

Pain Sensitivity Predicts Support for Moral and Political Views Across the Aisle

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We live in a time of exacerbating political polarization. Bridging the ideological divide is hard. Although some strategies have been found effective for interpersonal persuasion and interaction across the aisle, little is known about what *intrapersonal* attributes predict which individuals are more inclined to support their ideological opponent's views. The present work identifies a low-level attribute—sensitivity to physical pain—that robustly predicts individual variations in support for moral and political views typically favored by one's ideological opponent. We first summarize a psychophysical validation of an established pain sensitivity measure ($n = 263$), then report a series of exploratory and preregistered confirmatory studies and replications ($N = 7,360$) finding that more (vs. less) pain-sensitive liberal Americans show greater endorsement of moral foundations typically endorsed by conservatives (Studies 1a–1c), higher likelihood of voting for Trump over Biden in the 2020 presidential election, stronger support for Republican politicians, and more conservative attitudes toward contentious political issues (Studies 2a and 2b). Conservatives show the mirroring pattern. These “cross-aisle” effects of pain sensitivity are driven by heightened harm perception (Study 3). They defy lay intuitions (Study 4). They are not attributable to multicollinearity or response set. The consistent findings across studies highlight the value of deriving integrative predictions from multiple previously unconnected perspectives (social properties of pain, moral foundations theory, dyadic morality theory, principle of multiple determinants in higher mental processes). They open up novel directions for theorizing and research on why pain sensitivity predicts support for moral and political views across the aisle.

Keywords: pain, ideology, harm, moral foundations, political attitudes

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Liberals and conservatives exhibit numerous divergent ideological beliefs and psychological tendencies, from views about societal structure (Kteily et al., 2019; Pratto et al., 1994), traditions (Altemeyer, 1981), status quo (Jost et al., 2004), friends (Waytz et al., 2019), and family (Feinberg et al., 2019; Lakoff, 2002), to personality and behavioral profiles (Carney et al., 2008) and basic affective (Inbar et al., 2009) and cognitive styles (Jost et al., 2003). Given their pervasive differences, bridging the divide is no easy feat (Brandt et al., 2014), particularly with the exacerbating political polarization and sectarianism of our time (Finkel et al., 2020).

Various strategies have been offered and found effective for facilitating cross-aisle persuasion and interaction. Examples include framing liberal policies around moral themes that conservatives care about and vice versa (Feinberg & Willer, 2019), correcting overestimation of how negative one's political opponents feel toward one's political allies (Lees & Cikara, 2020; Ruggeri et al., 2021), discussing personal experience rather than arguing about facts with one's political opponents (Kubin et al., 2021), prompting the belief in the utility of cross-partisan empathy (Santos et al., 2022), and using language that de-moralizes people's attitudes and thus increases their willingness to compromise (Kodapanakkal et al., 2022). All of these strategies focus on *interpersonal* communication. In contrast, little is known about what *intrapersonal* attributes undergird who is generally more or less inclined to support moral and political views opposite to one's ideological placement (even without any cross-aisle

persuasive attempt or social interaction). We propose that such individual variations are predicted by a low-level attribute whose relation to morality and politics has received little attention in prior theorizing or research: sensitivity to physical pain.

Relating Pain to Morality and Politics

Biologically vital for survival, sensing pain is one of the most universal experiences, observable even in newborn infants (Jones et al., 2017) and nonhuman vertebrates (National Research Council of the National Academies, 2009). Individuals vary though in their sensitivity to pain stimuli (Nielsen et al., 2009). We suggest that these variations may be associated with moral and political views, due to two social properties of pain.

First, sensing physical pain (e.g., in bodily injury) and sensing social pain (e.g., in relational rejection) involve shared neural bases (Dewall et al., 2010; Eisenberger et al., 2003; Kross et al., 2011; Lieberman & Eisenberger, 2015), subjective experiences, and linguistic expressions (Macdonald & Leary, 2005). These overlapping processes imply that higher sensitivity to physical pain may be associated with higher sensitivity to social pain. Second, pain experience can be socially contagious and occur vicariously, such that perceiving a conspecific in pain or in painful situations increases one's own pain, a process that has been found physiologically and behaviorally in both mice (Langford et al., 2006; Lidhar et al., 2021; Smith et al., 2016) and humans (Goubert et al., 2005; Loggia et al., 2008; Singer et al., 2004). Meta-analytic imaging evidence also shows that feeling for others in pain and directly feeling pain oneself involve common neural networks, particularly the bilateral anterior insular cortex and medial/anterior cingulate cortex (Lamm et al., 2011). Witnessing others in somatic pain can even result in vicarious activation of one's somatosensory cortices, as shown in multiple fMRI experiments (Keysers et al., 2010).

Integrating both of these social properties of pain (overlap between physical pain and social pain; overlap between one's own pain and others' pain) suggests that individuals with higher sensitivity to their own physical pain may be more sensitive not only to their own social pain but also to others' physical and social pain (e.g., others' distress, social ills, harms being committed; for suggestive evidence, see Xiao et al., 2015). It is known that perception of suffering, damage, or harm—be it physical or nonphysical—caused by an intentional agent on a vulnerable patient can intensify judgments across moral domains (cf. dyadic morality theory; Gray et al., 2012, 2022; Schein & Gray, 2018). Considering that higher sensitivity to physical pain may heighten the perception of harm and that perception of harm can intensify moral views, it follows that more pain-sensitive individuals may have stronger moral views (e.g., stronger reactions to unfairness; Wang et al., 2019).

This raises an empirical question: Does pain sensitivity predict all moral views similarly strongly? Or does it predict some moral views more strongly than others? If so, which ones? We consider three competing hypotheses.

Hypothesis 1 is the most straightforward (Figure 1a). It draws on the reasoning above and expects simply that higher pain sensitivity should predict greater perception of harm and stronger moral views across domains. Hypotheses 2 and 3 add conceptual nuances by drawing on moral foundations theory and its corresponding evidence that liberals and conservatives hold different moral views (i.e., different views about what values and behaviors are morally relevant and are right or

wrong; Graham et al., 2009, 2013). Both Hypotheses 2 and 3 expect that pain sensitivity should particularly strongly predict perceived harm and moral views in certain domains and that which domains of perceived harm and moral views are most strongly predicted by pain sensitivity should depend on how liberal or conservative the perceiver is (Figure 1b).¹ But Hypotheses 2 and 3 differ in their expectations about how exactly this pattern should look like.

