



Full Length Article

When are assumptions shaken? A prospective, longitudinal investigation of negative life events and worldviews in a national sample [☆]Michael J. Poulin ^{a,*}, Roxane Cohen Silver ^b^a Department of Psychology, University at Buffalo, United States^b Department of Psychological Science, University of California, Irvine, United States

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ABSTRACT

Theorists maintain that negative life events (NLE) can alter worldviews, but evidence for this idea has been lacking. We present a model that raises three questions: (1) Do different types of NLE engender different types of worldview change? (2) Do factors that facilitate positive reappraisals of NLE buffer against worldview change? (3) Does change in stability of worldviews occur independent of change in worldview content? These questions were examined in data from a national U.S. sample of adults surveyed prospectively over a three-year period ($N = 2138$). NLE were reported by 91.6% of the sample. Each question was answered at least in part in the affirmative. Exposure to NLE may affect worldviews and thereby individual well-being and social behavior.

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1. Introduction

People rely on several types of beliefs about the world, or worldviews, to manage threat or uncertainty. Examples of worldviews include the implicit or explicit belief that life or society is fair (Jost, Banaji, & Nosek, 2004; Lerner, 1980), that in general, people are trustworthy (Bowlby, 1973; Dunning, Anderson, Schlösser, Ehlebracht, & Fechtenhauer, 2014; Erikson, 1950), and that one's culture has value (Pyszczynski, Solomon, & Greenberg, 2015). These worldviews provide a bulwark against threat or uncertainty because they are resilient: even when experience objectively indicates that life or one's society is not always fair, that trust can be exploited, or that one's culture is limited and fallible, motivated cognitive processes typically act to sustain adaptive worldviews. Laboratory research indicates that worldview threats typically lead not to worldview disconfirmation, but rather to strenuous efforts either to defend those worldviews (e.g., Hafer & Rubel, 2015; Jost, Gaucher, & Stern, 2015; Pyszczynski et al., 2015) or shift attention away from the threatened domain (Heine, Proulx, & Vohs, 2006). Even when worldview threats in the lab do prompt accommodation, such changes tend to occur in peripheral, but not central, aspects of worldviews (Hayes et al., 2015).

The stability of worldviews in the face of threat is consistent with the possibility that worldviews function as a relatively stable individual difference, bolstered by the adaptive operation of a psychological immune system (DeWall & Baumeister, 2007; Gilbert, Pinel, Wilson, Blumberg, & Wheatley, 1998). Indeed, these beliefs may at times buffer individuals against the psychological impact of adversity (Schleider, Woerner, Overstreet, Amstadter, & Sartor, 2018). However, while worldviews may resist disconfirmation in many circumstances, it is not clear that they are always immune to threat. Just as certain diseases can overwhelm the body's immune system, certain experiences may have the capacity to overwhelm the psychological immune system, producing change rather than continuity in one's core beliefs. Trauma researchers have long maintained that powerful, negative life events (NLE) have the potential to alter certain core components of people's worldviews (Janoff-Bulman, 1992; Kauffman, 2013; McCann & Pearlman, 1990; Park & Folkman, 1997; Tedeschi & Calhoun, 2004). However, evidence for this phenomenon has been sparse and inconsistent. Moreover, the circumstances under which negative life experiences are likely to alter worldviews are unclear: why is it that some individuals who are exposed to NLE may experience a dramatic "shattering" of their worldviews (Janoff-Bulman, 1992), while others' worldviews remain largely intact? Here, we review prior theory and research on the effects of NLE on worldviews, and on the basis of that review propose an exploratory model of the conditions under which NLE could lead to worldview change, as well as the forms such change may take. We then evaluate this

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model in a data set from a prospective, longitudinal study of a large U.S. national sample to better understand whether and when NLE are likely to produce this worldview change.

1.1. Prior research on NLE and worldviews

Over the past three decades, multiple theorists have proposed that the psychological effects of NLE, including both negative and positive outcomes such as depression, anxiety, PTSD, and posttraumatic growth, stem in part from their unique capacity to challenge and alter individuals' worldviews (e.g., Janoff-Bulman, 1992; Kauffman, 2013; McCann & Pearlman, 1990; Park & Folkman, 1997; Tedeschi & Calhoun, 2004). While there are many different beliefs that can constitute worldviews, trauma researchers have posited that there are two dimensions¹ in particular that should be affected by exposure to NLE. The first of these consists of beliefs that the world is more safe than not and that people are generally trustworthy²—together, beliefs about the extent to which the world is *benevolent*, according to Epstein (1973, 1990) and Janoff-Bulman (1989a, 1992). The second dimension consists of beliefs that outcomes are contingent upon a person's actions or character—i.e., that good and bad outcomes are justly deserved or controllable—what Epstein (1973, 1990) and Janoff-Bulman (1989a, 1992) describe together as beliefs about the *meaningfulness*³ of the world. While not all individuals agree equally with the proposition that the world is benevolent or meaningful, most individuals perceive some benevolence or meaningfulness in the world (Janoff-Bulman, 1992). According to trauma theorists, many NLE present data that challenge benevolence or meaningfulness beliefs with sufficient severity that individuals must accommodate these new data by altering the content of their worldviews to be less benevolent or meaningful (Janoff-Bulman, 1992; Kauffman, 2013; McCann & Pearlman, 1990; Park & Folkman, 1997; Silver, Boon, & Stones, 1983; Tedeschi & Calhoun, 2004).

Convincing evidence for this prediction is scant. Testing the prediction that NLE will give rise to *change* in individuals' worldviews requires the ability to detect worldview change when it occurs. But doing so is challenging, since experimentally manipulating the experience of NLE is unethical and impractical, and compelling correlational data would require assessing individuals' worldviews both *before* and *after* NLE. Most research has not accomplished this and has instead focused on comparing trauma-exposed individuals to others (e.g., Bramsen, van der Ploeg, van der Kamp, & Ader, 2002; Harter & Vanecek, 2000; Prager & Solomon, 1995; Ornduff, 2000; Solomon, Iancu, & Tyano, 1997; Tomich & Helgeson, 2002). Some of these studies suggest that people who have experienced NLE have less favorable worldviews (i.e., lower benevolence and/or meaningfulness beliefs) compared to those who did not. However, they leave open the possibility that these associations exist because people with different types of worldviews are more likely to experience or report trauma than others (cf. Magnus, Diener, Fujita, & Pavot, 1993). Moreover, other studies have found no associations between NLE and worldview favorability (e.g., Calhoun,

Cann, Tedeschi, & McMillan, 1998; Franklin, Janoff-Bulman, & Roberts, 1990; Ginzburg, 2004; Overcash, Calhoun, Cann, & Tedeschi, 1996).

Some studies have prospectively assessed worldviews before and after negative events, but these studies, too, have yielded inconsistent results. Two studies (Anders, Frazier, & Shallcross, 2014; Schuler & Boals, 2016) found that NLE predicted worldviews becoming overall less favorable (i.e., decreased benevolence and/or meaningfulness beliefs), but these effects were quite small. Two other studies found that NLE predicted changes in only certain aspects of people's worldviews (i.e., changes in vulnerability and self-views but not fatalism or justice: Gluhoski & Wortman, 1996; decreased benevolence but not meaningfulness beliefs: Rini et al., 2004).

Thus, while the idea that NLE alter people's worldviews has appealed to many, evidence for this proposition is not robust. We believe one likely explanation is that previous research has failed to explore empirically the specific conditions under which worldviews are—and are not—likely to change, despite the fact that those conditions can be specified. There are at least three specific predictions that are either explicit in or implied by previous theories about NLE and worldviews: (1) many NLE present data that challenge benevolence or meaningfulness beliefs; (2) this results in accommodation to these new data; and (3) accommodation occurs via altering the content of worldviews to be less benevolent or meaningful. We propose that a closer look at each of these predictions may reveal a more accurate picture of the associations between NLE and worldviews. In particular, these three predictions suggest a role for at least three conditions that might influence when and how NLE will alter worldviews, leading to a model that suggests testable research questions. This model is illustrated in Fig. 1, and described in detail below.

1.2. A model of the effects of NLE on worldviews

Types of events. NLE are thought to lead to worldview change in part because they present data that challenges benevolence or meaningfulness beliefs. However, it is not clear that all NLE are equally relevant to both of these beliefs, raising the possibility that certain events could threaten one belief but not the other. For example, experiencing a major illness may suggest that the world is less fair or controllable (i.e. meaningful) than one previously believed, but it may not threaten views of the benevolence of others. Conversely, encountering violence, which conveys another person's hostile intent, may challenge the view that people are benevolent, either with or without altering perceptions that the world is meaningful. In other words, whether or not a negative event challenges a specific aspect of a person's worldview may depend on the type of event experienced.

