the end where they could write in a different ethnicity. For analysing White ethnicity, we created a dummy variable (White/Caucasian=1, other ethnicities=0).

8.2.5.3 | Rural/urban
Participants indicated whether they lived in a more rural/country area or a more urban/city area, using a 5-point scale: 1 (*very rural/country*) to 5 (*very urban/city*).

8.2.5.4 | Religion
Participants selected their religion from 11 categories. Seven were religious categories: Buddhism, two Christian denominations (Catholic, Protestant), two Islamic denominations (Shia, Sunni), Judaism, and Hinduism. Three were non-religious categories: atheist, agnostic, and I do not belong to a religion but I am not atheist or agnostic. A final "other" category allowed people to specify other religions, other religious denominations, or other belief systems (e.g., spirituality). These categories were dummy-coded into 1=Christian and 0 for all other categories.

8.2.6 | Voting preference

Participants were asked "When thinking about your vote, if you had to choose between the two main parties (US: Republicans and Democrats; UK: Conservatives and Labour), how strong is your voting preference for these parties?" Ratings were made on a 7-point scale, from 1 (*Strongly leaning to [Democrats/Labour]*) through 4 (*Completely undecided*) to 7 (*Strongly leaning to [Republicans/Conservatives]*), with an additional option "I would definitely not vote for either party." Participants selecting the last option (US: $n = 17$; UK: $n = 15$) were excluded.

8.3 | Procedure

For the US sample data were collected on 1 November 2016, 1 week before the election. For the UK sample data were collected on 7 December 2019, 5 days before the election. Surveys were completed online in a setting at participants' discretion. Each survey was introduced as a study on the consequences of the election. At the beginning of the survey participants were told that responses were anonymous and confidential, that the survey was for academic research purposes only, and that the researchers were not aligned with any political party. The order of measures was collective futures, political responses, change worldviews, system justification, SDO, and demographics. Participants could choose to skip any item. US surveys took an average of 15 min (SD=8) and UK surveys 14 min (SD=6).

8.4 | Results

8.4.1 | Preliminary analyses

We performed CFA on the change worldview measure, which showed it was just short of desired fit on normed χ^2 (2.2) but had very good fit for RMSEA (0.05; 90% CI

[0.04, 0.06]), and close to a good fit for CFI (0.94). A single modification, allowing covariance between errors for two Balance items, increased CFI to a conventionally accepted value (0.95). This provides further evidence that the factor structure of the change worldviews measure is reasonable. All change worldview scales were reliable (all αs > 0.76).

CFA showed good fit on normed χ^2 (1.8) and very good fit for RMSEA (0.05; 90% CI [0.04, 0.06]), but less good fit for CFI (0.93). After removing three cases with missing data to compute modification indices, and restricting modifications to correlating errors within scales, CFI reached acceptable fit (0.95) after allowing two correlated errors within Balance, two correlated errors within Golden Age, and one correlated error within Progress. Overall, these findings also support the five-factor structure of the change worldviews measure in a different Western country. All change worldview scales were reliable (all αs > 0.74).

Descriptive statistics for all key variables are contained in Appendix S1 for Study 4. For collective futures dimensions, previous research has shown that Benevolence (combined morality and warmth) and Competence form distinct dimensions of beliefs about society's future (Bain et al., 2013), but in the US sample these dimensions were very highly correlated (Republican future, $r = 0.85$; Democrat future, $r = 0.88$). Hence, we examined the structure of responses in this sample using EFAs (principal axis factoring with varimax rotation). For both Republicans and Democrats these analyses identified the same two factors (based on scree plots and Kaiser's criterion of eigenvalues >1), which corresponded to valence (positive and negative characteristics). Hence, scales were created for Positive Characteristics (Republican, $\alpha = 0.95$; Democrat, $\alpha = 0.95$) and Negative Characteristics (Republican, $\alpha = 0.92$; Democrat, $\alpha = 0.92$). For analyses, collective futures ratings were made comparative by subtracting Democrat ratings from Republican ratings for each dimension, meaning a positive score represents society with a Trump/Republican administration more than a Clinton/Democrat administration having greater Positive Characteristics, greater Negative Characteristics, greater Societal Development, and lesser Societal Dysfunction. We used the same scales in the UK sample to ensure the comparisons were consistent.

8.4.2 | Predicting voting preference

We performed multiple regressions to identify the predictors of voting intentions while controlling for other constructs. In the US sample there was evidence of multicollinearity due to overlap between the collective futures dimensions of Positive Characteristics and Societal Development (VIFs > 5), so Positive Characteristics was removed from the model which reduced multicollinearity (all VIFs < 3.2), and was also removed from the model for the UK sample for consistency.

In the US sample, the model without party identification explained 67% of the variance in voting preferences, $F(16,447) = 55.65$, $p < 0.001$. Adding party identification increased multicollinearity somewhat (max VIF = 4.1) but we chose to retain all variables and this model explained 83% of the variance in voting preferences, $F(18,445) = 124.24$, $p < 0.001$. Table 6 shows the zero-order correlations for each variable along with standardized scores (betas) from both regressions. Unsurprisingly, party identification was the strongest predictor of voting preference, consistent with their zero-order correlations ($r = 0.80$). Of the other predictor categories, collective futures showed strong and consistent relationships with voting preference, especially for Societal Development, with a correlation almost as strong as for party identification—believing a Trump administration would result in relatively greater technological and economic development was very strongly related to voting for Trump/Republicans. Christianity and social dominance orientation were also significant predictors of supporting Trump both before and after controlling for party identification.