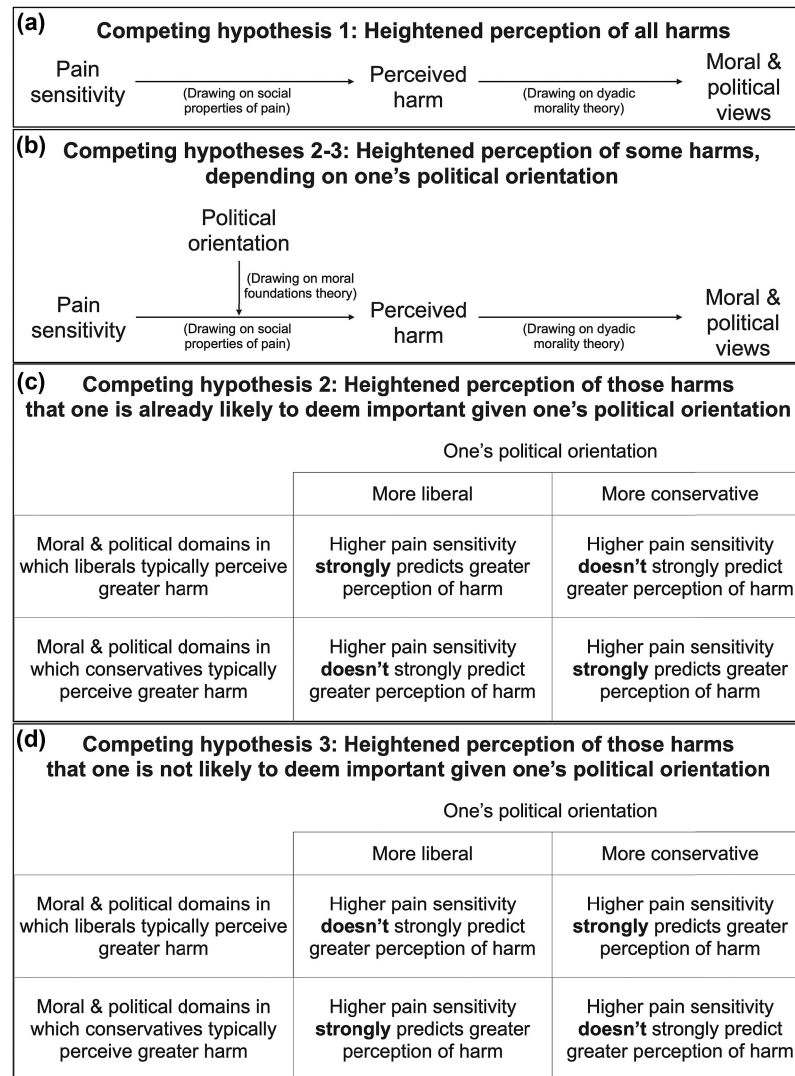
Hypothesis 2 expects that higher pain sensitivity should predict greater perception of harm and stronger moral views and that these predictive effects of pain sensitivity should be particularly strong for those domains one is already likely to deem important given one's political orientation, but weaker for those domains one is less likely to deem important given one's political orientation (Figure 1c). In other words, those harms that one is most ready to perceive and those moral views that one is most inclined to endorse are the ones that should be most amplified by pain sensitivity. Conservatives (more than liberals) are known to readily perceive harm in betrayal to one's group, subversion to one's authorities, and contamination of one's body and soul; liberals (more than conservatives) are known to readily perceive harm in failures to care for the vulnerable and to attain equality (Graham et al., 2009, 2013). Accordingly, Hypothesis 2 expects that higher pain sensitivity should predict amplified perception of harm and moral views in domains of disloyalty, disrespect, and degradation more strongly among conservatives than liberals, but in domains of unkindness and inequality more strongly among liberals than conservatives.

Hypothesis 3 also expects that higher pain sensitivity should predict greater perception of harm and stronger moral views. Contrary to Hypothesis 2, however, it expects that these predictive effects of pain sensitivity should be particularly strong for those domains one is *not* likely to deem important given one's political orientation, but weaker for those domains one is already likely to deem important given one's political orientation (Figure 1d). In other words, those harms that one is less ready to perceive and those moral views that one is less inclined to endorse are the ones that should be most amplified by pain sensitivity. This assumption draws on the basic principle that higher mental processes (e.g., social or moral judgments) are multiply determined such that the effect of a given factor decreases as the effect of competing factors increases (Bless et al., 2003). To liberals, if their liberal ideology and their liberal-leaning media diet and social network already tell them that racism, sexism, and inequality are immoral, then whether they have high or low pain sensitivity is unlikely to matter much for their perception of harm in these domains. But their liberal ideology does not typically lead them to perceive as much harm in nonconformity to societal traditions, challenge to authority figures, and unconventional sexual practices, so there is more room for higher pain sensitivity to amplify liberals' perception

¹ Terminological clarification about the word *harm* is warranted here. Moral foundations theory (Graham et al., 2009, 2013) calls one of the moral domains care/harm, which refers specifically to concerns about "suffering, distress, or neediness" and "motivations to care, nurture, and protect" (Graham et al., 2013, p. 69). In contrast to this domain-specific view, dyadic morality theory (Gray et al., 2012, 2022; Schein & Gray, 2018) takes a domain-general view and uses the word *harm* in a broader sense. It conceptualizes harm as affective in nature (Gray et al., 2022) and as "intuitively perceived" whenever a situation involves "an intentional agent causing damage to a vulnerable patient" (Schein & Gray, 2018, p. 32), whatever tangible or intangible form the damage may take. When we use the word *harm*, we mean it in the broader sense, which is also compatible with the way many psychologists and the general public use this word (Haslam, 2016).

Figure 1

Three Competing Hypotheses About How Pain Sensitivity May Be Related to Moral and Political Views



Note. Higher pain sensitivity may predict heightened perception of (a) all harms similarly strongly or (b) some harms most strongly, either (c) those harms that one is already likely to deem important given one's political orientation or (d) those harms that one is not likely to deem important given one's political orientation.

of harm in these domains (i.e., domains in which conservatives typically perceive greater harm). Applying the same logic to liberals and conservatives alike predicts a “cross-aisle” pattern of interaction effects (Pain Sensitivity \times Political Orientation): Higher pain sensitivity should predict greater perception of harm and stronger moral views, particularly in domains typically deemed important by one's ideological opponent.

For ease of reference, we will use the following shorthand for the three hypotheses throughout the rest of our article.

Hypothesis 1: Heightening all harms.

Hypothesis 2: Heightening own side.

Hypothesis 3: Heightening other side.

To test these competing hypotheses, we examine the relations of pain sensitivity and political orientation to moral views in Studies 1a (exploratory), 1b (direct replication), and 1c (preregistered conceptual replication). Considering that people's moral views are closely linked to their political views (Graham et al., 2013; Schein & Gray, 2018), we also test these competing hypotheses in the realm of political views²

² We use the term *political views* to refer to a person's views on specific political issues, varying on the spectrum of support—oppose. We use the term *political orientation* to refer to a person's general ideological leaning, varying on the spectrum of liberal—conservative.

in Studies 2a (exploratory) and 2b (preregistered replication). We further replicate these relations (of pain sensitivity and political orientation to moral and political views) and test the hypothesized process (moderated mediation by perceived harm) in Study 3 (preregistered). Finally, we compare the actual effects of pain sensitivity observed in Studies 1a–3 against lay intuitions about the effects of pain sensitivity in Study 4 (descriptive). Before reporting these primary studies, we first summarize our psychophysical validation of an established measure of pain sensitivity.

Psychophysical Validation of Pain Sensitivity Measure

To test the hypotheses above with sufficient statistical power, in general, we aimed for large sample sizes, and in the case of preregistered studies, we determined the sample size by conducting power analysis based on effect sizes from prior data. To attain the required sample sizes in a feasible manner, we needed a valid and reliable measure of pain sensitivity that could be used in online surveys. We chose the Pain Sensitivity Questionnaire (PSQ; [Ruscheweyh et al., 2009](#)) because it had been validated in multiple psychophysical studies ([Ruscheweyh et al., 2009, 2012](#); [Sellers et al., 2013](#)) among various samples (healthy adults, chronic pain patients, patients experiencing subcutaneous injection of lidocaine as a pain stimulus) as a reliable measure that consistently predicts the subjective intensity of pain experience across different sensory modalities (heat pain, cold pain, pressure pain, and pinprick pain) in daily life situations.