Prior research has not examined this issue directly. All prospective studies of NLE and worldviews combined all types of NLE together, and some treated multiple aspects of individuals' worldviews as a single construct (e.g., Lilly, Valdez, & Graham-Berman, 2011; Park, Mills, & Edmondson, 2012; Schuler & Boals, 2016). However, cross-sectional studies have looked at the association between worldviews and experiencing specific kinds of NLE (versus not). A review of these studies suggests some potentially instructive patterns. For example, several studies examining the impact of interpersonal violence found such events associated with less benevolent, but not less meaningful, worldviews (e.g., Ornduff, 2000; Prager & Solomon, 1995; Pyevich, Newman, & Daleiden, 2003; Solomon et al., 1997). In one notable exception, Janoff-Bulman (1989a) found that several different categories of NLE (e.g., death of parent, incest, rape, fire, or accident) predicted decreased benevolence beliefs. In contrast, several studies examining the worldviews of bereaved individuals (e.g., Mancini, Prati, &

¹ Some researchers (e.g., Janoff-Bulman, 1992) include self-worth or self-esteem as another dimension that trauma can challenge or alter. Here, we focus on the concept of worldviews as consisting specifically of beliefs about the world outside of the self, consistent with other uses of this concept (e.g., Hafer & Rubel, 2015; Jost et al., 2015; Pyszczynski et al., 2015), recognizing as well that there is a robust literature addressing links between adversity and self-esteem (e.g., Dumont & Provost, 1999; Hudd et al., 2000; Krause, 1987).

² In Epstein's formulation, these are actually separate categories—the benevolence of the world and the benevolence of people—but because Janoff-Bulman (1992) regarded them as parts of a single dimension, they are grouped here.

³ The word "meaningfulness" can obviously encompass many things beyond person-environment contingency. We use this term to facilitate comparisons to prior work in the trauma literature. However, we wish to emphasize for this investigation that we are using it in the narrow sense defined here.

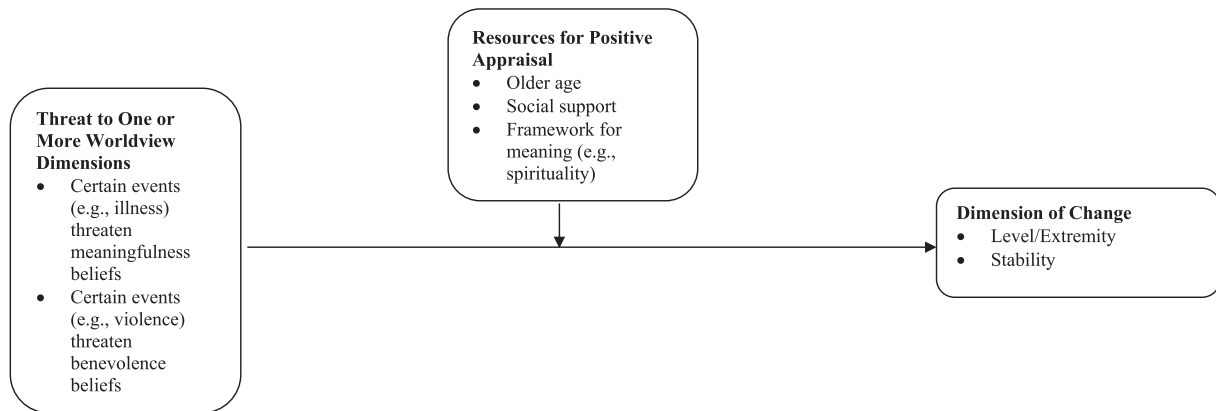


Fig. 1. Proposed model of the conditions under which negative life events may affect worldviews.

Bonanno, 2011; Poulin & Heckhausen, 2007; Poulin & Silver, 2008; Schwartzberg & Janoff-Bulman, 1991), or those suffering a serious illness (Tomich & Helgeson, 2002), found that such individuals perceive the world as less meaningful but not less benevolent. It would be valuable to test whether these patterns—or alternate ones—hold up in prospective data, as well.

Potential moderators of worldview change. The idea that NLE lead to change in worldviews relies on the notion that they challenge worldview dimensions severely enough that individuals must accommodate these new data. However, other factors may independently influence whether individuals are or are not forced to accommodate this new information, rather than assimilating it into their existing worldviews (Tait & Silver, 1989). In particular, the extent to which individuals can engage in positive reappraisals of NLE—for example, as experiences from which one has grown or learned (e.g., Kalisch, Müller, & Tüscher, 2015; Silver et al., 1983; Taylor, 1983)—could preserve beliefs in the benevolence and/or meaningfulness of the world. Altering one's worldviews, by contrast, would represent continued negative appraisals of a NLE (Park & Folkman, 1997; Park et al., 2012), leading to views of the world as less benevolent and/or meaningful. Prior research has not examined potential moderators of worldview change. However, there are several individual differences and situational characteristics known to facilitate positive reappraisals, including cognitive control (e.g., Ochsner & Gross, 2005) and optimism (e.g., Prati & Pietrantonio, 2009), and they may also buffer the effects of NLE on worldview change. Other individual differences are known to affect coping processes in part through positive reappraisals as well. For example, positive reappraisals of negative situations appear to increase with age (Folkman, Lazarus, Pimley, & Novacek, 1987; Lohani & Isaacowitz, 2014). Individuals who report receiving more social support engage in more frequent positive reappraisals (Holahan & Moos, 1987; Valentiner, Holahan, & Moos, 1994). Also, frameworks for finding meaning in life, such as religious involvement or spirituality, facilitate positive appraisals of events (e.g., Gall, 2000; McIntosh, Silver, & Wortman, 1993; Overcash et al., 1996; Park, 2006). These factors, in turn, could moderate the association between NLE and worldviews such that NLE would predict greater worldview change among people without these factors than among others.

Cognitive dimensions of worldviews. Prior models of NLE and worldviews further predict that worldview change occurs by people altering the content of their worldviews to be less benevolent or meaningful. However, this prediction is incomplete. Changes in beliefs spurred by new or conflicting information may or may not entail altered belief content—instead, it could involve weakened belief strength (for more on this distinction, see Petty &

Krosnick, 2014). With respect to benevolence and meaningfulness beliefs, the overall effect of NLE could be to leave these beliefs generally intact but potentially less consistent or stable within individuals (cf. Kernis, 2005; Luttrell, Petty, & Briñol, 2016), which would require examining variability in worldviews over time. No prior research has examined this issue. If worldview change does occur, but partially or even primarily in the form of changes in belief strength, that may explain why some studies failed to find the predicted effects (e.g., Calhoun et al., 1998; Franklin et al., 1990; Ginzburg, 2004; Overcash et al., 1996).

1.3. The present study

In sum, the model outlined above raises three questions about how and under what conditions NLE might affect worldviews: (1) Do different types of NLE engender different types of worldview change? (2) Do factors that facilitate positive reappraisals of NLE buffer against worldview change? (3) Does change in stability of worldview beliefs occur independent of change in worldview content? In order to address these questions in a prospective fashion, we examined pre-existing data from a national U.S. sample of adults (see Silver et al., 2002; 2006) who were studied prospectively over a three-year period and who were surveyed about their worldviews and about their experiences with a wide variety of NLE over time. This allowed us not only to address our research questions about the associations between NLE and worldviews, but also to assess the frequency of many types of negative events—important for establishing the theoretical or practical importance of any links between life events and worldview change.

It is important to note that, while we collected the data described above with the aim to examine NLE and worldview change, it was not designed specifically to test the model developed herein, which was refined subsequent to data collection. Because of this timeline (data collection first, then updated theorizing, and then analyses), the available data were not always perfectly tailored to the research questions, so the analyses presented represent a compromise between our model and what the data set would allow us to test. Below, we review our research questions and how we addressed them using the available data.

1) Do different types of NLE predict different types of worldview change? Prior cross-sectional research suggests that experiencing bereavement and illness may predict decreased *meaningfulness* beliefs, whereas experiencing violent events may predict decreased *benevolence* beliefs. Our NLE data allowed us to examine these patterns of within-person change in worldviews, as well as explore others that may not fit the findings of past cross-sectional research.

2) Do factors facilitating positive reappraisals moderate the effects of NLE on worldviews? While there are several factors that could facilitate positive reappraisals, we did not measure all of them. However, three individual differences that prior research has shown to predict greater positive reappraisals of negative events were assessed in our data set: older age (Folkman et al., 1987; Lohani & Isaacowitz, 2014), social support (Holahan & Moos, 1987; Valentiner et al., 1994), and religious involvement or spirituality (e.g., Gall, 2000; McIntosh et al., 1993; Overcash et al., 1996; Park, 2006). Accordingly, we tested whether greater age, social support, and religiosity/spirituality would buffer worldviews against NLE-related decline, recognizing that these variables are not direct proxies for positive reappraisals, and thus could have diverse possible effects on NLE and worldviews.

3) Do NLE predict changes in chronic stability of worldview beliefs? As a first step towards addressing this novel research question, we examined variability over time. In principle, we were interested in the possibility that NLE could lead to changes in within-person stability over time. However, we lacked sufficient longitudinal data to look at within-person stability at multiple points in time. Thus, we examined the associations between NLE and individual differences in within-person stability.

2. Method

2.1. Participants and procedure

Data collection took the form of Internet-based surveys of a large, national sample recruited using representative sampling techniques (see Silver et al., 2002; 2006). All data were collected in collaboration with Knowledge Networks Inc. (KN), a survey research organization that maintained a nationally representative, Web-enabled research panel of potential respondents recruited at the time of the study using stratified random-digit-dial telephone sampling. Panel members participated in brief surveys 3–4 times a month and were compensated with web connectivity and access (if needed), and cash or bonus points for merchandise. For the present study, participants earned the equivalent of approximately \$10 per survey. Members could leave the KN panel at any time, and Internet access was not contingent upon completion of any specific survey.