Most relevant, however, is that Golden Age predicted a Trump/Republican voting preference independently of all other predictors, including party identification. Beta values suggest that the magnitude of the association is similar to SDO or being Christian. These associations persisted after weighting by age, gender, and political orientation to match national demographics (see Appendix S1 for Study 4), with the main difference for weighted regressions being that system justification was also a significant predictor before party identification was included.

The correlations for change worldviews in Table 6 showed that all change worldviews except Balance were related to voting preference, although not independently of other predictors. In a rejection of the Clinton "maintenance" response to Trump's campaign, Maintenance was correlated positively with a preference for Trump/Republicans, not Clinton/Democrats.

Table 6 shows that the equivalent models in the UK showed generally similar patterns but differed in the importance of Golden Age. Overall, the model without party identification explained 75% of the variance in voting preferences, $F(16,294) = 53.99$, $p < 0.001$, and with party identification explained 89%, $F(18,292) = 127.15.24$, $p < 0.001$. In the latter model one VIF was >5 (Societal Development, VIF = 6.6) but was retained to facilitate US/UK model comparisons.

As in the US sample, in the UK party identification, perceived Societal Development, and SDO all predicted a voting preference for Conservatives, with similar beta values. In the UK men were also slightly more likely than women to prefer Conservatives. A notable difference however, was that Golden Age was not a significant predictor of voting preference in the UK. Although the zero-order correlation between Golden Age and voting preference was significant in both samples, a Fisher's Z-test that showed that the correlation was significantly

TABLE 6 Correlations and regressions predicting Republican/Trump or Clinton/Democrats (US 2016) and Conservative or Labour voting preference (UK 2019).

	US 2016			UK 2019		
	Correlation	Regression (without party identification)	Regression (with party identification)	Correlation	Regression (without party identification)	Regression (with party identification)
Demographics		β	β		β	β
Gender (dummy: 1=*male*)	0.05	0.01	0.02	0.10*	0.05	0.04*
Age	0.06	−0.01	−0.02	0.24***	0.01	0.01
Relative income	0.07	0.00	0.01	0.04	0.05	0.04
Rural/Urban	−0.09*	−0.03	−0.01	−0.07	−0.01	−0.01
Ethnicity (dummy: 1=White)	0.12**	0.05	−0.01	0.09	0.06	0.03
Christian (dummy: 1=Christian)	0.36***	0.12***	0.05*	0.19***	0.02	0.03
Ideologies						
System justification	0.17***	0.05	0.02	0.36***	0.03	0.03
Social dominance orientation	0.56***	0.16***	0.07***	0.55***	0.13***	0.07*
Collective futures *(difference score: Republican minus Democrat; Conservatives minus Labour)*						
Positive character[a]	0.69***	–	–	0.73***	–	–
Negative character	−0.54***	0.00	0.01	−0.44***	−0.03	−0.01
Societal dysfunction	0.45***	0.00	0.02	0.72***	−0.01	−0.05
Societal development	0.77***	0.60***	0.20***	0.85***	0.74***	0.21***
Party identification						
Republican (US)/Conservative (UK)	0.80***	–	0.34***	0.82***	–	0.39***
Democrat (US)/Labour (UK)	−0.80***	–	−0.39***	−0.83***	–	−0.42***
Change worldviews						
Progress	−0.15***	−0.01	0.01	0.08	0.04	0.00
Golden Age	0.42***	0.12***	0.08***	0.14**	0.06	0.02
Endless Cycle	0.19***	0.00	−0.02	0.14**	0.00	0.03
Maintenance	0.33***	0.01	0.02	0.21***	0.02	0.00
Balance	−0.07	−0.04	−0.02	0.00	0.04	0.03

Note: Positive coefficients denote a stronger Republican (US) or Conservative (UK) voting preference.

[a]This measure was removed from regressions to reduce multicollinearity.

*p < 0.05; **p < 0.01; ***p < 0.005.

higher in the US sample: $Z=4.26$, $p<001$. Of the other change worldviews, Maintenance and Endless Cycle were correlated with a voting preference for Conservatives, but no change worldview predictors remained significant after controlling for other variables in the regressions.

8.5 | Discussion

Change worldviews had clear and independent relationships with voting preference in the 2016 US election. A Golden Age worldview predicted a voting preference for Trump/Republicans, which was independent of people's personal backgrounds (gender, ethnicity, income), ideologies (system justification, social dominance), beliefs about specific future changes in society (e.g., economic and technological development), and even their identification as a Republican or Democrat. Notably, this relationship with Golden Age was not observed in the UK 2019 election,

even though other predictors of voting preferences were similar, suggesting that strong emphasis on Golden Age in the Trump campaign may have been involved in voting preferences for Trump/Republicans, even among those who did not identify as Republicans. We also note that Balance showed the weakest associations with voting preferences, in contrast to Study 1, indicating that while the structure of change worldviews is consistent, their relevance varies across contexts.

