

## Resilience of primal world beliefs to the initial shock of the COVID-19 pandemic

Vera U. Ludwig<sup>1,2\*</sup>, Damien Crone<sup>3t</sup>, Jeremy D. W. Clifton<sup>3</sup>, Reb W. Rebele<sup>4,5</sup>,  
Jordyn Schor<sup>1</sup>, and Michael L. Platt<sup>1,2,6,7</sup>

<sup>1</sup> Department of Neuroscience, Perelman School of Medicine, University of Pennsylvania

<sup>2</sup> Wharton Neuroscience Initiative, University of Pennsylvania

<sup>3</sup> Positive Psychology Center, University of Pennsylvania

<sup>4</sup> Melbourne School of Psychological Sciences, The University of Melbourne

<sup>5</sup> Wharton People Analytics, The Wharton School, University of Pennsylvania

<sup>6</sup> Marketing Department, Wharton School of Business, University of Pennsylvania

<sup>7</sup> Department of Psychology, School of Arts and Sciences, University of Pennsylvania

t: equal contributions

\* Corresponding author e-mail: vludwig@wharton.upenn.edu

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## Abstract

**Introduction:** People hold general beliefs about the world called primals (e.g., the world is *Safe*, *Intentional*), which are strongly linked to individual differences in personality, behavior and mental health. How such beliefs form or change across the lifespan is largely unknown, although theory suggests that beliefs become more negative after disruptive events. The COVID-19 pandemic provided an opportunity to test whether dramatic world changes and personal adversity affect beliefs.

**Method:** In a longitudinal, quasi-experimental, pre-registered design, 529 US participants (51% female, 76% White) provided ratings of primals before and several months after pandemic onset, and information about personal adversity (e.g., losing family, financial hardship). Data was compared to 398 participants without experience of the pandemic.

**Results:** The average person in our sample showed no change in 23 of the 26 primals, including *Safe*, in response to the early pandemic, and only saw the world as slightly less *Alive*, *Interactive*, and *Acceptable*. Higher adversity, however, was associated with slight declines in some beliefs. One limitation is that participants were exclusively American.

**Conclusion:** Primals were remarkably stable during the initial shock wrought by a once-in-a-century pandemic, supporting a view of primals as stable lenses through which people interpret the world.

Keywords: primal world beliefs, adversity, well-being, trauma, belief updating, COVID-19 pandemic

## Introduction

Our beliefs strongly shape our decisions, social relationships, and well-being in a wide variety of ways. For example, spiritual and religious beliefs are thought to support resilience by providing meaning and purpose in the face of hardship (Brown, Nesse, House, & Utz, 2004; Holland et al., 1999; LoSavio, Dillon, & Resick, 2017; Peres, Moreira-Almeida, Nasello, & Koenig, 2007), negative beliefs about oneself are linked with posttraumatic stress disorder and depression (Schumm, Dickstein, Walter, Owens, & Chard, 2015; Thompson-Hollands, Jun, & Sloan, 2017), and a belief that the world is dangerous may be tied to a higher likelihood of mistakenly shooting outgroup compared to ingroup members (Miller, Zielaskowski, & Plant, 2012). How such beliefs develop and what might cause them to change over time remains an open and important question.

Beliefs can be construed at many levels, including about oneself, one's future, or one's current environment. Here we focus on specific types of environment beliefs that concern the general nature of the world (e.g., the world is *Good*), which have been recently termed primal world beliefs, or primals, for short (Clifton et al., 2019). Such beliefs about the nature of the world may be particularly consequential given their potentially pervasive influence on how people perceive and respond to a range of everyday situations.

While a handful of world beliefs (e.g., the world being *Just*, Lerner & Miller, 1978; Lerner, 1980) have been studied for decades, Clifton and colleagues (2019) introduced the first comprehensive, structured framework of general beliefs that people maintain about the world as a whole. Each is a continuous dimension between two poles, such as belief that the world is *Good* vs. *Bad*, *Safe* vs. *Dangerous*, or *Abundant* vs. *Barren*. Based on analysis of influential historical sources, natural language analysis of social media tweets, focus groups, and expert interviews, and resulting factor analysis of items, the authors empirically identified a hierarchical structure of 26 beliefs, with one primary belief (*Good*), three secondary beliefs (*Safe*, *Enticing*, *Alive*), and 22 tertiary beliefs (*Beautiful*, *Interconnected*, etc.). Most (21) primals fall within a super-cluster

defined by *Good* world belief and describe desirable versus undesirable world states, while five primals do not (e.g., *Changing* vs. *Static*). The authors also developed and validated a comprehensive questionnaire, the Primals-Inventory (PI-99).

Primal world beliefs have been shown to be stable individual differences that demonstrate high test-retest reliability, at least under typical conditions (Clifton et al., 2019; Dalbert, Lipkus, Sallay, & Goch, 2001; Sibley, Wilson, & Duckitt, 2007). Although primals are substantially correlated with other personality traits (Clifton et al., 2019), they offer incremental predictive validity of important life outcomes. For example, the belief that the world is *Good* predicts more variance in life satisfaction than a model with all Big Five personality traits combined (see also Poulin & Silver, 2008).

There are many theories about how stable individual differences develop—and sometimes change—across the lifespan (Caspi, Roberts, & Shiner, 2005; McAdams & Olson, 2010; Specht et al., 2014). With regard to belief formation, it is widely assumed that adverse experiences, such as trauma, induce negative beliefs about the world (see Clifton, 2020b; Duckitt & Sibley, 2009; Janoff-Bulman, 1989, 1992; Kaler et al., 2008). Such accounts propose that life experiences are a key factor explaining what people believe, and are sometimes termed *retrospective accounts of belief formation* (Clifton, 2020b). However, the available empirical evidence supporting this idea is surprisingly mixed (Bonanno & Mancini, 2008; Kaler et al., 2008).

Some evidence supporting retrospective accounts of belief formation includes the finding that individuals came to see the world as more *Dangerous* and/or *Competitive* during the global financial crisis of 2008-2009, which in turn predicted corresponding rises in right-wing authoritarianism (*Dangerous*) or social dominance orientation (*Competitive*) (Sibley & Duckitt, 2013). There is also evidence that people see the world more negatively (e.g., less *Benevolent*) after experiencing negative life events, although effect sizes are typically small (Anders, Frazier, & Shallcross, 2014; Poulin & Silver, 2019; Schuler & Boals, 2016). There is also evidence

challenging retrospective accounts, however. For instance, sometimes *positive* changes in worldviews are observed after negative experiences (e.g., see Poulin & Silver, 2019). Another study found that only some beliefs concerning the self or vulnerability (Gluhoski & Wortman, 1996) were altered by trauma, while others were not (see also Rini et al., 2004).

The lack of strong empirical support for adversity-induced belief changes reflects the idiosyncratic and real-world nature of negative life experiences, which are impossible to replicate experimentally in the laboratory for ethical and practical reasons. Moreover, most of the research on belief changes to date has tended to focus on a specific sub-set of beliefs (e.g., dangerous or competitive worldviews; Sibley & Duckitt, 2013), making it difficult to draw generalizable conclusions about the process of belief change. Because a comprehensive measure of various core beliefs about the world--the Primals Inventory (PI-99)--has only recently been developed (Clifton et al., 2019), it has not previously been possible to assess changes in a broad set of world beliefs.