Participants were originally selected at random from the KN panel to take a survey focused on their acute stress and coping responses to the September 11, 2001 (9/11) terrorist attacks. A total of 3496 adults age 18 and over were invited to participate in that survey, fielded in the three weeks following 9/11, and 2729 completed it (78% participation rate). Of these individuals, 2138 (78% participation rate) participated in Wave 1 of the present study, fielded approximately 12 months post-9/11 (9/20/02–11/3/02). All Wave 1 participants were invited to complete surveys at each of three subsequent waves: Wave 2 (3/13/03–4/6/03, $N = 1666$, 78% participation rate); Wave 3 (9/12/03–10/31/03, $N = 1571$, 73% participation rate); and Wave 4 (9/12/04–11/2/04, $N = 1771$, 83% participation rate). At each wave, panel members were notified that a survey was available for completion in their password-protected email accounts. KN maintained the anonymity of panel participants and surveys were confidential, self-administered and accessible any time of day for a designated period. Panel members could complete a survey only once. Survey completion times varied between 30 and 45 min (additional measures not used in the present investigation primarily pertained to mental health and responses to the 9/11 attacks). All procedures were approved by the Institutional Review Board of the University of California, Irvine.

2.2. Measures

Worldviews: Benevolence and Meaningfulness beliefs. Worldviews pertaining to the benevolence and meaningfulness of the world were assessed using items from Janoff-Bulman (1989a) World Assumptions Scale (WAS). Because of space limitations, benevolence was measured with six of eight original items, three that referred to the benevolence of the world in general (e.g., “There is more good than evil in the world,” “The good things that happen in this world far outnumber the bad,” “The world is a good place”) and three that referred to the benevolence of people specifically (e.g., “Human nature is basically good,” “People are naturally unfriendly and unkind” [item reverse scored], “People are basically kind and helpful”). Meaningfulness was measured with six of eight original items, three that referred to the controllability of the world (e.g., “If people took preventive actions, most misfortune could be avoided,” “Through our actions, we can prevent bad things from happening to us,” “When bad things happen, it is typically because people have not taken the necessary actions to protect themselves”) and three that referred to the fairness of the world (e.g., “Generally, people deserve what they get in this world,” “By and large, good people get what they deserve in this world,” “People will experience good fortune if they themselves are good”). Scales were shortened by selecting those items that correlated most highly with the mean of its corresponding dimension in a study of trauma-exposed Vietnam War veterans (see Holman & Silver, 1998).

Study participants responded to WAS items using a five-point scale with endpoints 1 = “Strongly disagree,” and 5 = “Strongly agree”. The subscales demonstrated good internal consistency (α s for meaningfulness between 0.79 and 0.85 across waves; α s for benevolence between 0.83 and 0.87 across waves).⁴ A confirmatory factor analysis allowing for correlated error terms within each of the four subscales (benevolence of the world, benevolence of people, fairness, and controllability) indicated that a two-factor solution with benevolence and meaningfulness as separate but correlated factors provided adequate fit to the data at Wave 1 ($\chi^2[41] = 532.19$, $p < 0.001$, CFI = 0.95, TLI = 0.91, RMSEA = 0.07). Notably, an alternate model with each subscale modeled as a separate factor (for a total of four factors) did not provide improved fit ($\chi^2[48] = 663.77$, $p < 0.001$, CFI = 0.93, TLI = 0.91, RMSEA = 0.07).

Lifetime and recent NLE. At study entry, and again at each wave, respondents indicated whether and when they had been exposed to a list of 37 negative events (e.g., natural disaster, death of a friend, child abuse; see Table 1). This measure was modified from the Diagnostic Interview Schedule section on trauma (Robins, Helzer, Croughan, & Ratliff, 1981) and was expanded using open-ended coding of lifetime traumas reported by a primary care sample (Holman, Silver, & Waitzkin, 2000). At study entry, in order to reflect the fact that some events could have occurred more than once in an individual’s life, respondents were able to list up to four separate occasions on which each specific event had happened to them. At subsequent waves, respondents were asked to specify the month(s) during which each event happened to them since the previously completed survey.

From the NLE checklist, separate variables were created to reflect six different categories of negative events: injury or illness, violence, bereavement, social-environmental stressors,

⁴ While there is some evidence that the subscales of the WAS are independent (van Bruggen et al., 2018), other studies have noted psychometric problems with the WAS, including poor internal consistency and test-retest reliability when using these subscales (e.g., Ginzburg, 2004; Kaler et al., 2008; Tomich & Helgeson, 2002). In part because of these concerns, and in part to simplify presentation of results, this investigation focuses only on the higher-order dimensions of benevolence and meaningfulness.

Table 1
Negative event categories and specific negative events.

Category	Specific Events
Injury/illness	accident or injury to self, accident or injury to loved one, serious illness of self, serious illness of loved one, witnessed family member injured, witnessed other individual injured
Violence	attack or assault, coercion with threats to loved ones, homicide of loved one, suicide of loved one, experienced combat, been hit or pushed by spouse, undesired sexual touching, rape, childhood neglect ^a , childhood physical abuse ^a , witnessed violence between parents ^a
Bereavement	death of: mother, father, sibling, grandparent, child, spouse, friend
Social-environmental stress	had inadequate finances for survival, lived in dangerous housing/neighborhood, experienced discrimination, exposed to dangerous chemicals or biological agents
Relationship events	forced separation from family, gotten divorced, experienced parents' divorce, been shamed or embarrassed, had unwanted pregnancy
Community disasters	experienced or suffered loss in natural disaster, experienced or suffered loss in human-caused disaster

Note. ^a Only assessed in context of lifetime, not recent events.

relationship-focused events, and community disasters (see Table 1). Each of these variables was computed as the total number of each category of events individuals had experienced before study entry (i.e., *lifetime* exposure) and since the previous wave (i.e., *recent* exposure); overall sums of lifetime and recent events were also computed.

Moderators of worldview change. Age, social support and religiosity/spirituality (henceforth, phrased as “spirituality”) were measured as follows: Age was assessed in years at project entry. *Social support* was assessed at Waves 1, 3, and 4.⁵ Respondents answered two questions about three potential targets (as applicable: romantic partner, family, and close friends): “In the past week, how often did the following people help you understand or sort things out?” “In the past week, how often did the following people provide you with encouragement?” (1 = “Never,” 5 = “All the time”); an index was calculated using the mean at each wave. This scale demonstrated very good internal consistency (α s at all waves 0.89–0.90). *Spirituality* was assessed at each wave with the following item on a 10-point scale: “How important is religiosity or spirituality in your life?” (1 = “Not at all,” 10 = “Extremely”).

Worldview stability. In order to assess the stability versus instability of worldviews over time, we computed the across-wave standard deviation of mean benevolence scores and mean meaningfulness scores for each individual (see Kernis, 2005, for a similar method used to assess self-esteem instability). Because higher standard deviations represent greater across-wave variability, these variables represented the *instability* of benevolence and meaningfulness beliefs, respectively.

Exposure to the 9/11 attacks. Participants' experiences on 9/11/01 were assessed at study entry and screened as a covariate in all analyses to ensure that any results were not driven solely by exposure to this historically-specific negative event. In line with previous research on responses to 9/11 (e.g., Silver et al., 2002; 2006), individuals were grouped into three different categories of exposure: *direct exposure* (being in the World Trade Center or

Pentagon, seeing or hearing the attacks in person, or having a close relationship with someone in the buildings or airplanes during the attacks), *live media exposure* (watching the attacks unfold live on television), and *no live exposure* (only seeing or learning of the attacks after they had occurred). These categories were represented as a three-level variable (0 = no live exposure, 1 = live media exposure, 2 = direct exposure).

Demographic characteristics were collected by KN upon panel entry, including gender, age, race and ethnicity, education, and household income. Age was used as a covariate in analyses that did not examine its role as a moderator (see above).

2.3. Analytic strategy

All hypotheses were tested using multilevel modeling, also known as random-effects modeling, mixed-effects modeling, or hierarchical linear modeling (Singer & Willett, 2003), using STATA 14.0 (Stata Corp. College Station, Texas). Multilevel modeling made it possible to estimate differences in worldviews as a function of both between-person differences in exposure to lifetime or recent NLE and individual-level change in exposure over time. In multilevel modeling, predictor variables can vary between individuals, such as gender or prior exposure to NLE, or within individuals over time, such as worldviews each year or NLE experienced within the past year. A significant association between a between-person predictor and worldviews assessed as varying over time indicates that the predictor is associated with the *initial level* of worldviews. An example of a level-2 model that includes only age and lifetime negative event history as predictors is the following:

$$\pi_{0i} = \gamma_{00} + \gamma_{10}AGE + \gamma_{20}LIFEEVENTS + \zeta_{0i}$$

In this model, γ_{10} and γ_{20} are regression coefficients expressing differences in meaningfulness beliefs based on age and lifetime negative events, respectively, and ζ_{0i} represents person *i*'s deviance from the model based on the population average and these two factors alone. By contrast, a significant association between a within-person predictor and worldviews assessed as varying over time indicates that there are significant associations between those variables on a wave-to-wave basis (i.e., that they are coupled over time). For example, in accordance with the hypothesis that recent bereavement would predict lower meaningfulness beliefs, the within-person regression would test the prediction that at time points when individuals report having recently experienced bereavement, their meaningfulness beliefs should be lower than at other time points. Mathematically, this is expressed as:

$$Y_{ij} = \pi_{0i} + \pi_{1i}BEREAVEMENT_{ij} + \varepsilon_{ij}$$

Here, Y_{ij} stands for the outcome (meaningfulness beliefs) for person *i* at time point *j*, π_{0i} stands for the mean level of person *i*'s meaningfulness beliefs over time, π_{1i} is the regression coefficient linking bereavement occurrence for person *i* to meaningfulness levels, $BEREAVEMENT_{ij}$ is the number of recent bereavement events person *i* reported at time *j*, and ε_{ij} is unobserved measurement error.