While this study cannot establish causation, we speculate that it would be a remarkable achievement if a political campaign was able to create a belief, from nothing, that the US was in decline. We think it is more likely that people already held a worldview that society is in decline, which provided fertile ground for the Trump campaign's "Make America Great Again" message. By making this worldview highly salient (a key outcome of political framing, Chong & Druckman, 2007; Nelson et al., 1997), this slogan might have influenced the way people with this worldview

understood the election, and their openness to Trump's promises to return them to the greatness of the past.

Considering findings across both samples suggests that change worldviews may need to be made prominent to play a meaningful role in voting. Political campaigns are likely to invoke images of decline (as a result of their opponents past actions or if their opponent gains power), and to invoke progress and maintenance of the best things about society if they gain power. But even though the UK sample showed significant correlations between voting preferences and some change worldviews, these relationships were not independent of demographic and psychological predictors in the way that Golden Age was in the US sample. Appendix S1 for Study 4 shows that the mean level of endorsement of Golden Age was not higher in the US than the UK, so it is also unlikely that the beliefs about decline were especially prevalent in the US. While we do not have direct evidence, taken together it suggests that concerted effort and emphasis, in this case invoking Golden Age as a central campaign strategy, might be able to activate people's change worldviews when they contemplate how to vote.

9 | STUDY 5: CHANGE WORLDVIEWS AND SUSTAINABILITY ACROSS COUNTRIES

Studies 1–4 established the factor structure and measurement scales of change worldviews and their associations with supporting or opposing social change, but all were conducted in Anglo-Western countries, and all except one sample was from the USA. In Study 5 we examined the cultural generalizability of these worldviews, as well as how they are associated with sustainability.

While some change worldviews such as Balance and Endless Cycle may conceptually appear to be more grounded in Asian/Eastern philosophy, Studies 1–4 shows that US people also understand and distinguish these beliefs about change. Indeed, while East Asian concepts such as dialecticism might be less prevalent in the West, they are held to varying degrees in both Western and Asian countries (Spencer-Rodgers et al., 2018). Thus, while there may be some culture-specific elements of change worldviews (Zhang et al., 2018), there is also a reason to examine the extent to which these constructs are relevant to people across cultures.

Assessing measurement invariance is a common way to examine the equivalence of measures across samples (Rutkowski & Svetina, 2013). At the most basic level, *configural invariance* means the items show the expected patterns of associations across populations, but the strength of association can vary between items. For *metric invariance*, the strength of factor loadings for the items should be equivalent across populations—this establishes that measures are similar enough for their correlations with other constructs to be compared. *Scalar invariance* establishes that equivalent responses to items produce the same latent means, which

is important for directly comparing means across samples. *Strict invariance* equates the residual variances, strengthening the validity of mean comparisons. We examined the extent of measurement invariance for the five-factor change worldviews measures across 10 countries/regions.

Data reported in this study were collected as part of a larger cross-cultural survey (see Hornsey et al., 2018, Study 1), resulting in restrictions in the number and length of measures. As it was not possible to cover all issues from previous studies, we chose to focus on the sustainability topics of pro-environmental intentions and CSR. Our aim was to identify how change worldviews were associated with responses to these sustainability issues, whether these varied across countries/regions, and if so, what might explain these differences.

9.1 | Method

Data, including descriptions of variables, are available online at https://osf.io/u92d3/?view_only=37c88bd19dfb413195d0bb827a17b97a. This exploratory study and analyses were not pre-registered, and the measures included in this study were collected as part of a larger cross-cultural study spanning multiple research questions.

9.2 | Participants

Participants were recruited from 10 countries/regions: nine countries spanning five continents (USA, Australia, Chile, Peru, China, India, Japan, Russia, Spain), and one autonomous region (Hong Kong). Sample sizes were consistent or larger than other cross-national comparisons published in major journals focusing on psychological variables using original data rather than established survey panels (Gelfand et al., 2011; Terracciano et al., 2005). In all countries/regions but Spain participants were recruited through commercial survey companies. Spanish participants were recruited through a community college, and were older and more diverse than typical student samples. After excluding non-citizens, non-adults, those with missing data for the change worldview scales, and pattern-responders, the final sample was 2140 participants. Sample details and demographics are contained in the Supplemental Materials.

9.3 | Materials

9.3.1 | Change worldviews

To address space/time constraints in the larger survey we created a shorter 15-item change worldviews measure (3 items per dimension, marked * in Table 1), omitting items we judged would be difficult to translate or used expressions likely to be culturally specific (e.g.,

"If it ain't broke, don't fix it"). After data collection we identified one mistranslation in the Chinese/Hong Kong surveys that was not captured in back-translations, with the Golden Age item "When I think about the past, it seems preferable to contemplating the future" translated to instead suggest a negative evaluation of the past: "When I think about the past, it seems preferable to contemplate the future." This item was excluded from analyses.

9.3.2 | Pro-environmental intentions

Six items were adapted from previous cross-cultural work on climate change (Bain et al., 2016). Three items measured pro-environmental intentions using six items spanning three public behaviours (pro-environmental voting, donations, petitions) and three personal behaviours (reduce meat consumption, car travel, air conditioning/heating). EFAs in each country/region identified a single factor with loadings above 0.4 for all items in all countries/regions, with two exceptions (donations in Peru and reducing car travel in Hong Kong). We decided these deviations were minor enough to continue to create scales using all items in each country/region, with reliabilities ranging from $\alpha=0.65$ (Chile) to $\alpha=0.85$ (Japan).