Prior validation studies mostly focused on the subjective intensity of pain experience. To provide an independent and extended validation of the PSQ, we conducted a psychophysical study to assess not only the subjective intensity of pain experience but also other parameters of pain sensitivity. A brief summary is provided below. All methodological details and full results are available in the [Supplemental Material](#).

Using a pressure algometer for pain induction, our study involved two parts. The first part assessed pain threshold (minimum level of physical stimulation at which a person starts experiencing pain) and pain tolerance (maximum level of pain-inducing physical stimulation a person can tolerate). The second part assessed changes in the subjective intensity of pain experienced in response to increases in objective amount of physical stimulation. We examined the extent to which these parameters were predicted by PSQ scores.

We found that higher PSQ scores predicted both overall higher subjective pain intensity and steeper increases in subjective pain intensity as a result of increases in objective pressure amount. Beyond subjective pain intensity, we also found that higher PSQ scores predicted lower pain tolerance. These results dovetail and extend prior validation studies ([Ruscheweyh et al., 2009, 2012](#); [Sellers et al., 2013](#))—using different methods and spanning different populations (students, healthy adults, chronic pain patients, patients experiencing subcutaneous injection of lidocaine as a pain stimulus) from different countries (Germany, the United States, Canada)—to suggest that the PSQ, as a self-report measure, reflects experiential qualities of physical pain. Given such validity evidence, we use the PSQ as a tool for measuring pain sensitivity among large samples to test our theoretical hypotheses with sufficient power throughout our primary studies.

General Methodological Information Across Studies

For concision, this section outlines general methodological information across our studies. Subsequent Method sections describe

each study's procedure and analyses. Fine-grained details of each study's participants, sample size justification, exclusion criteria, and measures are provided in the [Supplemental Material](#), where measures are described in order of presentation to participants. Reliability, mean, and standard deviation of the measures are available in [Supplemental Tables](#).

Transparency and Openness

We report how we determined our sample size, all data exclusions, all measures, and all manipulations (if any) in each study. Studies 1a, 1b, 2a, and 4 were not preregistered. All aspects of Studies 1c, 2b, and 3 were preregistered, including study design, hypotheses, sample size justification based on power analysis, data collection, stopping rules, exclusion criteria, and analysis plan. For all studies, we follow the American Psychological Association's Journal Article Reporting Standards for Quantitative Research in Psychology ([Appelbaum et al., 2018](#)). All data, analysis code, research materials, and preregistrations of study and analysis plans are available at https://osf.io/mgceff/?view_only=ed0786335fdc41a39ea4b7a1c9c2e444. Data for all studies were processed, analyzed, and visualized using R 4.1.3 ([R Core Team, 2022](#)) with the aid of various packages noted in subsequent Method sections. Data visualization for Study 4 also involved using Tableau 2021.4.3 ([Tableau Desktop, 2021](#)).

Participants

Adults in the United States were recruited via Amazon Mechanical Turk (Study 1a) or Prolific (Studies 1b–4) because we aimed to collect data from Americans of diverse demographic backgrounds and spanning the ideological spectrum, from very liberal to very conservative, in order to test the interaction effects of Pain Sensitivity \times Political Orientation. In each study, we examined the initial distribution of liberals and conservatives and balanced them out by continuing recruitment of participants on the less-represented side of the ideological spectrum (e.g., if there were more liberals than conservatives, then we would continue recruiting conservatives until we had a balanced sample). Other than that, any U.S. adult could participate, and the recruitment material was generic. Across studies, the mean age hovered around the recent mean age of the U.S. population (38.5 years in 2022), and gender distribution was fairly representative of the U.S. population. That said, we did not set out to collect representative samples because we were interested in testing the hypothesized relations among variables, not in estimating the population means of variables.

Procedure and Exclusion Criteria

To maximize power, we (a) used or adapted established measures with known reliability and content validity, (b) determined the sample size for each preregistered study by running power analysis based on effect sizes from prior data or pilot data, and (c) used multilevel modeling analyses wherever possible to test the highest order interaction effects of interest. Within each measure, items were presented in randomized order unless noted otherwise. Reverse-scored items were reverse scored for analysis. All studies concluded with attention checks, demographic measures (including political orientation), debriefing, and re-consent for participants to indicate whether they would like to have their data included in or

withdrawn from the study. Participants were excluded if they did not provide reconsent, did not pass the attention check (e.g., failing to check the right boxes) or problematic response patterns check (e.g., choosing the same response for all items on a scale), or completed the study more than once.

Data Analysis and Visualization

All statistical tests were two sided. Given our primary interest in the interaction effects of Pain Sensitivity \times Political Orientation, in each study, we (a) centered all predictors and (b) conducted collinearity diagnostics and found no concern of multicollinearity (Cohen et al., 2013; Thompson et al., 2017; for details, see the General Discussion \rightarrow Potential Artifacts \rightarrow Multicollinearity section). In all statistical analyses, both pain sensitivity and political orientation were treated as continuous variables. In data visualization, for clarity of depiction and ease of comprehension, political orientation is shown as if it were a categorical variable (with liberal participants in one group and conservative participants in another).

In multilevel modeling analyses, all outcomes were analyzed using two-level models because measures were nested within participants. Each outcome was modeled as a function of the highest order interaction effect and all lower order effects. Models involving cross-level interaction effects included a random slope for the Level 1 predictor (measures) in addition to a random intercept (Aguinis et al., 2013). Models for the continuous (Likert) outcomes in all studies were linear mixed models fit by Restricted Maximum Likelihood with an unstructured covariance matrix and Satterthwaite degrees of freedom using the lmer function in the lme4 package V1.1-28 (Bates et al., 2022, p. 4) and the lmerTest package V3.1-3 (Kuznetsova et al., 2020) in R 4.1.3 (R Core Team, 2022). The model for the dichotomous outcome in Study 2a (voting for Trump over Biden) was a generalized linear mixed model fit by maximum likelihood (Laplace approximation) using the glmer function in the lme4 package. The intraclass correlation coefficient for each model suggested that the continuous (Likert) measures in general were fairly clustered within participants and that the dichotomous measures (intended and actual voting preferences) were highly clustered within participants.

Research Ethics

All studies had received institutional ethics approval and were executed in compliance with relevant ethical guidelines and American Psychological Association ethical standards, including adherence to the legal requirements of the study country.

Pain Sensitivity Predicts Moral Views (Studies 1a–1c)

Method

Procedure

As part of a larger survey, participants in Study 1a (exploratory; $N = 950$) completed the Moral Foundations Questionnaire (Graham et al., 2011), which was chosen because it is the most widely used measure of the five moral foundations that have been established across cultures (Graham et al., 2013). In addition, participants completed the PSQ (Ruscheweyh et al., 2009, 2012; Sellers et al., 2013). To test if our effects of interest might be explained away by

other variables known to predict moral foundations, participants also completed established measures of disgust sensitivity (Haidt et al., 1994), emotion reactivity (Nock et al., 2008), anxiety (Spielberger, 2012), anger proneness (Spielberger et al., 1983), and empathy (Reniers et al., 2011). These variables, together with gender, served as control predictors in our analyses. Finally, in the Demographics section, participants rated their political orientation (1 = liberal, 5 = centrist, 9 = conservative).