Multilevel models were evaluated specifically as random-effects models (i.e., combining within- and between-individual information) using STATA's *xtreg* module with maximum likelihood estimation.

To test whether certain types of recent NLE would predict change specifically in either benevolence or meaningfulness beliefs, separate multilevel models were generated for each. Benevolence and meaningfulness beliefs were significantly correlated (at Wave 1, $r = 0.31$), so to fully test these hypotheses, the model for benevolence controlled for meaningfulness beliefs and the model for meaningfulness controlled for benevolence beliefs. In each case, to reduce possible confounding, background charac-

⁵ Other reports using this data set (e.g., Silver et al., 2002; 2006) had interests in variables assessed by Knowledge Networks at time points prior to the data collections reported herein (i.e., at 2 and 6 months post-9/11). For simplicity, we exclude those waves for most of the present analyses. However, for analyses in which social support was used as a lagged predictor, data on social support were included from an earlier data assessment (November–December 2001) administered to a subsample of panel members ($N = 1382$).

teristics including age (in models where age was not being treated as a moderator), gender, ethnicity, income, 9/11 exposure, and lifetime number of negative events were screened as controls (i.e., potential confounds) for inclusion in the model. Ethnicity was used as a dummy-coded variable with five categories: White, the reference group; African American; Hispanic/Latino; other ethnicity; and missing (included to manage missing data). For both benevolence and meaningfulness beliefs, recent events—assessed as having occurred since the prior wave—were used to predict worldviews at the subsequent waves, adjusting for worldviews at the prior wave (i.e., lagged worldviews at time point $t-1$; see Singer & Willett, 2003, for additional information on the utility of lagging).

Hypotheses about moderation by age, social support, and spirituality were tested using multilevel models, fit separately for benevolence and meaningfulness worldviews, with each moderator tested in its own model, yielding a total of six models. In order to reduce the number of moderation effects being tested, moderation was first examined using the overall number of recent negative events rather than the frequencies of the six event categories. In each case, models for benevolence and meaningfulness were built using controls found to be significant in tests of the first two hypotheses, as described above.

Moderation was tested using the product-term interaction of the proposed moderator with the overall number of recent negative events. Both social support and spirituality, which varied over time along with recent negative events and worldviews, were examined as lagged variables, with the moderator from time point $t-1$ used as a predictor of the outcome at time t .

Analyses also examined the across-wave standard deviation (i.e., instability) of benevolence and meaningfulness beliefs. Analyses of worldview instability, a between-person variable, took the form of regular (OLS) regressions. These analyses only used lifetime negative events along with controls as predictors, and only included participants with data from all waves ($n = 1292$) so as not to confound worldview stability with non-participation.

Given that NLE variables were highly positively skewed, we visually examined the residuals of all models to assess possible violations of the assumption that residuals should be normally distributed. There were no obvious deviations from normality, suggesting that our multilevel models could be interpreted without transforming the variables.

2.4. Treatment of missing data

While all respondents participated in Wave 1, varying patterns of recruitment and attrition characterized other time points (see Silver et al., 2006 for details). In multilevel modeling, such missing data is not a severe problem, since individuals contribute to model estimation at particular time points, even if not at all points (Singer & Willett, 2003). Missing data on particular measures was managed by per-wave listwise case deletion; for each, data were missing for less than 2% of cases.

3. Results

3.1. Sample demographics and characteristics

The total sample ($N = 2138$) was 74.4% white, 8.6% African American, 9.8% Hispanic, and 7.2% other ethnicities; 2.0% were missing data on ethnicity. Females comprised 51.3% of the sample, and ages at the beginning of the study ranged from 18 to 101 ($M = 49.28$). These matched the demographic distribution of the U.S. at the time the study was conducted (see Silver et al., 2002; 2006 for additional details).

3.2. Analysis of Non-participants

In order to determine what variables predicted patterns of non-response over time, a multilevel model was constructed with participation at each wave (yes/no) as the time-varying dependent variable using STATA's *xtgee* module. All demographics and negative event history variables were screened for inclusion in this model. In addition, lagged variables representing worldviews and recent negative event categories from prior waves were used to predict participation at subsequent waves. Results from this model indicated that there were no differences in non-response based on worldviews or numbers of recent negative events. At each wave, respondents tended to be older ($M = 51.8$ years) than non-respondents ($M = 45.4$ years; $OR = 1.02$, $p < 0.001$), and the sample of respondents on average included proportionally fewer individuals of "other" ethnicity (5.7%) than the sample of non-respondents (9.1%; $OR = 0.66$, $p < 0.01$). Additionally, respondents, on average, reported a slightly higher number of lifetime bereavement events (3.35) as compared to non-respondents (2.61; $OR = 1.10$, $p < 0.001$).

3.3. Descriptive Statistics

Worldviews and moderators. Across the sample, individuals generally held positive but modest views of world benevolence at each wave (overall $M = 3.57$ on scale of 1 to 5, $SD = 0.69$), with more moderate views of world meaningfulness (overall $M = 3.04$, $SD = 0.71$). Age, social support and spirituality were highly independent of one another, with no correlations higher than $r = 0.20$. Age, social support and spirituality were also distinct from the worldview dimensions, with all correlations less than $r = 0.25$.

Lifetime and recent negative events. Almost all individuals in the present study (91.6%) reported at least one negative event in their lifetimes, with the average number of events reported being 8.44 ($SD = 6.46$) (see Table 2). Between approximately one-third and one-half the sample reported experiencing a recent negative event at each wave. The most common categories of events experienced were injury/illness and bereavement.

3.4. Research question 1: Do different types of NLE predict different types of worldview change?

At Wave 1, female gender ($B = -0.12$, 95% CI $[-0.15, -0.09]$, $p < .001$) and lifetime exposure to NLE ($B = -0.003$, 95% CI $[-0.01, 0.00]$, $p = 0.009$) predicted lower levels of meaningfulness beliefs: women and those who experienced greater numbers of NLE found the world less meaningful at Wave 1 than did others. There was no association between lifetime NLE and benevolence beliefs.

Multilevel models were used to predict worldview change from various types of NLE (see Table 3). Recent violence predicted a decline in benevolence beliefs ($B = -0.11$, 95% CI $[-0.18, -0.04]$, $p = 0.002$, $\phi = 0.05$), as did recent relationship events ($B = -0.08$, 95% CI $[-0.15, -0.01]$, $p = 0.02$, $\phi = 0.05$). In contrast, community disasters predicted increased benevolence beliefs ($B = 0.06$, 95% CI $[0.004, 0.12]$, $p = 0.04$, $\phi = 0.04$). No other categories of recent NLE predicted change in benevolence beliefs. Benevolence beliefs were positively associated with older age, female gender, ethnicity (i.e., membership in a non-"other" ethnic group), and higher income. The recent occurrence of injury or illness predicted a decline in meaningfulness beliefs ($B = -0.03$, 95% CI $[-0.06, -0.005]$, $p = 0.02$, $\phi = 0.02$), while recent violence predicted increased meaningfulness beliefs ($B = 0.10$, 95% CI $[0.02, 0.17]$, $p = 0.009$, $\phi = 0.02$), but no other categories of recent events predicted a change in meaningfulness beliefs.

Table 2

Descriptive statistics for lifetime and recent negative events (N = 2138).

Category	Lifetime events		Recent events				
	% reporting M (SD)	Max. # reported	Wave 1 % reporting M (SD)	Wave 2 % reporting M (SD)	Wave 3 % reporting M (SD)	Wave 4 % reporting M (SD)	Max. # reported ^a
Injury/illness	65.4%	20	13.3%	21.0%	21.5%	26.8%	6
	1.85 (2.03)		0.16 (0.48)	0.25 (0.54)	0.25 (0.57)	0.35 (0.67)	
Violence	40.3%	22	1.3%	3.2%	3.5%	5.2%	5
	0.86 (1.49)		0.02 (0.15)	0.04 (0.22)	0.04 (0.24)	0.06 (0.29)	
Bereavement	85.5%	13	16.4%	21.3%	20.6%	29.3%	4
	3.23 (2.38)		0.18 (0.42)	0.22 (0.45)	0.22 (0.45)	0.33 (0.54)	
Social-environmental stress	40.2%	6	6.8%	6.9%	8.1%	10.2%	3
	0.68 (1.05)		0.08 (0.33)	0.08 (0.32)	0.09 (0.34)	0.12 (0.39)	
Relationship events	50.4%	11	4.1%	4.2%	4.5%	6.1%	3
	1.24 (1.79)		0.04 (0.22)	0.04 (0.22)	0.06 (0.28)	0.07 (0.31)	
Community disasters	25.9%	5	3.4%	2.4%	3.4%	8.4%	4
	0.42 (0.84)		0.04 (0.24)	0.03 (0.17)	0.04 (0.21)	0.10 (0.37)	
TOTAL	91.6%	71	32.7%	39.7%	40.7%	52.6%	16
	8.44 (6.46)		0.57 (1.11)	0.67 (1.08)	0.70 (1.18)	1.04 (1.47)	

Note. Max. # reported = top of the range for that variable; minimum is always zero.