9.3.3 | Corporate social responsibility and neoliberal attitudes

We included four items from the CSR measure in Study 1. Two items indexed CSR in that study: "Companies must be socially responsible even when it negatively affects their economic performance" ("Social responsibility"); "Companies should play a role in our society that goes beyond the mere generation of profits" ("Beyond profit"). Two reversed items from that measure did not load on the scale in Study 1, but were included in this study as they appeared to index a distinct neoliberal economic philosophy about companies as having a singular role in society to pursue profit (Friedman, 1970): "Companies must obtain maximum profit from their activities" ("Profit maximization") and "Companies should not direct part of their budget to donations and social work" ("No donations"). EFAs were used to assess the dimensionality of these items.

9.3.4 | Procedure

Participants in the countries/regions except Spain were recruited by Survey Sampling International (SSI) through their online panels, responding to an invitation to take part in a study called "Personal Ideals and Views." Participants were reimbursed for the time taken at a rate set by SSI. The median time taken to complete the full survey ranged from 23 min (Japan) to 42 min (Peru).

9.4 | Results

9.4.1 | Measurement invariance: Change worldviews

We examined measurement invariance for the short five-factor change worldviews measures across the 10 countries/regions using CFA, focusing on RMSEA and CFI. As recommended by Widaman and Thompson (2003), for CFI the comparative null model set each item to have equal variance, equal means across groups, and all items as uncorrelated.

The configural invariance model showed slightly inconsistent fit indices, with RMSEA showing a very good fit (0.021), but was very slightly below a desirable level on CFI (0.944). Given that these are not strict decision criteria, we concluded that the strong RMSEA and the closeness of the CFI values to conventional standards of good fit was acceptable for our purposes, and proceeded to examine stricter forms of measurement invariance.

When examining measurement invariance with 10 groups or more (as in this study), Rutkowski and Svetina (2013) recommend assessing metric invariance using change in RMSEA (ΔRMSEA) of no more than 0.01, and change in CFI (ΔCFI) of no more than 0.02. On these criteria the change worldviews showed metric invariance (ΔRMSEA=0.010; ΔCFI=0.014), indicating that items loaded on the corresponding constructs to an equivalent degree across countries/regions. There was no support for scalar invariance (ΔRMSEA=0.013; ΔCFI=0.146), and attempts to establish partial scalar invariance by releasing constraints on the model did not improve this substantially (minimum ΔCFI=0.055).

In sum, this evidence indicates metric invariance, such that the five-factor change worldview measure can be reasonably used in correlational analyses (e.g., how they are related to demographics or other variables in each country/region), but a lack of scalar invariance indicates that mean score comparisons across countries/regions are less meaningful. Therefore, we focused on associations within each country/region with responses to social issues, using meta-analyses to consider variation in these associations.

9.4.2 | Measurement invariance: Pro-environmental intentions

We used the same approach to assess measurement invariance for pro-environmental intentions. Consistent with the distinction between public and private pro-environmental behaviours in previous cross-cultural research (Bain et al., 2016), a two-factor model distinguishing public and private pro-environmental items showed very good configural invariance (RMSEA=0.025, CFI=0.975) and metric invariance (ΔRMSEA=0.002; ΔCFI=0.006). However, scalar invariance was not established (ΔRMSEA=0.020; ΔCFI=0.123) and relaxing

assumptions was not successful in establishing partial scalar invariance. Thus, these measures were used to examine correlations with change worldviews, but comparisons of means across countries/regions is not warranted.

9.4.3 | Measurement invariance: Corporate social responsibility

We used the same approach to assess measurement invariance for the four CSR items. However, this model could not be fitted for metric invariance. EFA in each country/region (principal axis factoring, varimax rotation) identified that even subsets of items did not show consistent patterns of factor loadings across countries/regions, hence these items were analysed individually.

9.4.4 | Relative importance across countries/regions

While the lack of scalar invariance makes it more problematic to directly compare means across countries/regions, we can identify differences in relative endorsement by assessing whether patterns of means within each country/region differ systematically across countries/regions. For example, if Progress has a higher mean rating than Golden Age in the USA, but Golden Age is rated higher than Progress in India, this suggests that these countries differ in their relative endorsement of these change worldviews, even if cultures differ in overall endorsement of items.

We examined this formally using a mixed analysis of variance (ANOVA) with the five change worldview scales as a 5-level within-subjects factor, and country/region as a 10-level between-subjects factor. While main effects are not directly interpretable, the focal interaction effect was significant, $F(36,8520) = 28.64$, $p < 0.001$, partial $\eta^2 = 0.11$. The patterns of means in each country/region are shown in Figure 2, showing a similar general pattern from the lowest endorsement of Golden Age to highest endorsement of Balance, but with variation across countries/regions (the separate panels [a–c] of Figure 2 show groups of countries/regions with similar patterns).

To interpret this interaction, we conducted repeated-measures ANOVAs in each country/region with repeated contrasts to identify mean differences between adjacent change worldviews. We identified three main exceptions to the overall pattern (for more contrast analysis details see Appendix S1). Figure 2a shows that, in American countries and Spain, Maintenance was not endorsed more than Golden Age, either being not significantly different (Spain, USA) or significantly lower (Chile, Peru). In these countries, the idea of returning to a superior past was equally or more endorsed as keeping society as it is today, although both were endorsed less than other change worldviews.