To ascertain replicability, Study 1b (direct replication; $N = 686$) used the same measures (with minimal modifications as noted in the Supplemental Material) and analytic strategy as in Study 1a and recruited participants from a different platform. Study 1c ($N = 1,313$) was a preregistered conceptual replication that focused on contrasting pain sensitivity with disgust sensitivity—a frequently studied variable in moral and political psychology (Inbar et al., 2009; Petersen et al., 2020; Pizarro et al., 2011)—and used a psychometrically improved version of the Disgust Scale (Olatunji et al., 2007). Prior to the Disgust Scale–Revised, participants also completed the Moral Foundations Questionnaire (Graham et al., 2011) and the PSQ (Ruscheweyh et al., 2009, 2012; Sellers et al., 2013).

Analyses

Hierarchical regression models were used to test our hypotheses. In Studies 1a (exploratory) and 1b (direct replication), support for each moral foundation was regressed on the interaction effect of Pain Sensitivity \times Political Orientation and their main effects, first without (Step 1) and then with (Step 2) all the control predictors. The relevance of each moral foundation was analyzed in the same way.

In Study 1c (preregistered conceptual replication), to test our preregistered primary hypotheses, support for each moral foundation was regressed on the interaction effect of Pain Sensitivity \times Political Orientation and their main effects, first without (Step 1) and then controlling for (Step 2) disgust sensitivity and gender, and finally also controlling for the interaction effect of Disgust Sensitivity \times Political Orientation (Step 3). The relevance of each moral foundation was analyzed in the same way.

In each of Studies 1a–1c, support for and relevance of all moral foundations were also analyzed using multilevel modeling. Both pain sensitivity and political orientation were between-participant and continuous. Moral foundations were within-participant and effects coded: -1 (care/harm, fairness/cheating) versus 1 (loyalty/betrayal, authority/subversion, sanctity/degradation).

Results

Study 1a found significant interaction effects of Pain Sensitivity \times Political Orientation on support for all five moral foundations and relevance of four of the five moral foundations ($ps \leq .0264$; Table 1, Step 1). After adding various control predictors (Step 2), the interaction effects of Pain Sensitivity \times Political Orientation on all moral foundations were significant. Because of the highly similar patterns between support for and relevance of each moral foundation, we will refer to them collectively as endorsement of the moral foundation.

As noted in the General Methodological Information Across Studies section, both pain sensitivity and political orientation were treated as continuous variables in all statistical analyses. Only for the purpose of visualizing the interaction effects (Figure 2, Table S1),

Table 1

Hierarchical Regressions of Support for and Relevance of Moral Foundations on the Interaction Effect of Pain Sensitivity × Political Orientation and Their Main Effects (Step 1), Together With Control Predictors (Step 2), in Study 1a

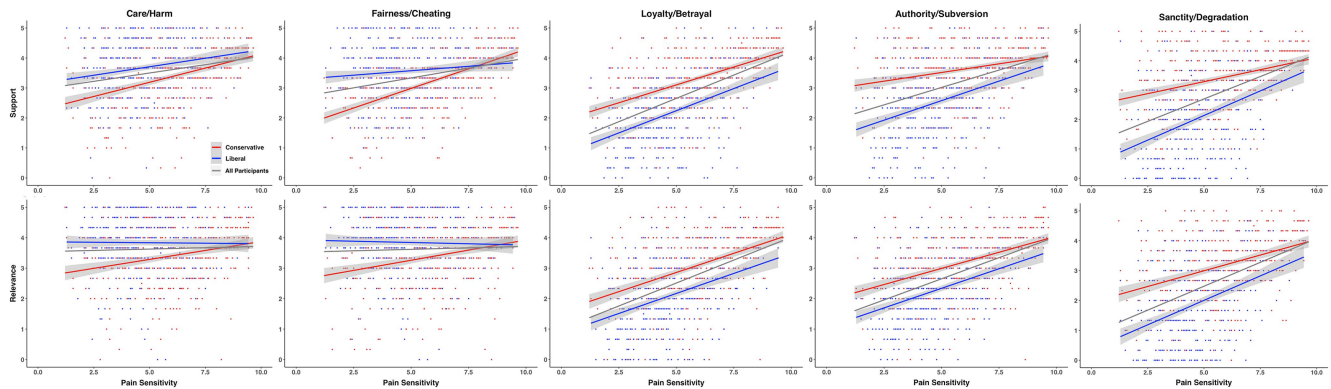
Predictor	Care/harm		Fairness/cheating		Loyalty/betrayal		Authority/subversion		Sanctity/degradation	
	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2
Pain Sensitivity × Political Orientation	0.07* (0.03)	0.07* (0.03)	0.20*** (0.03)	0.18*** (0.03)	−0.08** (0.03)	−0.07* (0.03)	−0.16*** (0.03)	−0.15*** (0.03)	−0.17*** (0.03)	−0.15*** (0.03)
Pain sensitivity	0.28*** (0.03)	0.23* (0.04)	0.32*** (0.03)	0.22*** (0.04)	0.44*** (0.04)	0.36*** (0.03)	0.32*** (0.03)	0.25*** (0.03)	0.35*** (0.03)	0.22*** (0.03)
Political orientation	−0.22*** (0.03)	−0.16*** (0.03)	−0.29*** (0.03)	−0.26*** (0.03)	0.37*** (0.03)	0.37*** (0.03)	0.40*** (0.03)	0.40*** (0.03)	0.39*** (0.03)	0.39*** (0.03)
Disgust sensitivity	0.11*** (0.03)	0.11*** (0.03)	0.08* (0.03)	0.08* (0.03)	0.10*** (0.03)	0.10*** (0.03)	0.11*** (0.03)	0.11*** (0.03)	0.23*** (0.03)	0.23*** (0.03)
Emotion reactivity		0.04 (0.05)		0.03 (0.05)		0.14** (0.04)		0.08 (0.05)	0.08 (0.04)	0.08 (0.04)
Anxiety		−0.02 (0.04)		−0.09* (0.04)		−0.13*** (0.04)		−0.19*** (0.04)	−0.08* (0.04)	−0.08* (0.04)
Anger		−0.14* (0.05)		0.03 (0.05)		−0.01 (0.04)		0.02 (0.05)	0.01 (0.04)	0.01 (0.04)
Empathy		0.29*** (0.03)		0.28*** (0.03)		0.05 (0.03)		0.08* (0.03)	0.07* (0.03)	0.07* (0.03)
Gender		−0.15* (0.06)		0.20*** (0.06)		0.21*** (0.05)		0.05 (0.06)	0.03 (0.05)	0.03 (0.05)
R ²	.098	.233	.189	.280	.418	.449	.331	.373	.353	.416
ΔR ²		.136		.091		.030		.041		.063
F	32.79***	30.57***	70.54***	38.97***	218.15***	81.68***	150.30***	59.69***	165.60***	71.45***
ΔF		26.68***		18.99***		8.24***		9.96***		16.13***
Pain Sensitivity × Political Orientation	0.11** (0.03)	0.08* (0.03)	0.12*** (0.03)	0.10** (0.03)	−0.04 (0.03)	−0.06* (0.03)	−0.07* (0.03)	−0.08** (0.03)	−0.12*** (0.03)	−0.12*** (0.03)
Pain sensitivity	0.08* (0.03)	0.05 (0.04)	0.08* (0.03)	0.06 (0.04)	0.41*** (0.03)	0.27*** (0.04)	0.42*** (0.03)	0.28*** (0.04)	0.38*** (0.03)	0.25*** (0.03)
Political orientation	−0.23*** (0.03)	−0.16*** (0.03)	−0.23*** (0.03)	−0.18*** (0.03)	0.27*** (0.03)	0.26*** (0.03)	0.29*** (0.03)	0.28*** (0.03)	0.36*** (0.03)	0.35*** (0.03)
Disgust sensitivity	0.07* (0.03)	0.07* (0.03)	0.05 (0.03)	0.05 (0.03)	0.15*** (0.03)	0.15*** (0.03)	0.13*** (0.03)	0.13*** (0.03)	0.24*** (0.03)	0.24*** (0.03)
Emotion reactivity		−0.15** (0.05)		−0.20*** (0.05)		0.09 (0.05)		0.08 (0.05)	0.07 (0.04)	0.07 (0.04)
Anxiety		0.04 (0.04)		0.03 (0.04)		−0.10* (0.04)		−0.10* (0.04)	−0.03 (0.04)	−0.03 (0.04)
Anger		−0.04 (0.05)		0.00 (0.05)		0.07 (0.05)		0.11* (0.05)	0.01 (0.04)	0.01 (0.04)
Empathy		0.43*** (0.03)		0.36*** (0.03)		0.10*** (0.03)		0.10*** (0.03)	0.09** (0.03)	0.09** (0.03)
Gender		−0.05 (0.06)		0.05 (0.06)		0.09 (0.06)		0.02 (0.06)	0.02 (0.05)	0.02 (0.05)
R ²	.061	.254	.061	.192	.304	.349	.319	.359	.341	.409
ΔR ²		.194		.132		.045		.040		.068
F	19.67***	34.27***	19.55	23.89***	132.60***	53.91***	142.10***	56.24***	156.90***	69.38***
ΔF		39.10***		24.55***		10.45***		9.38***		17.23***