^a At any wave.**Table 3**

Multilevel models for levels of world benevolence and world meaningfulness.

Variable	B [95% CI]	
	Benevolence	Meaningfulness
Benevolence	–	0.21*** [0.19, 0.24]
Lagged Benevolence	0.36*** [0.34, 0.39]	–
Meaningfulness	0.19*** [0.17, 0.22]	–
Lagged Meaningfulness	–	0.39*** [0.36, 0.41]
Age	0.004*** [0.003, 0.01]	–
Female gender	0.07*** [0.04, 0.10]	–0.15*** [–0.18, –0.11]
Other ethnicity	–0.09* [–0.16, –0.02]	–
Income	0.01*** [0.01, 0.02]	–
9/11 exposure	–	0.07*** [0.04, 0.11]
Lifetime negative events	–	–0.004** [–0.01, 0.001]
Recent injury/illness	<0.01 [–0.02, 0.03]	–0.03* [–0.06, 0.005]
Recent violence	–0.11** [–0.18, –0.04]	0.10** [0.02, 0.17]
Recent bereavement	0.02 [–0.01, 0.05]	–0.01 [–0.05, 0.02]
Recent social-environmental stress	0.01 [–0.04, 0.05]	–0.03 [–0.08, 0.01]
Recent relationship events	–0.08* [–0.15, –0.01]	0.03 [–0.04, 0.10]
Recent community disaster	0.06* [0.004, 0.12]	0.02 [–0.04, 0.08]

* $p < .05$ ** $p < .01$ *** $p < .001$.Note. Overall model fit: For benevolence, χ^2 (12, 5490) = 1700.39; for meaningfulness, χ^2 (11, 5391) = 1611.66; $ps < 0.001$. Benevolence, meaningfulness, and recent negative event categories assessed as time-varying (within-person) variables. Higher values for benevolence beliefs and meaningfulness beliefs indicate more agreement that the world is benevolent or meaningful, respectively.**Table 4**

Multilevel models testing moderators of recent negative events-world benevolence association.

Variable	B [95% CI]	
	Age as Moderator	Emotional Support as Moderator
Lagged benevolence	0.46*** [0.43, 0.48]	0.41*** [0.38, 0.45]
Meaningfulness	0.18*** [0.16, 0.20]	0.15*** [0.11, 0.18]
Age	<0.01*** [0.00, 0.00]	<0.01*** [0.00, 0.01]
Female gender	0.06*** [0.03, 0.09]	0.06** [0.02, 0.11]
Other ethnicity	–0.07* [–0.14, –0.02]	–0.12* [–0.21, –0.03]
Income	0.01*** [0.01, 0.02]	0.01*** [0.01, 0.02]
Total recent events	–0.05* [–0.08, –0.01]	–0.04† [–0.08, 0.01]
Recent events × Age	<0.01* [0.00, 0.00]	–
Social support (lagged)	–	0.02 [–0.01, 0.04]
Recent events × Support	–	0.01† [0.00, 0.03]

† $p < .10$ * $p < .05$ ** $p < .01$ *** $p < .001$.Note. Overall model fit: For age as a moderator, χ^2 (8, 5502) = 2028.82; for social support as a moderator, χ^2 (9, 2887) = 811.42; $ps < 0.001$. Social support was lagged one wave behind ($t-1$) the worldview variables. Higher values for benevolence beliefs and meaningfulness beliefs indicate more agreement that the world is benevolent or meaningful, respectively. Variables representing 9/11 exposure and lifetime number of negative events were screened as controls (i.e., potential confounds) for inclusion in the model but were not significant.

3.5. Research question 2: Do factors facilitating positive reappraisals moderate the effects of NLE on worldviews?

Age significantly moderated the association between total number of recent events and levels of benevolence beliefs ($B < 0.001$, 95% CI [<0.001 , <0.001] $p = 0.02$), and pre-event (lagged) social support was a marginally significant moderator of the recent event-benevolence association ($B = 0.01$, 95% CI [<0.001 , 0.03] $p = 0.09$; see Table 4). Follow-up analyses examined whether these moderation effects were explained by specific categories of events experienced, but neither age nor social support were significant moderators for any event category. Examination of simple slopes at low (mean $- 1$ SD) and high (mean $+ 1$ SD) age values indicated that recent negative events predicted a decline in benevolence beliefs among younger ($B = -0.02$, 95% CI [-0.05 , -0.002], $p = .03$, $\phi = 0.05$), but not among older, individuals ($B = 0.01$, 95% CI [-0.01 , 0.03], $p = 0.27$, $\phi < 0.01$; see Fig. 2).

Several plausible moderation effects were not found to be significant. Spirituality was not a significant moderator of the association between recent negative events and benevolence beliefs ($p = 0.86$), and no proposed moderators (age, social support, or spirituality) interacted significantly with recent events to predict change in meaningfulness beliefs (all p 's > 0.12).

3.6. Research question 3: Do NLE predict changes in chronic stability of worldview beliefs?

Separate multiple-regression analyses examined predictors of instability in benevolence beliefs and meaningfulness beliefs. Both sets of beliefs exhibited cross-wave variability significantly greater than 0 (mean S.D. for benevolence = 0.41, $t(1291) = 59.79$, $p < 0.001$; mean S.D. for meaningfulness = 0.41, $t(1290) = 59.46$, $p < 0.001$). The total number of NLE was a significant predictor of instability in benevolence beliefs ($B = 0.003$, 95% CI [0.001 , 0.01], $\beta = 0.08$, $p = 0.002$, $f^2 = 0.01$; see Table 5), but not instability in

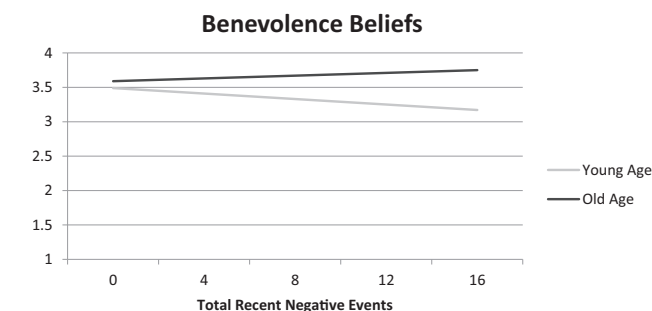


Fig. 2. Graph of the interaction of age with number of recent traumas for benevolence beliefs. Note. For the graph, Low and High values of age are 1 standard deviation (16.39 years) below and above the mean (47.30 years), respectively.

Table 5
Multiple regression model predicting variability (SD) in world benevolence beliefs.

Variable	Cross-Wave Benevolence SD B [95% CI]
Meaningfulness SD	0.23*** [0.18, 0.29]
Mean Benevolence	0.03* [0.01, 0.05]
Mean Meaningfulness	−0.003 [−0.02, 0.02]
African-American ethnicity	0.06* [0.01, 0.11]
Hispanic ethnicity	−0.05* [−0.10, −0.01]
Lifetime negative events	0.003** [0.001, 0.01]

* $p < .05$ ** $p < .01$ *** $p < .001$.
Note. $R^2 = 0.07$, $F(6, 1283) = 17.78$, $p < .001$. Age, gender, income, and 9/11 exposure were screened as controls (i.e., potential confounds) for inclusion in the model but were not significant.

meaningfulness beliefs ($p = 0.54$). Recent events did not significantly predict instability of either belief ($ps > 0.75$).

4. Discussion

Life is punctuated with the occurrence of negative life events that have the power to disrupt well-being or functioning. In any given moment, events such as the death of a close other, a serious injury, or a violent act seem unlikely, and yet these data suggest that over time, almost all individuals will encounter such events with some regularity. What implications do these events have for people's fundamental beliefs about the world? We conducted analyses in response to a model that aimed to clarify how and under what conditions NLE are linked to worldview change. We found that benevolence and meaningfulness beliefs each appeared to change to a small degree in response to specific categories of events: benevolence beliefs decreased following violence and relationship disruption, and meaningfulness beliefs decreased following illness or injury. These types of NLE, like NLE in general, were not rare: for example, over 40% of all individuals in the sample experienced violence, and nearly 2/3 experienced serious illness or injury. Furthermore, we found that worldviews changed the most in the absence of factors that may help individuals reinterpret those events, such as older age and social support. We also found evidence that worldview change can sometimes be positive and that it may not only take the form of changed worldview content—i.e., altered beliefs—but also altered stability, providing initial steps towards new ways of understanding the NLE-worldview association. These results have implications for understanding worldviews in general, as well as for research on the role of NLE in individual adjustment and social functioning.