The second exception was in East Asia and Australia (Figure 2b), where Endless Cycle was not endorsed more strongly than Maintenance, being either not significantly different (Australia, Hong Kong, Japan) or significantly lower (China). While Endless Cycle has a strong cultural affinity with religions prominent in East Asia, this did not translate into relatively greater endorsement compared to endorsing stability.

The third exception was found in India and Russia (Figure 2c), where Progress was endorsed to a similar degree as Balance. Both these countries are major emerging economic powers (along with China part of the acronym of major developing economies called BRICS [Brazil, Russia, India, China, South Africa]), so being in a period of rapid economic development may have increased endorsement of Progress in these countries.

9.4.5 | Associations with responses to sustainability issues

Correlations between change worldviews and sustainability topics were obtained in each country/region, with meta-analyses (DerSimonian-Laird estimation using Jamovi; jamovi project, 2020) used to examine overall relationships and variation across countries/regions (Table 7).

Starting with overall (mean) effects, most change worldviews were significantly positively correlated with sustainability for some issues, which was also the case for the US sample in Study 1. However, differences in consistency and strength of associations were apparent. Progress and Balance showed strongest relationships for issues involving social responsibilities of business, and the contrasting view that companies should not make donations was strongest for those with Golden Age, Endless Cycle, and Maintenance. For environmental issues, all change worldviews showed similar overall associations, contrasting with Study 1 where only Balance showed strong relationships.

However, overall effects need to be considered in the context of significant variation across countries/regions (Q) for most associations, typically with 60%–90% of this variation attributable to real differences in effect sizes across countries/regions (I^2). Forest plots in Appendix S1 for Study 5 indicate that effects usually varied from null to strong positive correlations. However, some meta-analyses showed consistently significant positive effects that varied in strength; for example, Balance was associated with stronger support for businesses having responsibility beyond profit in all countries/regions, but this was much stronger in Hong Kong than in Chile or Spain. In a small number of meta-analyses some countries/regions showed significant correlations in opposing directions, for example, the association between Progress and environmental citizenship was significantly negative in Japan and significantly positive in India. That is, in Japan a Progress worldview functioned as an impediment to environmental
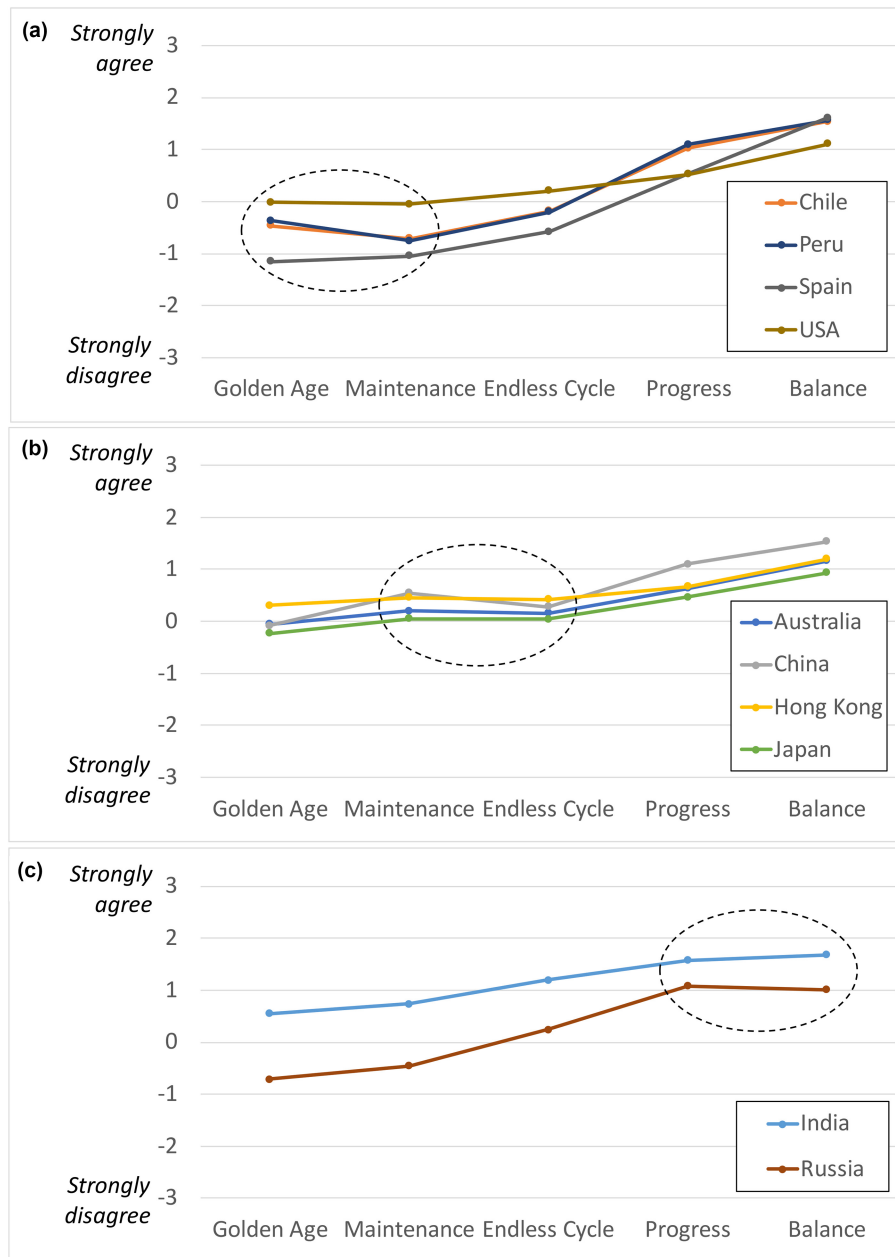
FIGURE 2 Three patterns of means indicating different relative priorities of change worldviews across countries (key differences indicated using dashed ellipses). (a) Maintenance not being endorsed more than Golden Age, as either non-significantly different or significantly lower. (b) Endless Cycle not endorsed more than Maintenance, as either non-significantly different or significantly lower. (c) Progress endorsed to a similar degree as Balance.