Note. Political orientation was a continuous variable (1 = *liberal*, 5 = *centrist*, 9 = *conservative*). Gender was coded as a dichotomous variable (−1 = female, 1 = male). Standardized regression coefficients are reported, with standard errors in parentheses. Results for the key predictor of interest, Pain Sensitivity × Political Orientation, are in bold. If we used the more stringent criterion of Bonferroni-corrected $\alpha = .05/10$ interaction effects of interest = .005, the interaction effects of Pain Sensitivity × Political Orientation remained significant on support for four of the five moral foundations ($ps \leq .00305$) and on relevance of three of the five moral foundations ($ps \leq .0011$).

* $p < .05$. ** $p < .005$. *** $p < .001$.

Figure 2

Interaction Effects of Pain Sensitivity × Political Orientation on Support for (Top Row) and Relevance of (Bottom Row) Moral Foundations in Study 1a



Note. Ninety-five percent confidence intervals are shown around the lines for conservatives (i.e., political orientation above scale midpoint; $n = 404$) and liberals (i.e., political orientation below scale midpoint; $n = 405$). For ease of reference, an overall line is shown for all participants who indicated any political orientation (i.e., regardless of whether it was above, below, or at the scale midpoint; $N = 950$). Statistical details are available in [Table S1](#). See the online article for the color version of this figure.

we categorized participants into liberals (political orientation below scale midpoint) and conservatives (political orientation above scale midpoint). Recall that loyalty/betrayal, authority/subversion, and sanctity/degradation are the moral foundations typically favored by conservatives more than by liberals (Graham et al., 2009, 2013); we found that higher pain sensitivity predicted endorsement of these “conservative moral foundations” more strongly among liberals ($\beta_s = 0.42\text{--}0.50$) than among conservatives ($\beta_s = 0.20\text{--}0.40$). In contrast, care/harm and fairness/cheating are the moral foundations typically favored by liberals more than by conservatives (Graham et al., 2009, 2013); we found that higher pain sensitivity predicted endorsement of these “liberal moral foundations” more strongly among conservatives ($\beta_s = 0.23\text{--}0.54$) than among liberals ($\beta_s = -0.03$ to 0.23). These opposite patterns constituted significant cross-level interaction effects of Pain Sensitivity × Political Orientation × Moral Foundations (loyalty/betrayal, authority/subversion, and sanctity/degradation vs. care/harm and fairness/cheating) in multilevel modeling analyses ($p_s \leq 1.80\text{e-}6$; [Table 2](#)).

Study 1b (direct replication) found a highly similar pattern of interaction effects ([Figure 3](#), [Table S2](#)), again generally robust to the addition of control predictors ([Table S3](#)). Likewise, Study 1c (preregistered conceptual replication) found significant interaction effects (Pain Sensitivity × Political Orientation) on support for all five moral foundations and relevance of four of the five moral foundations ([Figure 4](#), [Table S4](#)), controlling for disgust sensitivity, gender, and the interaction effect of Disgust Sensitivity × Political Orientation ([Table S5](#)).³ Both Studies 1b and 1c also replicated the significant cross-level interaction effects of Pain Sensitivity × Political Orientation × Moral Foundations (loyalty/betrayal, authority/subversion, and sanctity/degradation vs. care/harm and fairness/cheating) in multilevel modeling analyses ([Table 2](#)).

Discussion

Exploratory and confirmatory evidence from Studies 1a–1c showed that higher pain sensitivity predicted greater endorsement of moral foundations typically highlighted by one’s ideological

opponent. Specifically, higher pain sensitivity predicted greater endorsement of “conservative moral foundations” (loyalty/betrayal, authority/subversion, sanctity/degradation) more strongly among liberals than among conservatives, and greater endorsement of “liberal moral foundations” (care/harm, fairness/cheating) more strongly among conservatives than among liberals. The effects could not be explained away by other control variables known to predict moral views. Nor could they be attributed to moderate ideology because, throughout all of our studies, more pain-sensitive liberals and conservatives did *not* place themselves closer to the midpoint of the ideological spectrum (see the General Discussion section for details). Results of Studies 1a–1c (as well as Studies 2a, 2b, and 3) also could not be attributed to methodological artifacts such as multicollinearity and response set (General Discussion → Potential Artifacts).

The observed pattern of interaction effects supports Hypothesis 3 (heightening other side), which specifies that higher pain sensitivity should predict stronger moral views, particularly in domains typically deemed important by one’s ideological opponent. The observed pattern does not support Hypothesis 2 (heightening own side), which predicts the opposite pattern of interaction effects. It also does not support Hypothesis 1 (heightening all harms), which predicts no interaction effects, but only positive, similarly strong

³ In addition to our primary hypotheses of interaction effects, Studies 1a–1b revealed main effects of pain sensitivity on (a) support for all moral foundations, (b) relevance of three moral foundations (loyalty/betrayal, authority/subversion, sanctity/degradation), and (c) political orientation ([Tables 1](#), [Tables S3](#) and [S6](#)). For comprehensiveness, we included these effects in the preregistration of Study 1c. To test (a), support for each moral foundation was regressed on pain sensitivity, first without (Step 1) and then controlling for (Step 2) disgust sensitivity, political orientation, and gender. To test (b), the relevance of each of the three moral foundations (loyalty/betrayal, authority/subversion, sanctity/degradation) was regressed on pain sensitivity, first without (Step 1) and then controlling for (Step 2) disgust sensitivity, political orientation, and gender. To test (c), political orientation was regressed on pain sensitivity, first without (Step 1) and then controlling for (Step 2) disgust sensitivity and gender. Results for (a) and (b) are available in [Table S7](#). Results for (c) are available in [Table S6](#).