4.1. A refined model of event-induced worldview change

Types of events and worldview change. If change in benevolence and meaningfulness beliefs results from the fact that NLE provide evidence that the world is not benevolent or meaningful, then events that differentially convey each of these ideas should differentially affect each of these beliefs. In line with the notion that event type matters, we found no association between the total number of lifetime NLE and benevolence beliefs. By contrast, when we examined specific categories of events, having recently experienced violence specifically predicted lower levels of benevolence beliefs. It seems unsurprising that events that conveyed hostile intent, especially violent events, would be associated with decreased beliefs in the benevolence of the world. Additionally, however, the other category of recent events negatively associated with benevolence beliefs was relationship events, a broad category of events involving disturbance in a significant interpersonal relationship. While we did not include these events in our initial theorizing about events that would predict change in benevolence beliefs, prior research has demonstrated that negative social interactions are some of the most potent stressors people face (e.g., Rook, 1984, 2001). Our findings suggest that the impact of such events may even extend to people's fundamental beliefs about the goodness of other people and the world. In line with prior cross-sectional research, we also tested whether illness and bereavement would be associated with a decline in beliefs in the meaningfulness of the world. We found this association with respect to experiencing an injury or illness. It could be that physical infirmity strongly highlights the unfairness and uncontrollability of the world (cf. Poulin & Heckhausen, 2007; Roesch & Weiner, 2001), though it is not clear why violent events would not function similarly. Future research should explore the specific cognitive responses people have to different kinds of NLE to illuminate

why different categories of events predict different worldview beliefs.

By contrast, certain events predicted increases in benevolence and meaningfulness beliefs. For example, having experienced a community disaster predicted *increased* levels of benevolence beliefs. One possible explanation for this finding is that, in the wake of disasters, communities often bond together to respond to the problem and generally enjoy a period of post-disaster solidarity (e.g., Kaniasty & Norris, 2004; Norris, Phifer, & Kaniasty, 1995; Poulin, Silver, Gil-Rivas, Holman, & McIntosh, 2009). Such an experience may lead individuals in the community to appreciate the human capacity for resilience and compassion, leading to increased benevolence beliefs. In addition, violence was positively associated with meaningfulness beliefs. A possible reason for this association is that individuals who experience violence desire redress for acts committed against them, and they may experience increased (hopeful) confidence that the world is fair and just (cf. Norris & Kaniasty, 1991; Thompson, Norris, & Ruback, 1996). Alternately, such paradoxical results may simply reflect the successful actions of the psychological immune system (DeWall & Baumeister, 2007; Gilbert et al., 1998). However, we emphasize that these associations were not foreseen and warrant replication to ensure they are not merely chance findings.

Moderators of worldview change. We tested whether higher levels of three variables associated with positive reappraisals (age, social support, and religiosity/spirituality) would buffer the association between negative events and worldviews. We found that only age functioned as a moderator for benevolence beliefs. Specifically, there was no association between cumulative recent NLE and benevolence beliefs among older adults (See Fig. 2), but the relationship existed for younger individuals. A similar, though non-significant, trend was found for social support. Appraising NLE positively may allow individuals to maintain the belief that the world is benevolent, even in the face of negative events (Park & Folkman, 1997), which may in turn partially explain how coping with stress is facilitated by age (e.g., Scott, Poulin, & Silver, 2013) and social support (e.g., Park et al., 2012).

By contrast, none of the proposed moderators tested—age, social support, and religiosity/spirituality—moderated the association between NLE and meaningfulness beliefs. Examining the literature surrounding these proposed moderators suggests a possible explanation for these results. All three moderators are not only associated with positive appraisals of negative events; they are also associated with individuals' awareness of the limits of control and person-environment contingency in the world. Aging is associated with increased interpersonal trust and benevolence beliefs (Poulin & Silver, 2008; Poulin & Haase, 2015), but with growing awareness of limitations on the ability to exercise control (e.g., Heckhausen, Wrosch, & Schulz, 2010). Similarly, while social support is generally not related to control or justice beliefs, it is broadly associated with acceptance-focused coping (Holahan & Moos, 1987). Finally, religiosity and spirituality have classically been associated with a general belief that events in the world and in one's life are in the hands of an unpredictable power or force greater than the self. Religiosity tends to be associated with a belief in "ultimate justice"—that is, that the present world may not be fair, but that everyone will get what they deserve in a future or transcendent reckoning (Lerner, 1980; Maes, 1998). Thus, all three proposed moderators appear not simply to facilitate positive reappraisals of meaningfulness beliefs.

Differentiating types of worldview "change". While our findings suggest that negative life events have the capacity to change the content of a person's worldviews, we also found evidence that these cognitions can vary in terms of their stability over time. We found that lifetime negative events predicted greater instability (i.e., individual-level variability) in benevolence beliefs, specifi-

cally. This suggests that in addition to altering the content of worldviews, NLE could also reduce the strength with which they are held. Individuals who have experienced a larger number of lifetime negative events may have weaker opinions about the benevolence of the world than those who have experienced fewer negative events. Such a phenomenon would be consistent with the view, expressed by prior researchers, that worldviews can become more complex, reflecting positive and negative aspects of the world, following negative events (Epstein, 1990; Janoff-Bulman, 1989b; Joseph & Linley, 2005). Alternately, we cannot rule out the possibility that individual differences in worldview stability could predict greater likelihood of experiencing NLE, suggesting the value of future studies assessing longer-duration longitudinal data.

4.2. Implications for understanding worldviews

Ample laboratory research indicates that encountering worldview-discordant information leads to efforts to bolster one's worldviews (e.g., e.g., Hafer & Rubel, 2015; Jost et al., 2015; Pyszczynski et al., 2015). However, our findings suggest that this pattern may only hold up to a certain point: sufficiently severe events predict change in worldviews, perhaps because their impact overwhelms worldview defenses. One implication is that laboratory research may not provide a full account of how individuals respond to worldview threats. The types of threats that are possible in the lab are, for ethical and practical reasons, fairly benign. While laboratory threats tend to engender efforts to defend worldviews, more serious threats, which have the potential to change worldviews, may not. This possibility seems especially worthy of further consideration given that the types of real-world worldview threats our study examined are not rare. In light of the prevalence of these events, we believe comprehensive models for when worldviews are defensible versus when they succumb to threats will require both sophisticated correlational research *and* innovative approaches to experimental research.

Having acknowledged that NLE-induced worldview change does appear to occur, it is important for us to offer a serious caveat: the significant effect sizes we observed, with a well-powered sample, were quite small (ϕ s ranging from 0.02 to 0.05; an f^2 of 0.01). While some of this may be attributable to imperfect measurement (especially of NLE, as discussed below), it seems plausible that laboratory research illustrates an important truth about worldviews: while they can be altered, they are nonetheless arguably more like individual differences than not, and they may be highly stable and resilient. Our research shows little evidence of worldviews being dramatically "shattered" by NLE (cf. Janoff-Bulman, 1992), though perhaps provides intriguing signs that they can be shaken.

4.3. Implications for understanding outcomes of NLE

Many prior researchers have hypothesized that NLE exert effects on adjustment by way of disrupted worldviews (Janoff-Bulman, 1992; Silver et al., 1983). In addition to providing prospective evidence for the phenomenon of worldview disruption, our findings also suggest some novel predictions. For example, the occurrence of violence or relationship disruption, by reducing benevolence beliefs, may lead to decreased perceptions of social support even when such support is available, leading in turn to exacerbated effects of stress on mental and physical health (for a review, see Wills & Ainette, 2012). Experiencing serious illness or injury, on the other hand, may be especially a risk factor for depression, given that such events predict decreases in meaningfulness beliefs, which include beliefs about the controllability of the world (cf. Peterson, Maier, & Seligman, 1995).

Our findings also have implications for the effects of NLE not just on individual adjustment, but on social processes as well. If negative events do make worldviews less accessible or stable, they may also reduce the effects of those worldviews in guiding social behavior. For example, individuals with a greater history of NLE may be less likely to derogate victims than others do, because they rely less on their (less accessible) meaningfulness beliefs. Likewise, by reducing reliance on benevolence beliefs, negative events may lead some individuals to rely more on person- or situation-specific cues about a person's benevolence. Again, given the prevalence of negative life events that can change or weaken worldviews, these effects may explain more variance in human behavior than is currently known. This is an area ripe for investigation.

4.4. Limitations and future directions

While the present study goes beyond prior research on NLE and worldviews by conducting a longitudinal assessment of a national sample, examining diverse negative events and worldview dimensions, and testing moderators, its limitations must be acknowledged. First, while our measurement of exposure to negative events allowed us to assess a diverse set of stressful events, the measure did not quantify event severity. Future research could measure this dimension, including the use of more detailed prompts that leave events less open to individual interpretation (cf. Dohrenwend, 2006) and/or that allow for the identification of details about NLE that specifically conflict with worldviews (e.g., violence that is also a betrayal). Relatedly, future research could examine possible combinations of NLE that might have especially potent effects on worldviews. Second, while we were interested in the possible role of reappraisals of negative events as buffers against worldview change, we only examined this indirectly by way of factors correlated with positive reappraisals. The fact that only two of these three variables – social support and age – functioned as predicted, and for only benevolence beliefs, suggests that future research should examine this process more closely, and with better measures, where relevant (e.g., religiosity/spirituality). In addition, while ours is the first attempt to examine stability of worldviews, the study design (with waves separated by many months) limited the resolution of our measure of stability. Future research using refined procedures is warranted. Finally, while our sample was approximately representative of U.S. adults in the early 2000s, it did not represent those from other times or places, suggesting the value of ongoing research in other contexts.