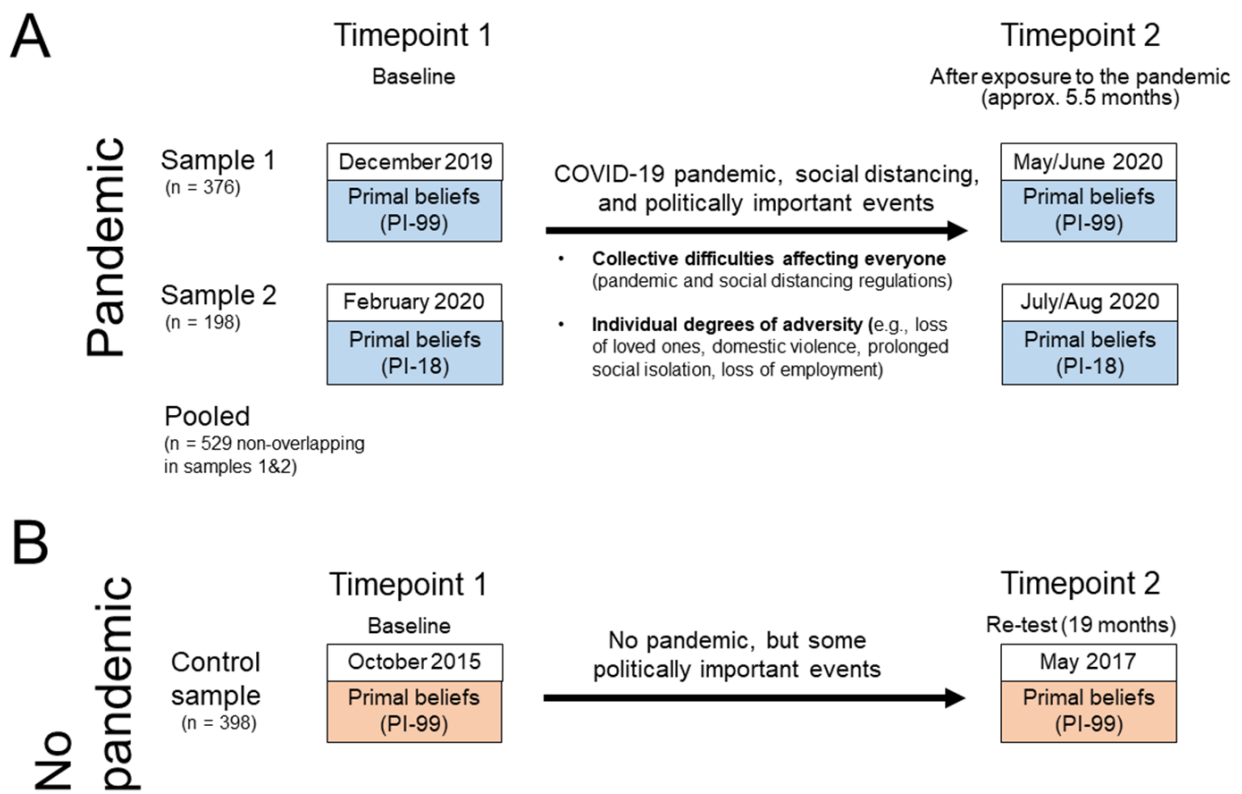
The COVID-19 pandemic was an unanticipated shock that severely disrupted global society. As of May 2022, more than 525 million people worldwide have been infected and more than 6.2 million have died (<https://coronavirus.jhu.edu/map.html>). Average life expectancy in the US is projected to decline by 1.13 years (and considerably more for Black and Latino Americans; Andrasfay & Goldman, 2021), which could be taken as an objective indicator that the world has in fact become more dangerous. The indirect impacts are even more pervasive, upending the daily lives of billions of people through unemployment, social isolation, and lost opportunities for education, growth and travel (De France, Hancock, Stack, Serbin, & Hollenstein, 2021; Kniffin et al., 2021; Zacher & Rudolph, 2021). The growing speculation that a "new normal" will take root in domains as diverse as healthcare (Berwick, 2020), education, and work (Microsoft, 2021; Välikangas & Lewin, 2020) is another indicator that COVID-19 has changed the world. The

pandemic therefore provides a unique natural experiment for testing the resilience of primal world beliefs in the face of extreme change, high uncertainty, and personal adversity.

We used a longitudinal, quasi-experimental design and re-sampled previous survey respondents from December 2019 (re-sample: May/June 2020) and February 2020 (re-sample July/August 2020, Fig. 1). Quasi-experimental study designs take advantage of naturally occurring changes in an independent variable in order to facilitate causal inferences in circumstances where the random assignment required for a true experiment is either impossible or unethical (Cook, Campbell, & Day, 1979; Grant & Wall, 2009). We asked two questions. First, on average, did primals change in response to the initial shock of the global pandemic? Second, did people who experienced more personal adversity (e.g., job loss, death of loved ones) report stronger and more negative changes in beliefs than people who experienced less or no personal adversity? If so, which primals were affected and to what extent? Following Grant and Wall (2009), we also obtained data from a non-pandemic comparison group to consider possible alternative explanations for any observed effects of the pandemic. To do so, we obtained data from a similar test-retest design conducted before the COVID-19 pandemic (October 2015 - May 2017; Clifton et al., 2019).

Importantly, not all primals may be expected to change equally due to a pandemic, because different types of negative life events may affect different beliefs (Poulin & Silver, 2019). For example, Janoff-Bulman (1992) proposed that events that involve intentional harm by another human being (e.g., violence) may specifically challenge beliefs regarding the benevolence of the world (and other people; e.g., see Ornduff, 2000; Prager & Solomon, 1995). In contrast, events that do not involve a human perpetrator (e.g., natural disasters, illness) may have stronger effects on beliefs that the world is Just, or that things happen for a reason (e.g., see Tomich & Helgeson, 2002).

Because the COVID-19 pandemic constitutes a worldwide increase in danger, we predicted decreases in the *Safe* (vs. *Dangerous*) world belief. Further, due to the overall severity of the situation and associated restrictions, we predicted that the pandemic and individual levels of adversity would negatively impact most primals, including—for example—*Good*, *Enticing*, and *Alive*. We also predicted decreases in *Just*, *Meaningful*, *Intentional*, and *Understandable*, in line with the pandemic being an uncontrollable natural threat (Janoff-Bulman, 1992). For some tertiary primals we expected an increase (*Changing*, *Hierarchical*, and *Interconnected*) or no change at all (e.g., *Cooperative*, *Interesting*, *Worth Exploring*; for all predictions see arrows in Fig. 3). We pre-registered all our hypotheses prior to collecting follow-up data from each group of participants.



**Fig. 1. Quasi-experimental study design.** A. Quasi-experimental design investigating how individual differences in adversity experienced during the pandemic affect beliefs about the world. We hypothesized that, if retrospective accounts of belief formation are correct, most humans would change their beliefs to some extent as a response to the

pandemic, but that those who experienced greater adversity would change more. B. Exploratory non-pandemic comparison group obtained from Clifton and colleagues (2019). While this comparison group is by no means ideal since its time span was much longer than for our current data set, it is useful to know how much primals change in non-pandemic conditions. PI: Primals Inventory (questionnaire). PI-99: detailed version with 99 items measuring all 26 primary, secondary and tertiary primals. PI-18: abbreviated version only measuring primary (*Good*) and secondary (*Safe, Enticing, Alive*) primals.

## Materials and methods

### Preregistration

We preregistered this study with regards to sample 1 on AsPredicted before data collection at T2 (time point 2): <https://aspredicted.org/ts539.pdf>. Sample 2 became available later and was not separately pre-registered, as the same hypotheses applied. The comparison group and exploratory analyses were not pre-registered (see S1 Material for more details).

### Data Availability Statement

All relevant data and all R scripts for analyzing and visualizing the data are available from [https://osf.io/79ucd/?view\\_only=52c758ef46e744898181ce9d92eaceab](https://osf.io/79ucd/?view_only=52c758ef46e744898181ce9d92eaceab) [public link to be created upon publication].

### Procedure

This study took advantage of two data sets on primals at T1 (time point 1, Fig. 1) that happened to be collected just prior to pandemic onset, which created an opportunity to conduct the quasi-experiment. We recontacted all participants several times via MTurk/email during the early months of the pandemic to obtain new measures of their primals, as well as measures of their individual adversity level and some additional variables. The Institutional Review Board of the University of Pennsylvania found that this study (protocol 828675) met eligibility criteria for



IRB review exemption authorized by 45 CFR 46.101, category 2, which applied to T1 and T2 of sample 1 and T2 of sample 2. T1 of sample 2 had been collected in a separate project approved by the Human Research Ethics Committee of The University of Melbourne, Australia (ID: 1955884.1). Consent was implied by participants continuing beyond the consent form to begin the surveys.