Table 2
Highest Order Interaction Effects of Theoretical Interest in Multilevel Modeling of Outcomes in Studies 1a–3

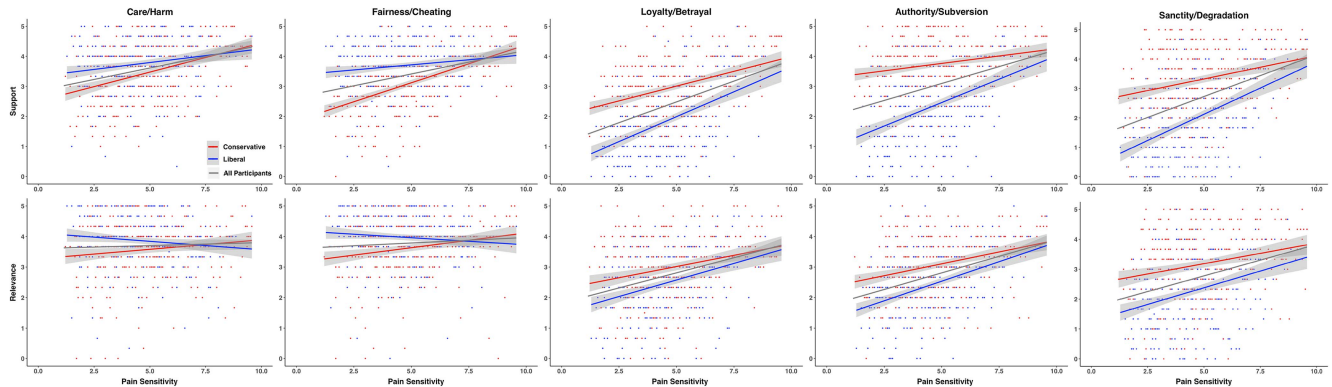
Highest order interaction of interest in exploratory multilevel model									
Study		Measures (within-participant): Effects-coding where relevant	Outcome (Likert)	ICC	β	SE	<i>t</i>	<i>df</i>	<i>p</i>
1a	PS × PO × Measures	Moral foundations: −1 versus 1 ^a	Support for moral foundations	.301	−0.133	0.0145	−9.174	920	<.001
1b	PS × PO × Measures	Moral foundations: −1 versus 1 ^a	Relevance of moral foundations	.323	−0.089	0.0167	−5.366	920	<.001
1c	PS × PO × Measures	Moral foundations: −1 versus 1 ^a	Support for moral foundations	.270	−0.131	0.0164	−7.989	655	<.001
2a	PS × PO × Measures	Moral foundations: −1 versus 1 ^a	Relevance of moral foundations	.324	−0.083	0.0172	−4.819	654	<.001
2b	PS × PO × Measures	Moral foundations: −1 versus 1 ^a	Support for moral foundations	.240	−0.151	0.0121	−12.473	1,256	<.001
3	PS × PO × Measures	Moral foundations: −1 versus 1 ^a	Relevance of moral foundations	.306	−0.083	0.0172	−4.819	654	<.001
2a	PS × PO × Measures	Political figures: −1 versus 1 ^b	Support for political figures	.101	−0.151	0.0147	−10.306	997	<.001
2b	PS × PO × Measures	Political issues: All issues ^c	Support for political issues	.365	−0.145	0.0106	−13.712	1,001	<.001
3	PS × PO × Measures	Political figures: −1 versus 1 ^b	Support for political figures	.179	−0.207	0.0159	−13.010	999	<.001
	PS × PO × Measures	Political issues: All issues ^c	Support for political issues	.380	−0.237	0.0145	−16.329	1,012	<.001
	PS × PO × Measures	Moral foundations: −1 versus 1 ^a	Support for moral foundations	.344	−0.149	0.0106	−14.112	1,563	<.001
	PS × PO × Measures	Political issues: All issues ^c	Relevance of moral foundations	.338	−0.105	0.0115	−9.136	1,563	<.001
	PS × PO	Political issues: All issues ^c	Support for political issues	.362	−0.273	0.0117	−23.284	1,564	<.001
Highest order interaction in multilevel model									
Study		Measures (within-participant)	Outcome (dichotomous)	ICC	β	SE	<i>z</i>		<i>p</i>
2a	PS × PO	Voting preferences: Intended and actual	Voting for Trump over Biden	.972	−8.521	1.2609	−6.758		<.001

Note. PS = pain sensitivity (between-participant, continuous); PO = political orientation (between-participant, continuous); SE = standard error; ICC = intraclass correlation coefficient.

^aEffects-coding of moral foundations (within-participant): –1 (care/harm, fairness/cheating) versus 1 (loyalty/betrayal, authority/subversion, sanctity/degradation). ^bEffects-coding of political figures (within-participant): –1 (Joe Biden, Kamala Harris, Bernie Sanders, Elizabeth Warren, Nancy Pelosi, Steny Hoyer, Chuck Schumer) versus 1 (Donald Trump, Mike Pence, Mitch McConnell, Kevin McCarthy). ^cAll political issues (within-participant) were coded such that higher scores represented more conservative views.

Figure 3

Interaction Effects of Pain Sensitivity × Political Orientation on Support for (Top Row) and Relevance of (Bottom Row) Moral Foundations in Study 1b



Note. Ninety-five percent confidence intervals are shown around the lines for conservatives (i.e., political orientation above scale midpoint; $n = 288$) and liberals (i.e., political orientation below scale midpoint; $n = 287$). For ease of reference, an overall line is shown for all participants who indicated any political orientation (i.e., regardless of whether it was above, below, or at scale midpoint; $N = 686$). Statistical details are available in [Table S2](#). See the online article for the color version of this figure.

main effects of pain sensitivity on all moral foundations. Contrary to these predictions, interaction effects consistently emerged, and the main effect of pain sensitivity varied in size for different moral foundations ([Table 1](#), [Tables S3 and S5](#)). Overall, results support Hypothesis 3 (heightening other side).

Pain Sensitivity Predicts Political Views (Studies 2a–2b)

Building on the evidence thus far, and considering that moral foundations are closely related to people's political views ([Graham et al., 2013](#); [Schein & Gray, 2018](#)), a corollary prediction is that individuals with higher pain sensitivity are more inclined to show political attitudes and voting preferences typically exhibited by their

ideological opponents. Supportive evidence for this prediction would reveal a novel theoretical relation (between pain sensitivity and political views). It would also shed light on outcomes that are often hard to move but have significant consequences in the real world (e.g., political attitudes toward contentious issues, voting preferences in a presidential election). We test this prediction in Studies 2a (exploratory) and 2b (preregistered replication).