citizenship, but in India believing in Progress was a motivator of environmental citizenship.

We examined potential moderators of significant differences across countries/regions using meta-regressions, run separately for each moderator due to the small number of countries/regions (see Appendix S1 for Study 5 for details). Moderators examined were four sociological indicators (Human Development Index [HDI]; Gross Domestic Product per capita [GDP-ppp]; inequality [Gini index]; and Environmental Performance Index [EPI]), and four cultural indicators (Individualism–Collectivism, Power Distance, Masculinity–Femininity, Uncertainty

Avoidance; Hofstede et al., 2010). However, we accept that with 10 countries/regions the power of moderation tests is likely to be low, such that these analyses are primarily intended to provide a first indication and possible pointers to future larger-scale studies.

From these meta-regressions one cultural indicator was most consistently and strongly associated with variation across countries/regions: Uncertainty Avoidance, which relates to the emphasis placed on rules and laws to guide behaviour and public opinion. Uncertainty Avoidance was a significant moderator for 20 of the 25 meta-analyses where significant variation across countries/regions was

TABLE 7 Meta-analyses of associations between change worldviews and responses to social issues across 10 countries (Study 5).

	Environmental		Social		Economic (neoliberal)	
	Environmental citizenship	Household	Social responsibility	Responsibility beyond profit	Profit maximization	No donations
Progress						
Effect	0.11*	0.12***	0.17***	0.18***	0.19***	0.05
Q	49.6***	27.4***	38.1***	31.7***	8.46	38.5***
I^2	82	67	76	72	0	77
Golden Age						
Effect	0.10***	0.08**	0.05	−0.02	0.09*	0.27***
Q	9.3	18.7*	43.5***	16.5	40.4***	70.4***
I^2	3	52	79	45	78	87
Endless Cycle						
Effect	0.10*	0.11***	0.10*	0.04	0.14***	0.21***
Q	29.5***	26.5***	34.7***	24.3***	35.8***	31.7***
I^2	70	66	74	63	75	72
Maintenance						
Effect	0.05	0.09**	0.06	−0.01	0.15***	0.27***
Q	17.2*	22.7**	26.4***	27.3***	42.0***	98.6***
I^2	48	60	66	67	79	91
Balance						
Effect	0.09*	0.13***	0.20***	0.32***	0.08***	−0.05*
Q	27.5***	27.3***	37.8***	70.6***	10.2	14.5
I^2	67	67	76	87	11	38

*$p<0.05$; **$p<0.01$; ***$p<0.005$.

identified, with EPI the next most common moderator (significant for 9 of 25 meta-analyses), and HDI was the only other significant moderator (3 of 25 meta-analyses).

For all meta-analyses where Uncertainty Avoidance was a moderator, associations were weaker in countries higher in Uncertainty Avoidance (e.g., Japan, Peru) that emphasize rules and laws, compared to lower Uncertainty Avoidance countries/regions that have historically been more accepting of differences of opinion and social change (e.g., Hong Kong, India). Where EPI and HDI were significant moderators the story was similar, with stronger associations between change worldviews and sustainability for countries/regions with lower environmental performance and lower development. That is, links between change worldviews and sustainability were stronger in countries/regions with more pressing environmental and economic problems.

9.5 | Discussion

The items measuring change worldviews showed consistency across countries/regions in how they loaded on the five dimensions, indicating that these are coherent dimensions of people's beliefs about change across diverse countries/regions. While country/region means were not directly comparable, when comparing patterns of means the USA, Spain, and Hispanic American countries placed relatively

more emphasis on believing the world is in decline (Golden Age) compared to remaining stable (Maintenance). Asian countries/regions and Australia placed relatively less emphasis on seeing change as cyclic (Endless Cycle) compared to stable (Maintenance), which was somewhat unexpected as we argued in the introduction that the idea of cyclic change should be more prominent in countries such as China. Finally, two major emerging economies, India and Russia, were the only countries to endorse Progress to a similar degree as Balance (although another major emerging economy, China, did place more emphasis on Balance).

While patterns of means were broadly similar, associations with environmental/social sustainability and support for neoliberal economics varied widely. Identifying Uncertainty Avoidance as a common moderator suggests that this variation may be primarily about country/region differences in perceived opportunities to enact sustainability attitudes. That is, in high Uncertainty Avoidance countries/regions where following rules is emphasized and divergent opinions less tolerated, people believe they have relatively less input into social outcomes (as rule "takers") so their change worldviews are less relevant to social issues. This is further suggested by observing that this moderation occurred for both neoliberal and pro-environmental topics.