## **Participants**

The sample size and characteristics of participants were constrained by the T1 samples that were available. Sample size was otherwise determined by the willingness of baseline participants to re-participate (for an analysis of attrition patterns, see S2 Material). Data quality for both re-samples was high since participants had been strictly screened for passing attention checks at time point 1.

### ***Sample 1***

376 valid cases completed both time points (out of an initial sample of 611 participants at T1). Seven further participants were excluded in accordance with criteria employed by author JDWC for T1 (failing more than 2 attention checks) and one further participant was excluded due to taking less than one second per item at both time points and indicating a lack of attention in the T2 questionnaire (Wood, Harms, Lowman, & DeSimone, 2017). Initial criteria to qualify for the study on mTurk were: age 18 and older (as the scale was not validated in minors), currently living in the United States or U.S. territory (due to the original purpose of T1 data collection relating to political variables in the U.S.), and a > 95% HIT approval rate on mTurk.

## **Sample 2**

197 participants provided complete and valid data on T2 (out of an initial sample of 369 at T1). Three additional participants were excluded on T2 due to failing at least one out of seven self-reported response quality checks (Wood et al., 2017), thereby applying the same criterion as previously for T1 by author RR. Initial criteria to qualify for the study on mTurk were: an overall HIT approval rate > 95 %, and more than 100 HITs approved overall. It was further specified that participants had to be American adults who were fluent or native speakers of English. All participants were born in the US and were in the US when completing the T2 questionnaire. When pooling both samples, we removed 45 out of these 197 participants, since they had participated in both samples. On any instances where we report on the two samples separately, these 45 participants are included.

## **Pooled Sample**

The combined sample ( $n = 529$ ) consisted of 256 men, 270 women, 3 other/neither gender identity, all in the US; it was ethnically diverse but primarily White (76 %; 7 % Black/African-American, 6% Hispanic, 8% Asian including Middle Eastern, 3%: other), with a mean age of 40.72 ( $SD = 12.81$ ); 47% Democrat/Democrat leaning, 25% Republican/Republican leaning, 20% Independent, 9% other or no party affiliation. In terms of highest level of education, 33% had completed high school, 14% an Associate's degree, 42% a Bachelor's degree, and 10% some graduate degree (e.g., M.Sc., or PhD; only two people did not finish high school). Mean household income in sample 1 at T1 was \$60,972 before taxes ( $SD = \$41,169$ ); median personal income in participants from sample 2 at T1 was \$30,000 - \$39,999 and most participants in sample 2 (41%) reported a "middle income level" at T2, followed by a "lower middle income level" (29%; the variables with regards to income differed between samples). To obtain the combined sample, we

pooled samples 1 and 2, while excluding data of 45 cases in sample 2 who had also taken part in sample 1.

### **Post-hoc power analysis for within-subject changes and links with adversity**

A post-hoc power analysis showed that the sample size was more than sufficient. It can detect clinically meaningful pre-post changes (Cuijpers, Turner, Koole, van Dijke, & Smit, 2014) defined here as 0.24 SD, with a power of 99.98% for the pooled sample and 99.6% for sample 1 alone (only sample measuring tertiary primals). It can detect links with adversity of the same size ( $r = .24$ ) with a power of 99.99% (pooled sample) or 99.7% (sample 1). It further has a power of 80% to detect small changes or associations ( $d = 0.12$  or  $r = 0.12$  for the pooled sample, and  $d = 0.14$  or  $r = 0.14$  for sample 1). These power analyses were calculated using the R-package *pwr* for paired t-tests and Pearson's correlations ( $\alpha = .05$ ) (Champely et al., 2018). Note that for links with adversity, there might be somewhat less power for detecting interaction effects in our regressions, as well as reduced power in the multivariate analyses to the extent that we have correlated, and imperfectly reliable predictors.

### **Non-pandemic comparison group**

Data from 398 participants were obtained from Clifton and colleagues (2019), who had taken part in October 2015 and, again, in May 2017 (19 months). Though not an ideal control condition due to a different time between samples, we submit that this was the best comparison available and can help inform whether changes in primals were particularly pronounced during the pandemic. Eight additional participants were excluded, as in the original study, due to failing attention checks. Mean age at T1 was 39.4 ( $SD = 12.0$ , range: 19 to 73) with 55% female, 79% White, 42% Democrat, 19% Republican, with a median combined household income of \$40,001-\$50,000. In terms of highest level of education, 33% had completed high school, 11% an

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Associate's degree, 39% a Bachelor's degree, and 17% some graduate degree (one person did not finish high school). The study was originally conducted for the purpose of establishing primals re-test reliability, change scores had not been reported in the study. Note that there were two other samples available in Clifton et al. (2019), but for methodological reasons they were not considered suitable for comparison.

## Materials

### *Primals Inventory*

Participants in all samples completed the Primals Inventory (PI) at both time points. Sample 1 and the comparison group completed the PI-99 (99 items; Clifton et al., 2019). Sample 2 received a shorter version, PI-18 (18 items; Clifton & Yaden, 2021). Both the PI-99 and the PI-18 consist of statements about the world (e.g., "No matter where we are, incredible beauty is all around us.", or "On the whole, the world is a dangerous place."). Responses were collected on a 6-point scale from 0 (strongly disagree) to 5 (strongly agree) and averaged across the respective items relevant for each primal (Clifton et al., 2019).

In line with previous reports, Cronbach's alpha indicated high internal reliability, ranging between .74 and .97 (all primary and secondary primals > .88, S1 and S2 Tables). Scores for all primals before and during the pandemic are shown in S3 Table.

Test-retest correlations were similar to previous reports (Clifton et al., 2019), see Fig. 2A for a direct comparison of pandemic and non-pandemic re-test correlations, and S1 Fig. for these values for all primals separately. Test-retest correlation after our 5-6 months intervals for the primary primal *Good* was .82 (n = 529), and for secondary primals: .76 for *Safe*, .81 for *Enticing*, and .86 for *Alive* (n = 529). Average retest correlation for all remaining 22 tertiary primals (sample 1 only, n = 376) was .68 (SD = .07). Note that retest correlations are scale-free and test to what degree people retained their individual differences relative to each other, and not whether change

occurred (if everyone scored a constant factor lower on T2 compared to T1, the test-retest correlation would not show any decrease).

### ***Adversity Score***

While individual adversity levels during the pandemic could be quantified in various ways, we opted for the following pre-registered approach using the measures specified below: An overall adversity score was calculated based on summing up the number of traumatic/adverse events that have occurred between T1 and T2, as described in detail in the Appendix (S3 Material; more than 5 events per trauma category were counted as 5). Items included the Trauma History Questionnaire (THQ) and our novel COVID-related Trauma History Questionnaire (CTHQ) as described below. Additional adversity points were added for living situations (indicating a ‘poor’ or ‘rather poor’ relationship quality within their household, living with at least one child or adult requiring care, or living completely alone and lacking any form of real-life social contact during the previous 2 weeks, S3 Material).

### ***Trauma History Questionnaire (THQ)***

The THQ (Hooper, Stockton, Krupnick, & Green, 2011) consists of 24 items asking about the occurrence of various potentially traumatic events, covering several domains (physical, crime, etc.). At T2, we asked “How many times since [T1] has this happened to you?” (No-never (0), 1, 2, 3, 4, 5 or more) [T1: approximate date of completion of questionnaire 1]. We added an additional item asking about chronic pain episodes (S3 Material). At T1 (only used for supplementary analyses), the same questions referred to participants’ entire lives up to that point (lifetime trauma).

### ***COVID-Related Trauma History Questionnaire (CTHQ)***

Using a similar format to the THQ, on T2 we added 20 additional items that specifically asked about adverse or potentially traumatic events and stress factors that might have occurred due to the COVID-19 pandemic or associated regulations since T1. Twelve items had yes/no response options (e.g., becoming unemployed, losing access to medical treatment, being in an at-risk group), and 8 asked about the number of people one is close to (4 items) or knows (4 items) who have suffered substantially or died during/due to the pandemic (from 0 to 5 or more, see S3 Material for items).