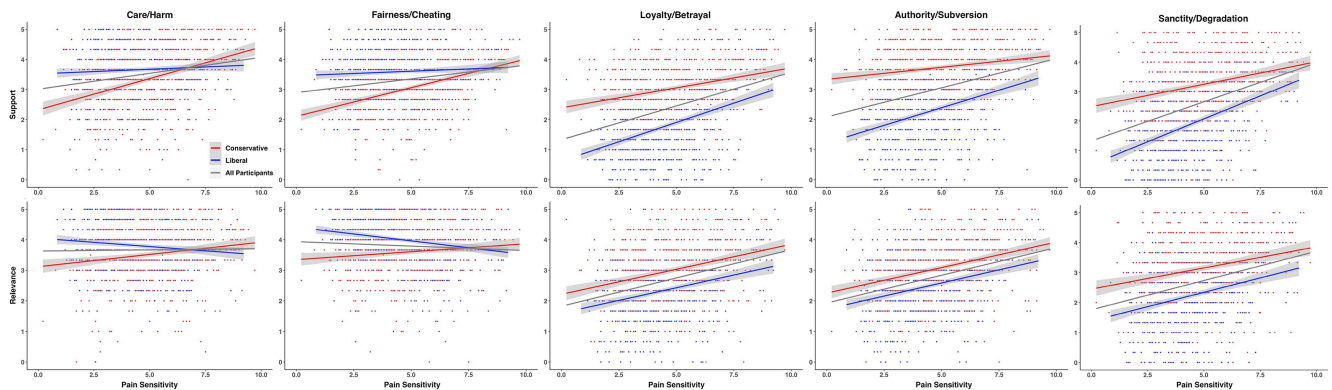
Method

Procedure

Study 2a (exploratory; $N = 1,007$) explored the hypothesized interaction effect of Pain Sensitivity × Political Orientation on

Figure 4

Interaction Effects of Pain Sensitivity × Political Orientation on Support for (Top Row) and Relevance of (Bottom Row) Moral Foundations in Study 1c



Note. Ninety-five percent confidence intervals are shown around the lines for conservatives (i.e., political orientation above scale midpoint; $n = 554$) and liberals (i.e., political orientation below scale midpoint; $n = 583$). For ease of reference, an overall line is shown for all participants who indicated any political orientation (i.e., regardless of whether it was above, below, or at scale midpoint; $N = 1,260$). Statistical details are available in [Table S4](#). See the online article for the color version of this figure.

voting preference in the 2020 U.S. presidential election, support for leading Republican/conservative and Democratic/liberal figures, and attitudes toward 25 contentious political issues. Data were primarily collected on October 10–15, 2020 (preelection), except for the brief postelection survey on November 4–9, 2020 (right after November 3 the Election Day) where the same participants were recruited to indicate whom they actually voted for ($N = 723$; 71.8% of the original sample). We describe each wave of data collection in turn.

During the preelection primary data collection, participants first rated their attitudes toward 15 contentious political issues with item-specific scale labels (adapted from prior research; Day et al., 2014; Feinberg & Willer, 2015; Koleva et al., 2012; Qian & Yahara, 2020) and 10 contentious political issues with items-general scale labels (adapted from prior research; Christie et al., 2019; Feinberg & Willer, 2015; Franks & Scherr, 2019; Frimer et al., 2017; Monroe et al., 2020). Responses to some issues were reverse scored such that higher scores would always indicate more conservative attitudes. Then, three items prompted participants to indicate their likelihood of voting for a liberal, a conservative, and an independent political candidate. Next, participants rated their support for 11 leading political figures, each with three items (using Donald Trump as an example here: “I support Donald Trump”; “I approve of Donald Trump’s performance in the administration of his job”; “I support the political issues that Donald Trump stands for”). Participants were also asked whom they intended to vote for in the upcoming 2020 U.S. presidential election. Finally, participants completed the PSQ (Ruscheweyh et al., 2009, 2012; Sellers et al., 2013), attention check, and demographic measures (including political orientation).

During the postelection brief data collection, participants were asked whom they actually voted for in the 2020 U.S. presidential election.

To provide a preregistered replication of Study 2a’s results, Study 2b ($N = 1,022$) used the same measures as in Study 2a, with two exceptions. First, because the 2020 U.S. Election had already happened, Study 2b measured actual (not intended) voting preference. Second, because of the highly consistent results across political issues in Study 2a, Study 2b included 10 of the 25 original issues, selected on the basis of (a) significant interaction effects of Pain Sensitivity \times Political Orientation and (b) significant effects of pain sensitivity among both liberals and conservatives.

Analyses

Multiple regression models were used to test our hypotheses. Each dependent variable was regressed on the interaction effect of Pain Sensitivity \times Political Orientation and their main effects. All of the dependent measures were continuous and analyzed using linear regression, except for intended voting preference in the preelection data of Study 2a (exploratory) and actual voting preference in the postelection data of Study 2a (exploratory) and in Study 2b (preregistered replication). These dependent variables were categorical and thus analyzed using logistic regression.

In Study 2a, because actual voting preference (measured postelection) showed a highly similar pattern of results to intended voting preference (measured preelection), we also submitted them to multilevel modeling analysis (Table 2, bottom row) and formally tested their consistency using cross-tabulation analysis. Indeed, intended voting preference and actual voting preference were highly

consistent (98.3% of participants who had indicated they intended to vote for Trump later reported actually having voted for him, and 98.9% of participants who had indicated they intended to vote for Biden later reported actually having voted for him); McNemar’s $\chi^2(1) = 0, p = 1$, among Trump and Biden voters. Such consistency was observed regardless of whether we analyzed participants who completed the postelection survey on November 4, 5, 6, 7, 8, or 9 (Table S8), alleviating concerns about memory distortion following the announcement of election results.