Overall, the findings suggest areas of convergence and divergence with the earlier US studies. Change

worldviews do seem to be similar across countries/region, at least in terms of their basic meanings, but their associations with social issues vary with whether a country/region emphasizes rule-following or embraces differences of opinion.

10 | GENERAL DISCUSSION

Five basic worldviews about change were observed in US and international samples: Progress, Golden Age, Endless Cycle, Maintenance, and Balance. While these change worldviews are not mutually exclusive, they were distinct from major individual difference constructs such as values and political orientation. Importantly, change worldviews were associated with people's views and intentions across diverse cultures and contexts, even after controlling for widely-used individual difference constructs (e.g., values), and context-specific predictors (e.g., political party identification for voting; self-perceived innovativeness for innovations). The results suggest that people's worldviews about change can act as a broad lens people use to inform their responses in a wide range of contexts involving social change.

While change worldviews always added to our understanding of people's responses across domains and cultures, the most relevant dimensions varied, with a summary in Table 8. In US samples, Balance was most important for sustainability, Golden Age (and to some degree Progress) for innovation, and Golden Age for politics (at least for the 2016 US election). Examining associations with social change issues across countries/regions suggested that the associations identified in US samples are unlikely to be universal. For example, across

countries there was a general association between Golden Age, Endless Cycle, and Maintenance change worldviews and support for pro-environmental and pro-social actions that were not identified in the US. While change worldviews may not be the most important factor in every context, their applicability across a wide range of contexts suggest they do function at a very general level, as a worldview that people apply across a wide range of situations.

Of course, correlational findings do not establish causation. Ideally, we would manipulate people's worldviews and show that this affects their responses. However, during data collection for Study 1 we piloted several approaches to manipulating the salience or endorsement of these worldviews without success, including implicit activation (e.g., sentence unscrambling task), visual metaphors (e.g., expanding and contracting shapes), aphorisms (e.g., different versions of the parable of King Midas and the golden touch), and philosophical wisdom (e.g., summarizing the philosophy of the golden mean). Perhaps the ineffectiveness of experimental manipulations might be expected for an individual difference variable, but as a belief about the world we have been surprised at its resistance to influence. However, the distinct association found in Study 4 between Golden Age and voting in the context of Trump's "Make America Great Again" slogan suggests it could be possible to influence the salience of change worldviews given stronger and consistent messaging over time from powerful people, which is beyond what can be achieved in experimental studies. However, we continue to explore possibilities for effective manipulations of these worldviews to provide a stronger basis for testing causation.

These general worldviews are more than summaries of specific views about change. People are able to generate

TABLE 8 Summary of associations between change worldviews and social change issues across studies.

Studies/topics	Change worldview				
	Progress	**Golden Age**	**Endless Cycle**	**Maintenance**	**Balance**
Study 1 (USA)					
Environmental sustainability	+				++
Social sustainability		−		−	++
Economic sustainability	+				+
Study 3 (USA)					
Support innovation	++		+		
Oppose innovation		++	−	−	
Study 4					
More conservative voting (USA)	− −	++	+	+	
More conservative voting (UK)		+	+	+	
Study 5 (average effects across countries)					
Pro-environmentalism	++	++	++	+	++
Corporate social responsibility	++		+		++
Economic neoliberalism	+	++	++	++	

Note: ++ or − −, stronger or more consistent associations (positive/negative); + or −, weaker or less consistent associations (positive/negative).

detailed ideas about society's future in specific scenarios, such as what would happen if we address climate change or legalize marijuana (Bain et al., 2012, 2013), and can identify instances of historical progress such as computers or the industrial revolution (Liu et al., 2011). But as we showed in the political context in Study 4, change worldviews help explain people's reactions independently of more concrete and contextualized beliefs about change such as whether a Trump administration would have an impact on economic development or crime.

While we have attempted to show the value of these worldviews as context-general and abstract psychological constructs, there may be value in trying to understand change worldviews in more detail. For instance, there may be a distinctive "left" and "right" view of Progress, similar to a distinction proposed by Fuller (2011) where the left focuses more on progress in science and technology, whereas the right focuses more on progress in terms of increasing individual freedoms and personal initiative. There may also be differences in how these worldviews are construed. For example, while one person may look back to a Golden Age experienced in their childhood, others may look back much further to a historical Golden Age many centuries ago, and the period invoked may affect the types of changes they support or oppose.

Such a deeper examination may be particularly useful for Balance and its links to homeostasis, as there may be meaningful distinctions in how people think about homeostasis. One perspective is *passive homeostasis*, where people believe society is a self-regulating system that naturally maintains and restores balance over time. Perhaps the most famous example is Adam Smith's (1979/1776) invisible hand of the market where people acting for their own economic gain will ultimately produce the best outcomes for society without intending to do so. A Balance item from Study 1 ("There are always forces moving us towards a state of equilibrium or harmony") is consistent with passive homeostasis, but as it did not load strongly on the Balance scale (see Table 1) this indicates that the existing Balance measure does not capture this passive aspect of homeostasis. Believing in passive homeostasis might be more likely to have reduced motivations to engage in political action. In contrast, a belief in *active homeostasis* requires actors to drive change—people see themselves and others as active agents in restoring balance to society. Believing in active homeostasis may motivate action and catalyse the formation of new social movements—"we" are required to act to bring the world back into balance. If such differences in understanding Balance occur across cultures this might help explain cultural variation in its associations with sustainability.