Our findings also suggest possible avenues for future research beyond merely addressing the present study's limitations. First, while trauma research has highlighted the connections between NLE and beliefs in the benevolence or meaningfulness of the world, future studies could examine the extent to which negative events affect other worldview beliefs, such as beliefs in the value of one's culture (Pyszczynski et al., 2015) or the rightness of the social order (Jost et al., 2015). Second, the idea that negative events have effects not just on individual-level adjustment but on social functioning is largely unexplored (see Piff, Kraus, Cheng, & Keltner, 2010, for an exception). Research could treat prior exposure to NLE as an individual-difference variable moderating the effects of laboratory manipulations such as mortality salience or system threats to test the possibility that prior exposure leads to decreased reliance on one's worldviews.

Worldviews provide a stable foundation for much of human functioning. However, our results indicate that they are not immune to disruption. Research is just beginning to uncover what happens when that stable foundation is shaken and how worldviews may change in diverse ways over time.

Author contributions

Both authors were responsible for study conceptualization, data collection, data preparation, and manuscript writing; the first author was responsible for data analysis. Data are available from the first author upon request.

Declaration of Competing Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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References

- Anders, S. L., Frazier, P. A., & Shallcross, S. L. (2014). Changes in functioning following potentially traumatic life events in college students. *Psychological Trauma: Theory, Research, Practice, and Policy*, 6, S99–S106.
- Bowlby, J. (1973). *Attachment and loss: Separation* (2). New York: Basic Books.
- Bramsen, I., van der Ploeg, H. M., van der Kamp, L. J. T., & Ader, H. J. (2002). Exposure to traumatic war events and neuroticism: The mediating role of attributing meaning. *Personality and Individual Differences*, 32, 747–760.
- Calhoun, L. G., Cann, A., Tedeschi, R. G., & McMillan, J. (1998). Traumatic events and generational differences in assumptions about a just world. *Journal of Social Psychology*, 138, 789–791.
- DeWall, C. N., & Baumeister, R. F. (2007). From terror to joy: Automatic tuning to positive affective information following mortality salience. *Psychological Science*, 18, 984–990.
- Dohrenwend, B. P. (2006). Inventorying stressful life events as risk factors for psychopathology: Toward resolution of the problem of intracategory variability. *Psychological Bulletin*, 132, 477–495.
- Dumont, M., & Provost, M. A. (1999). Resilience in adolescents: Protective role of social support, coping strategies, self-esteem, and social activities on experience of stress and depression. *Journal of Youth and Adolescence*, 28, 343–363.
- Dunning, D., Anderson, J. E., Schlösser, T., Ehlebracht, D., & Fetchenhauer, D. (2014). Trust at zero acquaintance: More a matter of respect than expectation of reward. *Journal of Personality and Social Psychology*, 107, 122–141.
- Epstein, S. (1973). The self-concept revisited: Or a theory of a theory. *American Psychologist*, 28, 404–416.
- Epstein, S. (1990). Cognitive-experiential self-theory. In L. A. Pervin (Ed.), *Handbook of personality: Theory and research* (pp. 165–192). New York: Guilford Press.
- Erikson, E. H. (1950). *Childhood and society*. New York: Norton.
- Folkman, S., Lazarus, R. S., Pimley, S., & Novacek, J. (1987). Age differences in stress and coping processes. *Psychology and Aging*, 2, 171–184.
- Franklin, K. M., Janoff-Bulman, R., & Roberts, J. E. (1990). Long-term impact of parental divorce on optimism and trust: Changes in general assumptions or narrow beliefs? *Journal of Personality and Social Psychology*, 59, 743–755.
- Gall, T. L. (2000). Integrating religious resources within a general model of stress and coping: Long-term adjustment to breast cancer. *Journal of Religion and Health*, 39, 167–182.
- Gilbert, D. T., Pinel, E. C., Wilson, T. D., Blumberg, S. J., & Wheatley, T. P. (1998). Immune neglect: A source of durability bias in affective forecasting. *Journal of Personality and Social Psychology*, 75, 617–638.
- Ginzburg, K. (2004). PTSD and world assumptions following myocardial infarction: A longitudinal study. *American Journal of Orthopsychiatry*, 74, 286–292.
- Gluhoski, V. L., & Wortman, C. B. (1996). The impact of trauma on world views. *Journal of Social and Clinical Psychology*, 15, 417–429.
- Hafer, C. L., & Rubel, A. N. (2015). The why and how of defending belief in a just world. *Advances in Experimental Social Psychology*, 51, 41–96.
- Harter, S. L., & Vanecek, R. J. (2000). Cognitive assumptions and long-term distress in survivors of childhood abuse, parental alcoholism, and dysfunctional family environments. *Cognitive Therapy and Research*, 24, 445–472.
- Hayes, J., Schimel, J., Williams, T. J., Howard, A. L., Webber, D., & Faucher, E. H. (2015). Worldview accommodation: Selectively modifying committed beliefs provides defense against worldview threat. *Self and Identity*, 14, 521–548.
- Heckhausen, J., Wrosch, C., & Schulz, R. (2010). A motivational theory of life-span development. *Psychological Review*, 117, 32–60.