### ***Living situation***

At T2, we included specific questions about participants' living situation during the pandemic: being isolated vs. living with others, number of children and people requiring care within the household, relationship with those one lives with, and amount of real-life contact and physical touch experienced within the previous 14 days. These measures were used for calculation of the overall adversity score, while the following were assessed for completeness but not included in the adversity score: days per week exercising, changes in living situation compared to pre-pandemic, relationship quality within household before pandemic, pets.

### ***Additional Variables Not Reported Here***

Several additional questionnaires (e.g., Moral Foundations Questionnaire) were also collected but are outside the scope of the current article (as pre-registered). Moreover, we collected data from several mental health and well-being related questionnaires which we used for exploratory supplementary analyses.

## **Analysis**

### ***General approach***

Data were analyzed and visualized using R, version 3.6.3 (R Core Team, 2020). Key packages used were *ggplot2* 3.3.6 (Wickham, 2016), *ggpubr* 0.4.0 (Kassambara, 2020), *psych* 1.9.12.31 (Revelle, 2019), *Isr* 0.5 (Navarro, 2013), *stats* 3.6.3, *dplyr* 1.0.6. (Wickham, François, Henry, & Müller, 2021), *data.table* 1.14.0 (Dowle, 2021), *sjplot* 2.8.10 (Lüdecke, 2018), *stringr* 1.4.0 (Wickham, 2019), *scales* 1.1.1 (Wickham & Seidel, 2020), and *Hmisc* 4.4.0 (Harrell Jr., 2020).

### ***Pooling of the two pandemic samples***

We pooled the data from pandemic samples 1 and 2 with regards to the primary and secondary primals, since both samples had data available on these primals (though with slightly different measurements). A comparison of the raw descriptives and reliability values for the two scales PI-99 (sample 1) and PI-18 (sample 2) before pooling are shown in S1 and S2 Tables. Before pooling, values were standardized separately for the two scales with respect to their T1 values to minimize the effect of any differences in psychometric properties between the PI-99 and PI-18. For analysis of the pooled sample, an additional regressor for 'study' was included in the models. Data on tertiary primals were only available in sample 1, and so could not be analyzed in the pooled sample.

### ***Analysis 1: Visualization of changes and comparison between pandemic and non-pandemic sample***

As pre-registered, our main hypotheses were tested via regression (see below). However, for a more intuitive visualization and exploration of general changes from T1-T2, we also calculated an established standardized individual difference score per participant and primal

(Estrada, Ferrer, & Pardo, 2018; Ferrer & Pardo, 2014; Gollwitzer, Christ, & Lemmer, 2014; Payne & Gwynne Jones, 1957), as follows:

$$SID = D / S_{dif}$$

where

$D$ : individual pre-post difference:  $Primal\_T2 - Primal\_T1$  using the overall scores for each primal on both occasions

$S_{dif}$ : standard deviation of these differences

This score only served to visualize all changes across primals and compare them across pandemic and non-pandemic contexts.

We also calculated the average absolute SID across all primals for the pandemic and non-pandemic context to explore whether changes in any direction (rather than a systematic direction) were higher during the pandemic than during a non-pandemic time span, using a two-sample t-test (unequal variances assumed).

### ***Analysis 2: Hypothesis testing via regression analyses***

As pre-registered, to test whether changes occurred during the pandemic and whether changes in primals depended on personal experiences of adversity, we ran separate regression analyses for all primals. The following model was fit to each primal:

$$T2 \sim \text{intercept} + T1 + \text{Adversity} + T1 * \text{Adversity},$$

where  $T1$  is the baseline measurement for the respective primal, Adversity is the adversity score and  $T2$  is the current score.

To facilitate interpretation, primals at both time points were standardized according to their  $T1$  means and SDs. Adversity was standardized as well. This particular variable-centering approach means that the intercept in our model corresponds to the estimated change in a given



primal at T2 in standardized T1 units for a participant with an average T1 primal score and average adversity.

### ***Analysis 3: Prediction error analysis***

In line with the belief updating and prediction error (PE) literature (e.g., Vlasceanu, Morais, & Coman, 2021), we considered that in addition to or instead of absolute adversity, changes in beliefs might reflect whether more or less adversity was experienced than participants might have predicted based on their previous experiences before the pandemic.

In an exploratory analysis, we therefore derived estimates of individuals' PEs and used these estimates to predict change in primals. We estimated PE only for Sample 1, for which THQ (Trauma History Questionnaire) scores were available for T1. No such measure was available for T1 in Sample 2.

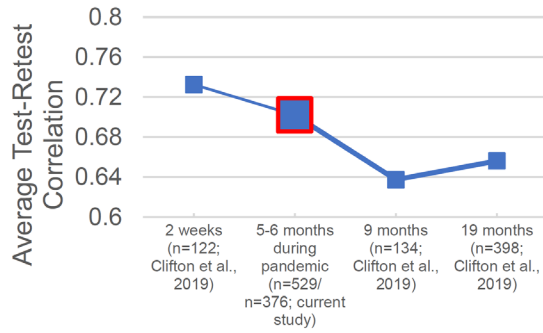
We first Z-scored THQ scores for T1 (all trauma experienced in someone's life up to T1) and raw Adversity scores for T2, and then calculated:

$$PE\_experience = Adversity\_T2\_Z - THQ-T1\_Z$$

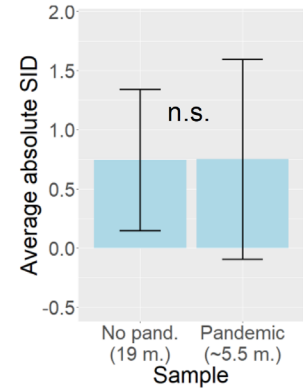
A higher positive PE denotes experiencing more adversity than expected based on previous experience. This is an approximation since not all events that were measured at T2 were measured at T1 (i.e., the T2-adversity score comprises both THQ scores and COVID-19-related adversity between T1 and T2, whereas T1-THQ only comprises the THQ), and some of the adverse events measured at T2 could have happened in a non-pandemic context (e.g., job loss) but were not measured.