In hindsight, when creating items we did a better job of separating change processes from goals for some change worldviews than others. Similarly, in selecting items that represented orthogonal factors some change worldview measures had a more descriptive focus about how the world *is* changing (Progress, Endless Cycle), some

more prescriptive about how the world *should* change (Maintenance, Balance), or an equal focus on both (Golden Age). To address both issues in future research we are developing items to distinguish between descriptive change worldviews (the way the world is or, or is not changing for Maintenance) and prescriptive change worldviews (how the world should or should not change). For example, for Golden Age people may believe the world truly is in decline from the past, but not believe that we should be trying to reclaim that idealized past. While we did not find strong evidence of distinct prescriptive and descriptive dimensions of the five change worldview dimensions, further development and refinement of measures might be able to do so if descriptive and prescriptive change worldviews were meaningfully distinct cognitively and had different consequences. For example, people holding a more prescriptive Maintenance worldview may more actively oppose change such as a new policy or innovation (in order to keep society as it currently is) than those with a more descriptive Maintenance worldview because their view of the world as inherently stable may mean they believe social policies and innovations are unlikely to produce change.

A further consideration is that the broadness of items meant the target was sometimes ambiguous. For example, "'Everything in moderation' is a great guiding principle for life" may be something people endorse just for their own life or for people's lives in general, and may also reflect more of a focus on the desirability of moderation than an explicit belief about change. However, shared loadings with more explicitly social- and change-focused items (e.g., "Everything in this world should try to achieve a state of 'balance'") suggests that such distinctions may not be substantial. Nonetheless, the final set of items selected for Balance has drifted most from an explicit focus on change and this is a target for improvement/refinement of measures in future research.

We do not claim that this set of change worldviews is exhaustive. Just as Balance invokes a more complex system rather than a linear path from past to future, other perspectives on change are possible. For instance, change could be seen through a lens of expressions of power or violence (Páez et al., 2016) or the achievements of important historical figures (Liu et al., 2011), and there is likely to be culturally-specific or indigenous understandings of change that are not captured by this theory and measures. But these worldviews do seem to capture a set of basic perspectives on change that play a role in understanding people's attitudes and intentions.

In focusing on trajectories of change, change worldviews complement other approaches to thinking about societal change that focus on the outcomes of change in terms of people's character and societal functioning (Bain et al., 2013) or desired utopias (Fernando et al., 2020). It also complements other types of general worldviews, such as viewing social relations as dangerous or competitive (Duckitt et al., 2002), or social axioms about how the world works such as believing that hard work

is rewarded, people cannot be trusted, or that the world is complex (Chen et al., 2016; Leung et al., 2002). Along with these models, change worldviews can help build a richer picture of the general beliefs that can influence people's attitudes and actions across situations.

Overall, we propose that change worldviews provide distinctive insights into contemporary social contexts. They are lenses on change that can help us understand whether people will support or oppose social change across contexts and cultures.

AUTHOR CONTRIBUTIONS

Paul G. Bain: Conceptualization; data curation; formal analysis; funding acquisition; investigation; methodology; project administration; supervision; writing – original draft; writing – review and editing. **Renata Bongiorno:** Conceptualization; investigation; methodology; writing – review and editing. **Kellie Tinson:** Conceptualization; investigation; methodology; writing – review and editing. **Alanna Heanue:** Conceptualization; investigation; methodology; writing – review and editing. **Ángel Gómez:** Investigation; methodology; writing – review and editing. **Yanjun Guan:** Investigation; methodology; writing – review and editing. **Nadezhda Lebedeva:** Investigation; methodology; writing – review and editing. **Emiko Kashima:** Investigation; methodology; writing – review and editing. **Roberto González:** Investigation; methodology; writing – review and editing. **Sylvia Xiaohua Chen:** Investigation; methodology; writing – review and editing. **Sheyla Blumen:** Investigation; methodology; writing – review and editing. **Yoshihisa Kashima:** Conceptualization; methodology; writing – review and editing.

CONFLICT OF INTEREST STATEMENT
The authors declare there are no conflicts of interest.

DATA AVAILABILITY STATEMENT
The data that support the findings of this study are available through the Open Science Framework:

Study 1: https://osf.io/63vz7/.
Study 2: https://osf.io/dwbm3/.
Study 3: Study 3a: https://osf.io/mndvz/.
Study 3b: https://osf.io/34gxz/.
Study 4: US sample: https://osf.io/rn6rk/.
UK sample: https://osf.io/xzyec/.
Study 5: https://osf.io/u92d3/.

ETHICS STATEMENT
All studies were conducted in accordance with ethical guidelines in psychology and obtained university ethical approval from the University of Queensland (Studies 1 & 2; Study 4 [US sample]), Queensland University of Techology (Studies 3 and 5), and the University of Bath (Study 4 [UK sample]).

RESEARCH MATERIALS STATEMENT
Research materials for each study are accessible using the links provided in the Data Availability Statement.

PRE-REGISTRATION STATEMENT
The studies presented in this paper were not preregistered.

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