- Heine, S. J., Proulx, T., & Vohs, K. D. (2006). The meaning maintenance model: On the coherence of social motivations. *Personality and Social Psychology Review*, 10, 88–110.
- Holahan, C. J., & Moos, R. H. (1987). Personal and contextual determinants of coping strategies. *Journal of Personality and Social Psychology*, 52, 946–955.
- Holman, E. A., & Silver, R. C. (1998). Getting “stuck” in the past: Temporal orientation and coping with trauma. *Journal of Personality and Social Psychology*, 74, 1146–1163.
- Holman, E. A., Silver, R. C., & Waitzkin, H. (2000). Traumatic life events in primary care patients: A study in an ethnically-diverse sample. *Archives of Family Medicine*, 9, 802–811.
- Hudd, S. S., Dumlaio, J., Erdmann-Sager, D., Murray, D., Phan, E., Soukas, N., & Yokozuka, N. (2000). Stress at college: Effects on health habits, health status and self-esteem. *College Student Journal*, 34, 217–227.
- Janoff-Bulman, R. (1989a). Assumptive worlds and the stress of traumatic events: Applications of the schema construct. *Social Cognition. Special Issue: Stress, Coping, and Social Cognition*, 7, 113–136.
- Janoff-Bulman, R. (1989b). The benefits of illusions, the threat of disillusionment, and the limitations of inaccuracy. *Journal of Social and Clinical Psychology*, 8, 158–175.
- Janoff-Bulman, R. (1992). *Shattered assumptions: Towards a new psychology of trauma*. New York: Free Press.
- Joseph, S., & Linley, P. A. (2005). Positive adjustment to threatening events: An organismic valuing theory of growth through adversity. *Review of General Psychology*, 9, 262–280.
- Just, J. T., Banaji, M. R., & Nosek, B. A. (2004). A decade of System Justification Theory: Accumulated evidence of conscious and unconscious bolstering of the status quo. *Political Psychology*, 25, 881–919.
- Just, J. T., Gaucher, D., & Stern, C. (2015). The world isn't fair: A system justification perspective on social stratification and inequality. In J. F. Dovidio & J. A. Simpson (Eds.), *APA Handbook of Personality and Social Psychology Volume 2: Group Processes* (pp. 317–340). Washington, DC: American Psychological Association.
- Kaler, M. E., Frazier, P. A., Anders, S. L., Tashiro, T., Tomich, P., Tennen, H., & Park, C. (2008). Assessing the psychometric properties of the World Assumptions Scale. *Journal of Traumatic Stress*, 21, 326–332.
- Kalisch, R., Müller, M. B., & Tüscher, O. (2015). A conceptual framework for the neurobiological study of resilience. *Behavioral and Brain Sciences*, 38. <https://doi.org/10.1017/S0140525X14001757> e92.
- Kaniasty, K., & Norris, F. H. (2004). Social support in the aftermath of disasters, catastrophes, and acts of terrorism: Altruistic, overwhelmed, uncertain, antagonistic, and patriotic communities. *Bioterrorism: Psychological and Public Health Interventions*, 3, 200–229.
- Kauffman, J. (Ed.). (2013). *Loss of the assumptive world: A theory of traumatic loss*. New York: Brunner-Routledge.
- Kernis, M. H. (2005). Measuring self-esteem in context: The importance of stability of self-esteem in psychological functioning. *Journal of Personality*, 73, 1569–1605.
- Krause, N. (1987). Life stress, social support, and self-esteem in an elderly population. *Psychology and Aging*, 2, 349–356.
- Lerner, M. J. (1980). *The belief in a just world*. New York: Plenum Press.
- Lilly, M. M., Valdez, C. E., & Graham-Bermann, S. A. (2011). The mediating effect of world assumptions on the relationship between trauma exposure and depression. *Journal of Interpersonal Violence*, 26, 2499–2516.
- Lohani, M., & Isaacowitz, D. M. (2014). Age differences in managing response to sadness elicitors using attentional deployment, positive reappraisal and suppression. *Cognition & Emotion*, 28, 678–697.
- Luttrell, A., Petty, R. E., & Briñol, P. (2016). Ambivalence and certainty can interact to predict attitude stability over time. *Journal of Experimental Social Psychology*, 63, 56–68.
- Maes, J. (1998). Immanent justice and ultimate justice: Two ways of believing in justice. In L. Montada & M. J. Lerner (Eds.), *Responses to victimizations and belief in a just world* (pp. 9–40). New York: Plenum.
- Magnus, K., Diener, E., Fujita, F., & Pavot, W. (1993). Extraversion and neuroticism as predictors of objective life events: A longitudinal analysis. *Journal of Personality and Social Psychology*, 65, 1046–1053.
- Mancini, A. D., Prati, G., & Bonanno, G. A. (2011). Do shattered worldviews lead to complicated grief? Prospective and longitudinal analyses. *Journal of Social and Clinical Psychology*, 30, 184–215.
- McCann, I. L., & Pearlman, L. A. (1990). *Psychological trauma and the adult survivor: Theory, therapy, and transformation*. Philadelphia, PA: Brunner/Mazel Inc.
- McIntosh, D. N., Silver, R. C., & Wortman, C. B. (1993). Religion's role in adjustment to a negative life event: Coping with the loss of a child. *Journal of Personality and Social Psychology*, 65, 812–821.
- Norris, F. H., & Kaniasty, K. (1991). The psychological experience of crime: A test of the mediating role of beliefs in explaining the distress of victims. *Journal of Social and Clinical Psychology*, 10(3), 239–261.
- Norris, F. H., Phifer, J. F., & Kaniasty, K. (1995). Individual and community reactions to the Kentucky floods: Findings from a longitudinal study of older adults. In R. J. Ursano & B. G. McCaughy (Eds.), *Individual and community responses to trauma and disaster: The structure of human chaos* (pp. 378–400). New York, NY: Cambridge University Press.
- Ochsner, K. N., & Gross, J. J. (2005). The cognitive control of emotion. *Trends in Cognitive Sciences*, 9, 242–249.
- Ornduff, S. R. (2000). Childhood maltreatment and malevolence: Quantitative research findings. *Clinical Psychology Review*, 20, 997–1018.
- Overcash, W. S., Calhoun, L. G., Cann, A., & Tedeschi, R. G. (1996). Coping with crises: An examination of the impact of traumatic events on religious beliefs. *Journal of Genetic Psychology*, 157, 455–464.
- Park, C. L. (2006). Exploring relations among religiousness, meaning, and adjustment to lifetime and current stressful encounters in later life. *Anxiety, Stress, and Coping: An International Journal*, 19, 33–45.
- Park, C. L., Mills, M. A., & Edmondson, D. (2012). PTSD as meaning violation: Testing a cognitive worldview perspective. *Psychological Trauma: Theory, Research, Practice, and Policy*, 4, 66–73.
- Park, C. L., & Folkman, S. (1997). Meaning in the context of stress and coping. *Review of General Psychology*, 1, 115–144.
- Peterson, C., Maier, S. F., & Seligman, M. E. P. (1995). *Learned helplessness: A theory for the age of personal control*. New York: Oxford University Press.
- Petty, R. E., & Krosnick, J. A. (2014). *Attitude strength: Antecedents and consequences*. New York: Psychology Press.
- Piff, P. K., Kraus, M. W., Cheng, B., & Keltner, D. (2010). Having less, giving more: The influence of social class on prosocial behavior. *Journal of Personality and Social Psychology*, 99, 771–784.
- Poulin, M. J., Silver, R. C., Gil-Rivas, V., Holman, E. A., & McIntosh, D. N. (2009). Finding social benefits after a collective trauma: Perceiving societal changes and well-being following 9/11. *Journal of Traumatic Stress*, 22, 81–90.
- Poulin, M. J., & Haase, C. M. (2015). Growing to trust: Evidence that trust increases and becomes more important for well-being across the life span. *Social Psychological and Personality Science*, 6, 614–621.
- Poulin, M. J., & Heckhausen, J. (2007). Stressful events compromise control strivings during a major life transition. *Motivation and Emotion*, 31, 300–311.
- Poulin, M. J., & Silver, R. C. (2008). World benevolence beliefs and well-being across the life span. *Psychology and Aging*, 23, 13–23.
- Prager, E., & Solomon, Z. (1995). Perceptions of world benevolence, meaningfulness, and self-worth among elderly Israeli holocaust survivors and non-survivors. *Anxiety, Stress and Coping: An International Journal*, 8, 265–277.
- Prati, G., & Pietrantonio, L. (2009). Optimism, social support, and coping strategies as factors contributing to posttraumatic growth: A meta-analysis. *Journal of Loss and Trauma*, 14, 364–388.
- Pyeich, C. M., Newman, E., & Daleiden, E. (2003). The relationship among cognitive schemas, job-related traumatic exposure, and Posttraumatic Stress Disorder in journalists. *Journal of Traumatic Stress*, 16, 325–328.
- Pyszczynski, T., Solomon, S., & Greenberg, J. (2015). Thirty years of Terror Management Theory: From genesis to revelation. *Advances in Experimental Social Psychology*, 52, 1–70.
- Rini, C., Manne, S., DuHamel, K. N., Austin, J., Ostroff, J., Boulard, F., ... Redd, W. H. (2004). Changes in mothers' basic beliefs following a child's bone marrow transplantation: The role of prior trauma and negative life events. *Journal of Traumatic Stress*, 17, 325–333.
- Robins, L. N., Helzer, J. E., Croughan, J. L., & Ratcliff, K. S. (1981). National Institute of Mental Health Diagnostic Interview Schedule: Its history, characteristics, and validity. *Archives of General Psychiatry*, 38, 381–389.
- Roesch, S. C., & Weiner, B. (2001). A meta-analytic review of coping with illness – Do causal attributions matter? *Journal of Psychosomatic Research*, 50, 205–219.
- Rook, K. S. (1984). The negative side of social interaction: Impact on psychological well-being. *Journal of Personality and Social Psychology*, 46, 1097–1108.
- Rook, K. S. (2001). Emotional health and positive versus negative social exchanges: A daily diary analysis. *Applied Developmental Science*, 5, 86–97.
- Schleider, J. L., Woerner, J., Overstreet, C., Amstadter, A. B., & Sartor, C. E. (2018). Interpersonal trauma exposure and depression in young adults: Considering the role of world assumptions. *Journal of Interpersonal Violence*. Advance online publication.
- Schuler, E. R., & Boals, A. (2016). Shattering world assumptions: A prospective view of the impact of adverse events on world assumptions. *Psychological Trauma: Theory, Research, Practice, and Policy*, 8, 259–266.
- Schwartzberg, S. S., & Janoff-Bulman, R. (1991). Grief and the search for meaning: Exploring the assumptive worlds of bereaved college students. *Journal of Social and Clinical Psychology*, 10, 270–288.
- Scott, S. B., Poulin, M. J., & Silver, R. C. (2013). A lifespan perspective on terrorism: Age differences in trajectories of response to 9/11. *Developmental Psychology*, 49, 986–998.
- Silver, R. L., Boon, C., & Stones, M. (1983). Searching for meaning in misfortune: Making sense of incest. *Journal of Social Issues*, 39(2), 81–102.
- Silver, R. C., Holman, E. A., McIntosh, D. N., Poulin, M., & Gil-Rivas, V. (2002). Nationwide longitudinal study of psychological responses to September 11. *JAMA. Journal of the American Medical Association*, 288, 1235–1244.
- Silver, R. C., Holman, E. A., McIntosh, D. N., Poulin, M., Gil-Rivas, V., & Pizarro, J. (2006). Coping with a national trauma: A nationwide longitudinal study of responses to the terrorist attacks of September 11th. In Y. Neria, R. Gross, R. Marshall, & E. Susser (Eds.), *9/11: Mental health in the wake of terrorist attacks* (pp. 45–70). NY: Cambridge University Press.
- Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis*. Oxford: Oxford University Press.
- Solomon, Z., Iancu, I., & Tyano, S. (1997). World assumptions following disaster. *Journal of Applied Social Psychology*, 27, 1785–1798.
- Tait, R., & Silver, R. C. (1989). Coming to terms with major negative life events. In J. S. Uleman & J. A. Bargh (Eds.), *Unintended thought* (pp. 351–382). New York, NY: Guilford.

- Taylor, S. E. (1983). Adjustment to threatening events: A theory of cognitive adaptation. *American Psychologist*, 38, 1161–1173.
- Tedeschi, R. G., & Calhoun, L. G. (2004). Posttraumatic growth: Conceptual foundations and empirical evidence. *Psychological Inquiry*, 15, 1–18.
- Tomich, P. L., & Helgeson, V. S. (2002). Five years later: A cross-sectional comparison of breast cancer survivors with healthy women. *Psycho-Oncology*, 11, 154–169.
- Thompson, M. P., Norris, F. H., & Barry Ruback, R. (1996). System influences on posthomicide beliefs and distress. *American Journal of Community Psychology*, 24, 785–809.
- Valentiner, D. P., Holahan, C. J., & Moos, R. H. (1994). Social support, appraisals of event controllability, and coping: An integrative model. *Journal of Personality and Social Psychology*, 66, 1094–1102.
- van Bruggen, V., ten Klooster, P. M., van der Aa, N., Smith, A. J., Westerhof, G. J., & Glas, G. (2018). Structural validity of the World Assumption Scale. *Journal of Traumatic Stress*, 31, 816–825.
- Wills, T. A., & Ainette, M. C. (2012). Social networks and social support. In A. Baum, T. A. Revenson, & J. Singer (Eds.), *Handbook of health psychology* (2nd ed., pp. 465–492). New York, NY: Psychology Press.