**A**

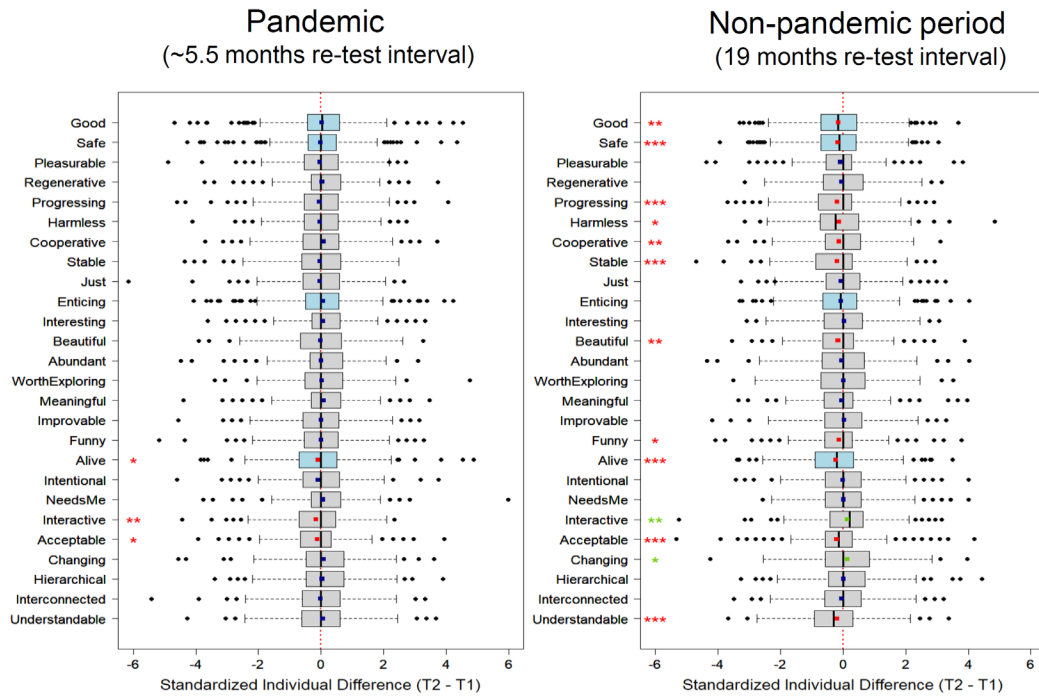
Reliability

**B**

Absolute change  
(any  
direction),  
averaged  
across all  
primals

**C**

Systematic  
change  
(specific  
direction)  
of primals



**Fig. 2. Primals remained stable during the early phase of the pandemic.** A. Test-retest correlations during the early phase of the pandemic were in the expected range (cf. Clifton et al., 2019). Figure shows the average correlation across all primals. B. Mean absolute standardized individual difference scores (SID, standardized T2-T1) across all primals in pandemic and non-pandemic samples. There was no significant difference when comparing average absolute SID across primals between both samples. Error bars denote 95% CI. C. Boxplots of standardized pre-post individual differences in specific primal world beliefs for all participants, irrespective of experienced adversity (Pandemic:  $n = 529$  for primary and secondary primals, light blue boxplots;  $n = 376$  for tertiary primals, gray boxplots, Non-pandemic:  $n = 398$ ). Black line = median, square = mean (red:  $< 0$ , green:  $> 0$ , blue: not different from 0). Asterisks indicate significant difference from 0 (single-sample t-tests).

## Results

### Adversity

Adversity scores showed a long tail, with few participants reporting numerous adverse events or circumstances (skew = 7.27). For example, there were two scores > 100, while the average raw score was only 5.40, and the median was 3. A substantial fraction of participants reported hardly any personal adversity: 16% of participants had an adversity score of 0.

In order to avoid undue influence of the extremely high adversity values on our models, before we ran any analyses, we made a slight departure from our pre-registration by truncating the data at 2SD above the mean (replacing any values higher than this threshold with the mean + 2SD). This transformation substantially reduced skew to 2.28. The resulting adversity distribution can be seen in S2 Fig. alongside example comments by participants at different adversity levels. Truncation of scores did not substantially change results: In S3 Fig, we present our main regression analysis (as reported in Fig. 3) but using the non-truncated scores for comparison; the results were similar although results for specific primals differed and were somewhat weaker (i.e., less changed). Prior to regression analysis, Adversity was also standardized to facilitate interpretation.

S4 Table shows to what extent participants attributed the adverse event to the pandemic, for each adversity item that was not obviously caused by the pandemic. On average, 38% of the events measured on the THQ (e.g., experiencing crime) were attributed entirely or partly to the pandemic, as well as 83% of the events/items that related to financial and professional hardship. For items that were clearly COVID-19 related (e.g., someone dying due to COVID-19), we did not ask about participants' attributions.

### **Primals remained stable in the average person during the pandemic (analyses 1 & 2)**

Overall, our predictions were largely disconfirmed with regards to the general effects of the pandemic. In Analysis 1, almost no significant mean-level changes in primals were detected during the early stages of the pandemic, including no decrease in the *Safe* world belief. The only exceptions were small decreases in the beliefs *Alive* (SID = -0.10), *Interactive* (SID = -0.16) and *Acceptable* (SID = -0.12; SIDs are equivalent to Cohen's *d* effect sizes). For comparison, there were significant changes in half of the primals in our non-pandemic control group (Fig. 2C). In fact, when we look across all primals in aggregate, there was no difference between the average absolute change in the pandemic and the non-pandemic time periods ( $t(921.25) = 0.226$ ,  $d = 0.015$ ,  $p = .821$ , Fig. 2B).

These findings were confirmed by our formal, pre-registered hypothesis test (Analysis 2) using regression: Intercepts for most primals were non-significant (Fig. 3, left). Note that due to our variables being standardized, the intercept in our model signifies the effects of the pandemic for someone with average adversity and average T1 primal values; this is conceptually equivalent to the single-sample t-tests run on the SID scores (Fig. 2C), implying that sample-wide changes (i.e., changes that did not depend on participants' unique experiences of adversity) were largely absent.

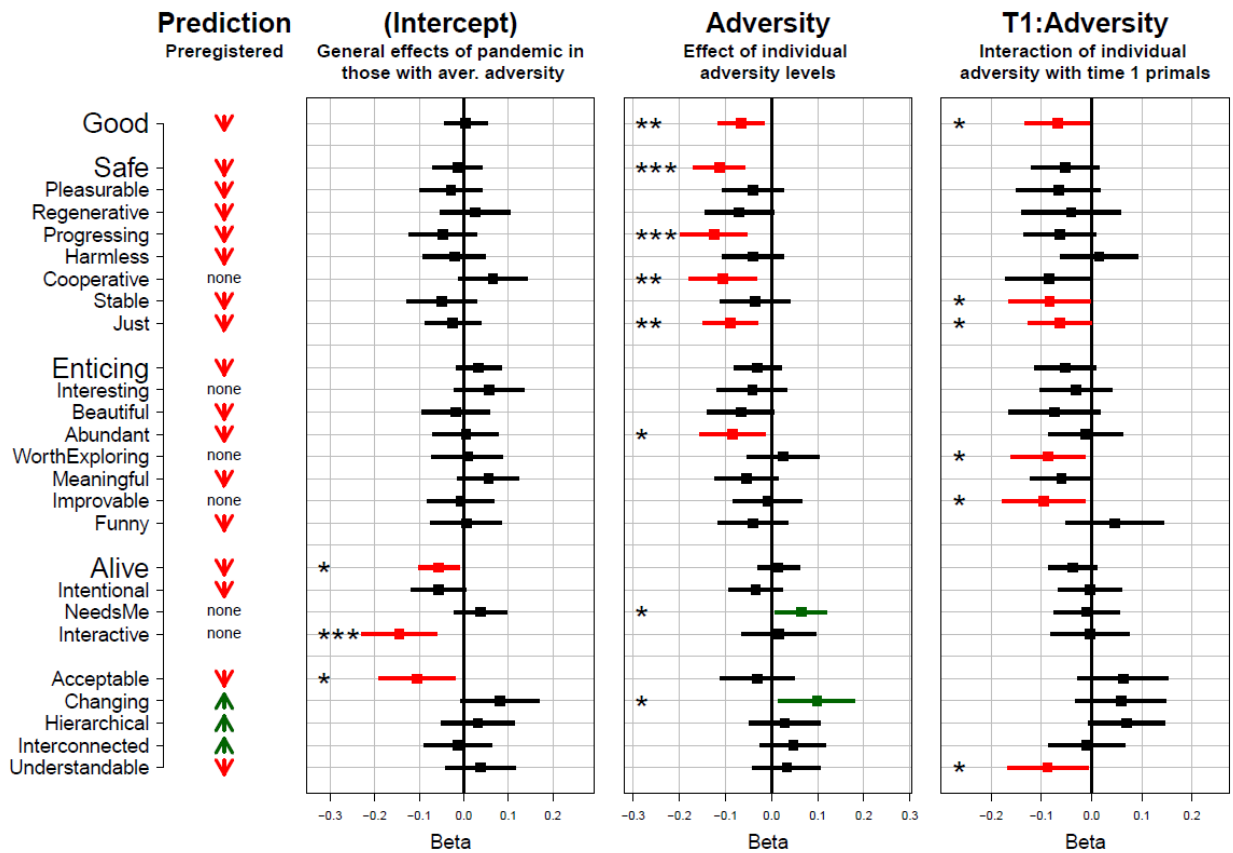
### **Primals varied little with personal adversity (analysis 2)**

With regard to the effects of individual adversity, our predictions were only partly confirmed (Fig. 3, arrows indicate pre-registered predictions). Twelve primals showed either main or interaction effects for adversity ( $p < .05$ , two-tailed, uncorrected; for all values from the regression analyses see S6 Table). Higher adversity experienced by an individual during the pandemic predicted decreases in their beliefs that the world is *Good*, *Safe*, *Progressing*, *Cooperative*, *Just*, and *Abundant*, and predicted increases in the belief that the world *Needs Me* and is *Changing*.

Moreover, there were six significant interaction effects between T1 primals and adversity (*Good*, *Stable*, *Just*, *Understandable*, *Worth Exploring*, and *Improvable*). Adversity-related effects were small, as they corresponded to approximately a 0.1 SD change in primals with each 1 SD change in adversity.

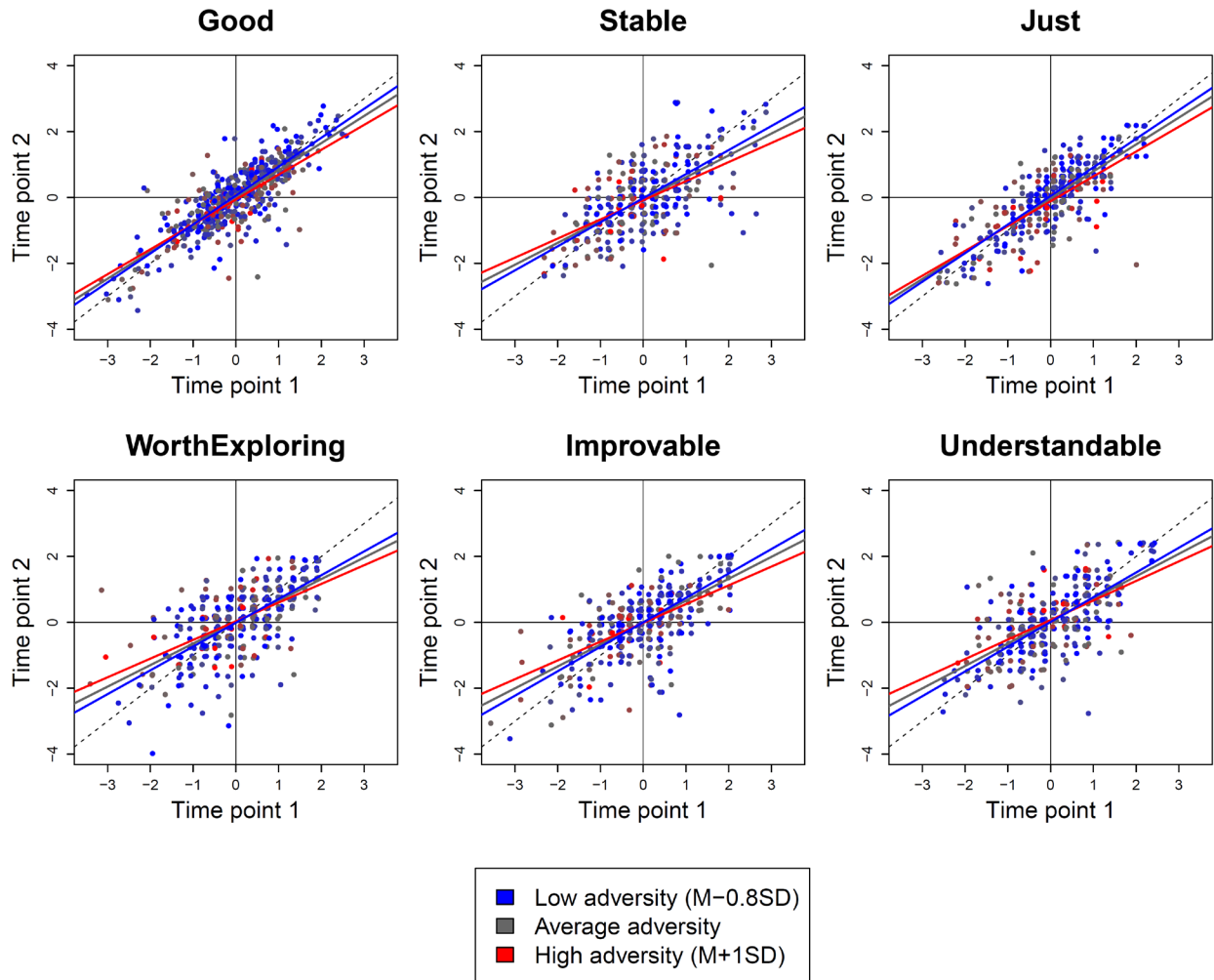
To explore the interaction effects further, we plotted predicted T2-primals as a function of T1-primals for three different adversity levels for the six significant interaction effects (Fig. 4; see also S4 Fig). In general, participants who held strong positive beliefs before the pandemic and then had many adverse experiences showed the relatively strongest decline in positive beliefs, compared to those with more neutral or negative T1-primal scores.

We assessed whether these interaction effects might have been caused by floor effects (i.e., people with extremely negative primals having no room for further worsening). There was no evidence for floor effects for these primals, as only very few participants scored 0 on the original scale on either T1 or T2 (no participant did so for *Good* and *Improvable*, 0.3% for *Worth Exploring*, 0.5% for *Understandable*, 1.3% for *Stable*, and 2.4% for *Just*; see S5 Table and S5 Figure to inspect all primals). This suggests that the observed interaction effects were not a statistical artifact of using a scale with restricted range.



**Fig. 3. Regression models predicting primal beliefs at time 2 based on primals at time 1 and personal adversity experienced since Time 1.** Beta values for regressors of interest for hypothesis testing. Model was formulated as:  $T2 \sim \text{intercept} + T1 + \text{Adversity} + T1 * \text{Adversity}$ . T1 coefficients not shown (see S6 Table for all values). Each point represents the estimated change in a given primal in standardized T1 units. Since all variables were standardized, the intercept denotes the effect of the pandemic time period for a person with *average adversity and average T1-primal values*. Arrows refer to our pre-registered hypotheses. Red arrows: pre-registered predicted decrease (after the pandemic and/or associated with increasing individual adversity), green arrows: pre-registered predicted increase.

n = 529 for primary and secondary primals (bigger font, pooled sample), n = 376 for all other primals (small font, only available in sample 1). Error bars = 95% confidence intervals. \*:  $p < .05$ , \*\*:  $p < .01$ , \*\*\*:  $p < .001$ , t: (two-tailed; not corrected for multiple comparisons).

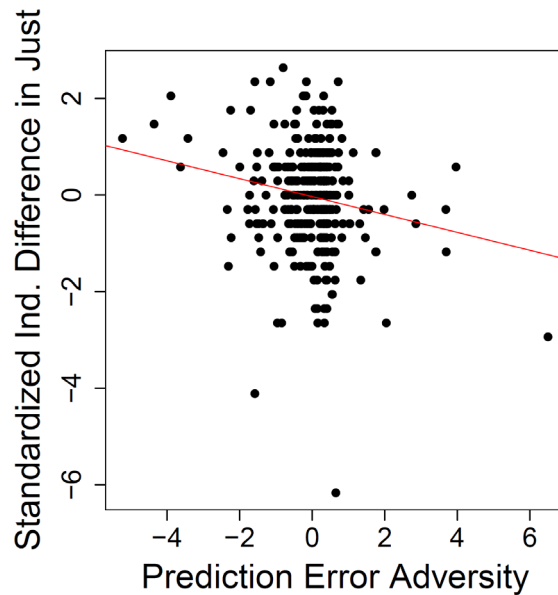


**Fig. 4. Interaction effects between T1 primals and adversity scores on T2 primals.** Shown are only those primals for which the interaction was significant (see Fig. 3). Each point represents an individual participant's scores on a given primal at T1 and T2. Dashed line indicates no change. Solid vertical and horizontal lines mark the T1 average.

### Effects of adversity prediction errors on primals (analysis 3)

Replacing Adversity in our regression models with PE revealed a main effect of PE on *Just* at T2 ( $\beta = -0.08$ ,  $p = .018$ ). There were no significant main effects or interaction effects of PE for any other primal (see S7 Table for all values). We also regressed standardized individual difference scores (SID) for all primals (standardized T2-T1) on PE. Changes in *Just* were

predicted by PE ( $\beta = -.19$ ,  $p < .01$ , Bonferroni-corrected for multiple comparisons, Fig. 5, S8 Table). Thus, experiencing more adversity than in the past led to decreases in the belief *Just*.



**Fig. 5. Prediction errors in adversity predicted changes in the belief that the world is *Just*.** Experiencing more adversity than expected based on past experience--estimated based on lifetime trauma at T1-- was associated with participants perceiving the world as less *Just* during the pandemic ( $n = 376$ ).

### Supplementary analysis of different types of adversity on primals

While our hypotheses were about overall adversity experienced during the pandemic, we also explored whether different types of adversity had differential effects on primals. Using an approach adapted from Poulin and Silver (2019), we estimated the amount of adversity in several subcategories: witnessing or experiencing injury/illness, violence, bereavement, financial/professional stress, social isolation, social stress, community disasters, and risk to own health. We then re-ran our regression analyses in each of these categories, while controlling for the number of categories using Bonferroni-correction. Methods and detailed results can be found in S4 Material, S6 Figure, and S7 Figure.



Different types of adversity during the pandemic appeared to have differential effects on primals. Experiencing violence and financial/professional hardship predicted several changes in primals, whereas other types of adversity were mostly unrelated to changes in people's beliefs. For example, participants who experienced financial/professional hardship during the pandemic reported decreased beliefs in a *Safe*, *Pleasurable*, *Regenerative*, *Progressing*, and *Just* world; while those who had experienced violence reported decreases in *Abundant* and *Meaningful*. There were also interaction effects for other primals for these and other adversity types. These mirrored the interaction effects for the overall adversity score, in that participants with more positive beliefs prior to the pandemic showed relatively stronger decreases in primals compared to those with negative prior beliefs (with one exception; S7 Figure). For social isolation and bereavement, no significant effects on any primals were found. All effect sizes in the various subcategories were again relatively small, as in the main analysis.

### **Supplementary analysis of lifetime trauma and primals at T1**

The unexpectedly small changes in primals—especially in the *Safe* world belief—during the pandemic appear to cast doubt on retrospective accounts of belief formation. It is unclear, however, whether this pattern would hold beyond the unique circumstances of the pandemic. To further explore the relationship between adversity and primals, we examined whether lifetime trauma history (THQ-sum score at T1) correlates with primals at T1, given the common assumption of negative experiences being associated with negative beliefs. It did indeed for most primals (S9 Table), with participants with more lifetime trauma showing more negative beliefs. The strongest correlations were  $-.28$  ( $p < .001$ ) for both *Safe* and *Just*.

### **Supplementary analysis of associations with mental health**

We also explored associations of our findings with mental health (S10 Table). We replicated previous findings showing clear links between primals and well-being (Clifton et al., 2019; Vazquez et al., 2021): For example, participants with higher depression and anxiety at T2 reported lower beliefs in *Good* at T2 (depression:  $r = -.42$ , anxiety:  $r = -.39$ ,  $p < .001$ , corrected). Moreover, adversity during the pandemic correlated with T2 depression ( $r = .33$ ), and T2 anxiety ( $r = .30$ , both  $ps < .001$ , corrected).

### **Supplementary analysis of attrition**

Finally, we explored to what extent attrition might have influenced our results. Several demographic and psychological characteristics were significant predictors of study retention (see S2 Material and S11 Table for details). Using a multivariate analysis approach, we identified age and lifetime trauma at T1 as the potentially most important attrition predictors. We then explored how our results would change if we controlled for these variables. The results (S8 Figure) were similar to those reported here, although the pattern in terms of which primals did or did not reach significance slightly changed. Most importantly, again only very few primals showed any significant changes from T1 to T2 (as indicated by significant intercepts), and all standardized betas were small. Thus, our main conclusion of the relative stability of primals does not change when controlling for the variables that were most predictive of drop-out.

## **Discussion**

### **General stability of primals during the pandemic**

In this longitudinal, quasi-experimental study, we tested whether the initial shock of the pandemic and individual levels of experienced adversity were associated with changes in primal world beliefs. Contrary to our hypothesis, we did not find evidence that primals became substantially more negative for the average person during the initial phase of the pandemic (Figs.

2B, 2C, and 3). Primals were surprisingly stable, except that participants saw the world as slightly less *Alive*, *Interactive*, and *Acceptable*. Most strikingly, despite a global increase in danger, the general belief that the world is *Safe* (vs. *Dangerous*) did not change. These findings may suggest that primals are trait-like, stable characteristics of individuals rather than flexible states that dynamically adapt to the current context (see also Poulin & Silver, 2019). COVID-19 may have changed the world in many ways, but it does not appear to have had much impact on what people believe about it, at least within the first half year of the pandemic.

Surprisingly, there were a greater number of significant changes in primals in the non-pandemic comparison sample than in the pandemic sample. Although the comparison sample was not matched in duration or occurrence of major events to the pandemic sample, these findings underscore the overall resilience of primals during the early phases of a world-wide shock to the system. We note that determining exactly why and which changes occurred in the non-pandemic sample is beyond the scope of the current paper although we offer some ideas on this further below.

### **Small adversity-related changes in primals**

Despite primals' overall stability, people who reported many adverse experiences (e.g., job loss) showed some small changes in primals. The more adversity people experienced, the less *Good*, *Safe*, *Progressing*, *Cooperative*, *Just*, and *Abundant* they tended to see the world, and the more they thought the world *Needs Them* and was *Changing*. Moreover, there were interaction effects between adversity and T1-beliefs for the primals *Good*, *Stable*, *Just*, *Worth Exploring*, *Improvable*, and *Understandable*. People with more positive beliefs before the pandemic who then experienced greater adversity subsequently reported more negative shifts in beliefs compared to people with comparable levels of adversity but more negative initial beliefs. This fits with Janoff-Bulman's (1992) suggestion that people with more positive assumptions

about the world might—at least initially after a trauma—experience stronger degradation of these assumptions compared to those who already had negative views before the event (of note, she suggested that these individuals may also recover more quickly)<sup>1</sup>. All changes found here, however, were small.

### **Considerations regarding the significance of the small changes**

In the depression intervention literature, effects of the size found for general and adversity-related effects in this study (max. 0.16 SD change, most around 0.1 SD change) are typically not considered clinically meaningful (Cuijpers et al., 2014). In the individual differences literature, by contrast, effect sizes similar to the ones found here have been interpreted as more meaningful (Hudson & Fraley, 2015). Funder and Ozer (2019) recently pointed out that smaller effect sizes in psychology should not be discarded as meaningless, since they may accumulate over time or across people and have important long-term impacts. This may be particularly relevant for highly general beliefs such as primals which likely impinge on a wide range of behaviors, and given the large proportion of the global population who were affected by adversity during the pandemic. Indeed, in a supplementary analysis (S9 Table), we found that most primals at T1 correlated with lifetime trauma experienced prior to T1 (max.  $r = -.28$ ). This suggests that cumulative trauma or adversity across long time periods may indeed lead to increasingly negative primal beliefs from small to moderate degrees.

It is also possible that the small declines we did observe might not endure. As such, it could be that as individuals' mental health improves, so too will their beliefs about the world - in those few cases in which changes did occur at all. However, we note that our data was sampled

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<sup>1</sup> When applying Janoff-Bulman's thinking to any of our results, it should be kept in mind that she was writing about trauma, whereas many of the events we assessed in this study might only qualify as adverse experiences (Krupnik, 2019).

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relatively early in the pandemic. It is also possible that the protracted societal disruptions caused people to experience more adversity or declining negative mental health, which may lead to more severe or enduring primal changes. For example, one study of the psychological effects of the global financial crisis found that participants' depression was worse in the declining stage of the crisis than it was at its peak (Sargent-Cox, Butterworth, & Anstey, 2011). Further research should investigate this question and should aim to determine the causal direction of interactions between adversity, mental health, and primals (Clifton & Kim, 2020; Clifton, 2020a). Thus, the impact of the small changes in primal world beliefs observed here will depend on whether they stabilize, accumulate over time, or return to baseline after the pandemic.

### **Different types of adversity have different effects on primals**

During the early stages of the pandemic, people differed not only in how many adverse events they experienced, but also in what challenges they faced. Our finding that various kinds of adversity had different effects on primals (Material S4) suggest that when it comes to influencing how people see the world, not all experiences are created equal (Janoff-Bulman, 1992; Poulin & Silver, 2019).

This could offer one potential explanation for some of the differences between the pandemic and the non-pandemic time period. Many hardships experienced in the first half of 2020 (e.g., the virus, social isolation) were unique to this timeframe, whereas the non-pandemic sample (2015-2017) experienced a different set of unique societal/political upheavals. Possibly, pandemic-specific types of adversity were less potent for inducing changes in beliefs about the world. Indeed, we found very few primal changes after social isolation, social stress (e.g., in one's household during lock-down), bereavement, and for those at increased risk to their health. In contrast, violence or financial stress—which might have been relatively prevalent during the non-pandemic time as well—were associated with numerous small primal changes.

Further, although primals are purportedly beliefs about the world as a whole, it is not yet clear which categories of objects, people, or places most inform these beliefs. For example, primals may reflect what people believe about the natural world, the social world, some combination of the two, or possibly some other conceptualization of what the world entails. If primals are primarily concerned with the social world, one may predict that societal and political conflicts would have stronger impacts on primals than threats from the natural world. This would be consistent with our finding that there was a greater decline in primals during the socially and politically tumultuous time during which our non-pandemic sample completed their surveys, although there was notable social upheaval in 2020 as well (e.g., the “Black Lives Matter” protests).

The exploratory nature of this analysis makes it difficult to draw firm conclusions. Future research should continue to explore what aspects of the world most inform the content of primals and should further tease apart the impact of various types of adversity on beliefs about the world.

### **Implications for psychological theory**

Our hypotheses that the global disruption caused by the pandemic and the individual adversity one experienced as a result would predict negative changes in a person’s primals were based on so-called retrospective accounts of belief formation, which postulate that people will update their beliefs in response to substantial changes in the environment and/or individually traumatic events (see Clifton, 2020b; Duckitt & Sibley, 2009; Janoff-Bulman, 1989, 1992; Kaler et al., 2008). Our study offers only limited support for such accounts. Despite widespread global upheaval, we did not find any evidence for a general trend toward believing the world is worse than it was before the pandemic. Our finding that individual adversity did predict a negative change in primals is consistent with retrospective accounts of belief formation; however, the

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effects were smaller than prior theories might suggest, and it is unclear how robust and enduring these changes will be. *World beliefs* overall were not altered by a highly disruptive *world event*.

Instead, our findings may accord more with interpretive accounts of primal world belief formation. These hold that primals serve as lenses through which we see the world, and thus are relatively insensitive to evidence or experience (Clifton, 2020b; Poulin & Silver, 2019). As a speculation, for someone who sees the world as *Safe*, the pandemic might be interpreted as exceptional and temporary, or this person may pay more attention to information reinforcing their prior beliefs (e.g., reading up on vaccine safety). For someone who sees the world as *Dangerous*, by contrast, the pandemic might demonstrate something obvious they knew all along and they may pay more attention to information reinforcing that belief (Nickerson, 1998). This view can be linked to findings that personality traits tend not to show consistent patterns of change in response to major life events (Denissen, Luhmann, Chung, & Bleidorn, 2019), and with meta-analytic evidence that “strong situations” do not overwhelm individual differences in how people construe events nearly as much as prior theorizing suggested (Keeler, Kong, Dalal, & Cortina, 2019). This may also be because individual differences in primals might relate to individual variation in underlying brain biology—but precisely how remains to be determined.

It is worth noting that although the present study has focused on the resilience of positive primal world beliefs, our findings also suggest that negative beliefs about the world may be stubbornly resistant to change even when there is evidence to the contrary. For example, most people believe that the world is getting poorer, even though extreme poverty has significantly declined in recent decades (Roser, 2018). For people who believe the world is *Dangerous*, *Competitive*, and getting *Worse*, it may be hard to persuade them otherwise. Future research should investigate whether major, positive life events (global and/or individual) lead to changes in primal world beliefs.

## Constraints on generality

We note that our participants were sampled on MTurk, which comes with certain biases, such as different levels of depression and anxiety compared to the general population (Engle, Talbot, & Samuelson, 2020). While the potential limitations need to be kept in mind, MTurk has been found to be a reliable and efficient source for data (Mortensen & Hughes, 2018), particularly as we conducted rigorous data quality checks. Most importantly, in this case, the availability of pre-pandemic data constituted a unique opportunity to test the effects of the pandemic on primals, outweighing limitations.

Regarding the generalizability of our study, our sample did cover various ages, genders, and ethnic groups, albeit it was primarily (76%) White, substantially more Democrats than Republicans, and exclusively American. It is possible that our results would be different, for example, for only Black participants or those with very low socioeconomic status--people who were disproportionately negatively affected by the pandemic. It is possible that members of these groups would experience stronger average primal changes based on higher average adversity scores and fewer resources to buffer negative effects of the pandemic: future research should address this. However, when considering the income data of our sample, most participants were not wealthy, but rather on an average or below-average level compared to other Americans. Moreover, the *relation* between adversity and primal changes, as investigated here, might be expected to be the same in various groups.

Additionally, we observed some non-random attrition at T2, which is another limitation of this research (see S2 Material, S11 Table, and S8 Fig. for details). For example, participants with more trauma at T1 and Black participants were more likely to drop out of the study. Due to this--as well as due to relatively low participation of Black and Hispanic/Latino individuals at baseline--the average adversity experienced in this study might be underestimated (Fraiman,



Litt, Davis, Pursley, & Pediatric Policy Council, 2021; Goldmann et al., 2021; Grooms, Ortega, Rubalcaba, & Vargas, 2021).

We expect results would generalize to adults in other Western democracies that experienced similar societal disruptions because of the pandemic, but of course it is unknown whether similar results would be found in non-WEIRD countries [WEIRD: Western, educated, industrialized, rich and democratic], or in places that experienced a higher or lower level of COVID-19-related adversity.

### **Suggestions for future research**

There are several interesting follow-up questions to this study. One, as mentioned above, is whether the small adversity-related effects that we identified stabilize or even accumulate over time, or whether they revert to baseline levels. Another question concerns how other types of beliefs, such as those about one's own self or about 'my world' rather than 'the world in general', may have changed during the pandemic. Moreover, one may ask which factors can buffer the small negative effects of adversity on primals, including for example social support (Valentiner, Holahan, & Moos, 1994). Furthermore, we replicated here previous findings of a clear link between low mental health and more negative primals, which were both associated with increased adversity. Researchers should elucidate this link further. One may ask, for example, whether adversity causes mental health issues, which then lead to more negative primals, or whether adversity increases negative beliefs, which then lead to mental health issues, or whether both are true. Finally, one may investigate whether age plays a role in how malleable beliefs are. Specifically, it is possible that children experience larger changes in primals than adults in response to global adverse events (e.g., see Poulin & Silver, 2019; Rini et al., 2004).

## Concluding remarks

If general beliefs about the world play a crucial role for mental health and well-being, as has been proposed by several scholars, it is critical to understand how these world beliefs arise and how they can change. If they are strongly impacted by objective world conditions, then the path to positive beliefs (and theoretically, increased well-being) may be to, quite simply, make the world objectively better—less dangerous, more abundant, and so forth. However, our findings indicate remarkable resilience of primal world beliefs during extreme global change, at least initially and in a primarily White American sample. For example, though the world became objectively more dangerous, the belief that the world is *Dangerous* did not increase. This finding parallels research showing that objective improvements in quality of living do not necessarily result in corresponding improvements in subjective well-being (Easterbrook, 2003). Improving the world is per se a good idea, but it is unlikely to be sufficient for boosting people's well-being without attending to how people experience and perceive those changes.

Our findings resonate with the consistency of personality traits over the life course as well as postulated homeostatic functions of spiritual and religious beliefs for navigating hardship during crisis. This resilience offers hope for psychological recovery after a once-in-a-century pandemic (see also Bonanno & Mancini, 2008; Luchetti et al., 2020). However, we also found some evidence that personal adversity (particularly financial hardship or violence) leads to a slight degradation of beliefs. With the effects of climate change and other societal disruptions likely to be acutely felt by billions more people in the years ahead, it is more important than ever that we understand whether such changes will endure and what might help people have more hope for a better world.

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