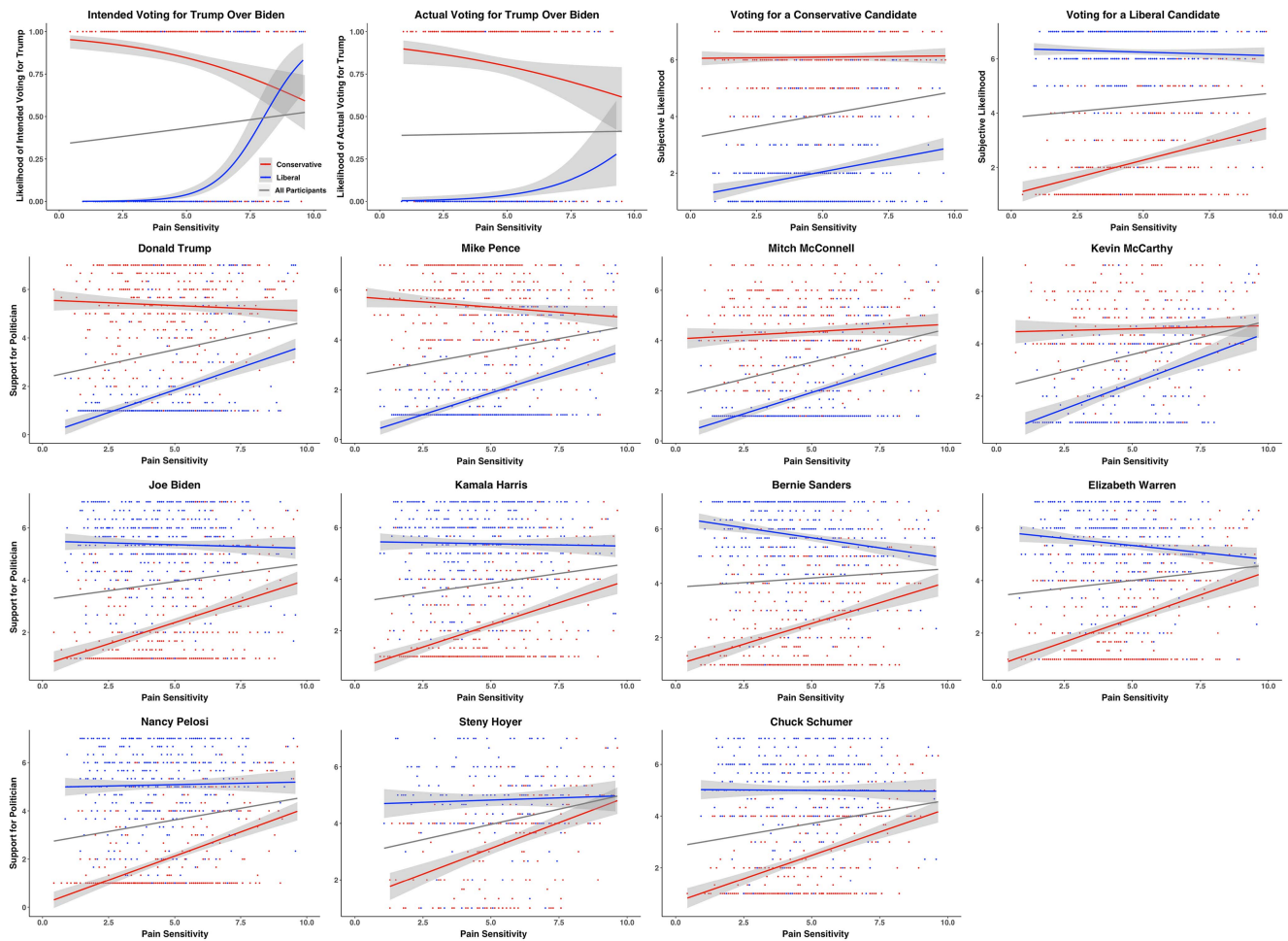
In both Studies 2a and 2b, each set of dependent variables was also analyzed using multilevel modeling (Table 2). Both pain sensitivity and political orientation were between-participant and continuous. Political figures were within-participant and effects coded: -1 (Joe Biden, Kamala Harris, Bernie Sanders, Elizabeth Warren, Nancy Pelosi, Steny Hoyer, Chuck Schumer) versus 1 (Donald Trump, Mike Pence, Mitch McConnell, Kevin McCarthy). Political issues were also within participant and all coded such that higher scores represented more conservative views.

Results

Study 2a found significant interaction effects of Pain Sensitivity \times Political Orientation on intended and actual voting preferences in the 2020 U.S. Presidential Election and support for all leading Republican/conservative and Democratic/liberal figures ($ps \leq 9.40e-7$; Table S9). As in Studies 1a–1c, both pain sensitivity and political orientation were treated as continuous variables in all statistical analyses, but for the purpose of visualizing the interaction effects (Figure 5), we categorized participants into liberals (political orientation below scale midpoint) and conservatives (political orientation above scale midpoint). Higher pain sensitivity predicted higher intended voting preference for Trump over Biden among liberals ($\beta = 1.92$), but higher intended voting preference for Biden over Trump among conservatives ($\beta = -0.53$). Likewise, higher pain sensitivity (measured preelection) predicted higher actual voting preference (measured postelection) for Trump over Biden among liberals ($\beta = 0.98$), but higher actual voting preference for Biden over Trump among conservatives ($\beta = -0.37$).

Higher pain sensitivity also predicted a higher likelihood of voting for a conservative candidate and greater support for Trump, Pence, McConnell, and McCarthy among liberals ($\beta s = 0.14\text{--}0.38$) more than among conservatives ($\beta s = -0.07\text{--}0.05$). In contrast, higher pain sensitivity predicted a higher likelihood of voting for a liberal candidate and greater support for Biden, Harris, Sanders, Warren, Pelosi, Hoyer, and Schumer among conservatives ($\beta s = 0.20\text{--}0.39$) more than among liberals ($\beta s = -0.09\text{--}0.03$). These opposite patterns constituted a significant cross-level interaction effect of Pain Sensitivity \times Political Orientation \times Political Figures (Republican vs. Democratic) in multilevel modeling analyses ($p < 2e-16$; Table 2).

In addition, we found a robust pattern of significant interaction effects of Pain Sensitivity \times Political Orientation on attitudes toward 23 of the 25 contentious political issues ($ps \leq .008$; Table S10), where response options were presented on a bipolar scale and scored or reverse-scored such that higher scores always indicated conservative (as opposed to liberal) attitudes. Higher pain sensitivity predicted conservative attitudes toward political issues among liberals more than among conservatives (Figure 6).

Figure 5*Interaction Effects of Pain Sensitivity × Political Orientation on Voting or Support for Political Figures in Study 2a*

Note. Ninety-five percent confidence intervals are shown around the lines for conservative participants (i.e., political orientation above scale midpoint; $n = 434$) and liberal participants (i.e., political orientation below scale midpoint; $n = 455$). For ease of reference, an overall line is shown for all participants who indicated any political orientation (i.e., regardless of whether it was above, below, or at scale midpoint; $N = 1,005$). Statistical details are available in Table S9. See the online article for the color version of this figure.

Study 2b (preregistered) replicated the interaction effects of Pain Sensitivity × Political Orientation on all measures ($ps \leq .001$; Table 2, Tables S11 and S12, Figures 7 and 8), reinforcing the conclusion that individuals with higher pain sensitivity are more inclined to support political views and show voting preferences typically exhibited by their ideological opponents.

Discussion

Exploratory and confirmatory evidence from Studies 2a–2b indicated that higher pain sensitivity predicted stronger inclinations to support political views and show voting preferences typically exhibited by one's ideological opponent. Specifically, among liberals, higher pain sensitivity predicted a higher likelihood of voting for Trump over Biden in the 2020 U.S. presidential election, stronger support for leading Republican politicians, and more conservative attitudes toward contentious political issues. Among conservatives,

higher pain sensitivity predicted a higher likelihood of voting for Biden over Trump, stronger support for leading Democratic politicians, and more liberal attitudes toward contentious political issues. The cross-aisle effects of pain sensitivity on political views in Studies 2a–2b echo the cross-aisle effects of pain sensitivity on moral views in Studies 1a–1c. Both sets of results support Hypothesis 3 (heightening other side).⁴

It is important to be precise about what our cross-aisle effects did and did not show. Consider first the patterns in Figures 6 and 8. They show that highly pain-sensitive liberals and highly pain-sensitive conservatives hold more similar attitudes toward various contentious

⁴ As higher pain sensitivity predicted stronger endorsement of various moral foundations in Studies 1a–1c and stronger support for political views typically exhibited by one's ideological opponent in Studies 2a–2b, our findings are consistent with the idea that stronger endorsement of various moral foundations is associated with more ideologically diverse views on different issues (Pyszczynski et al., 2018).

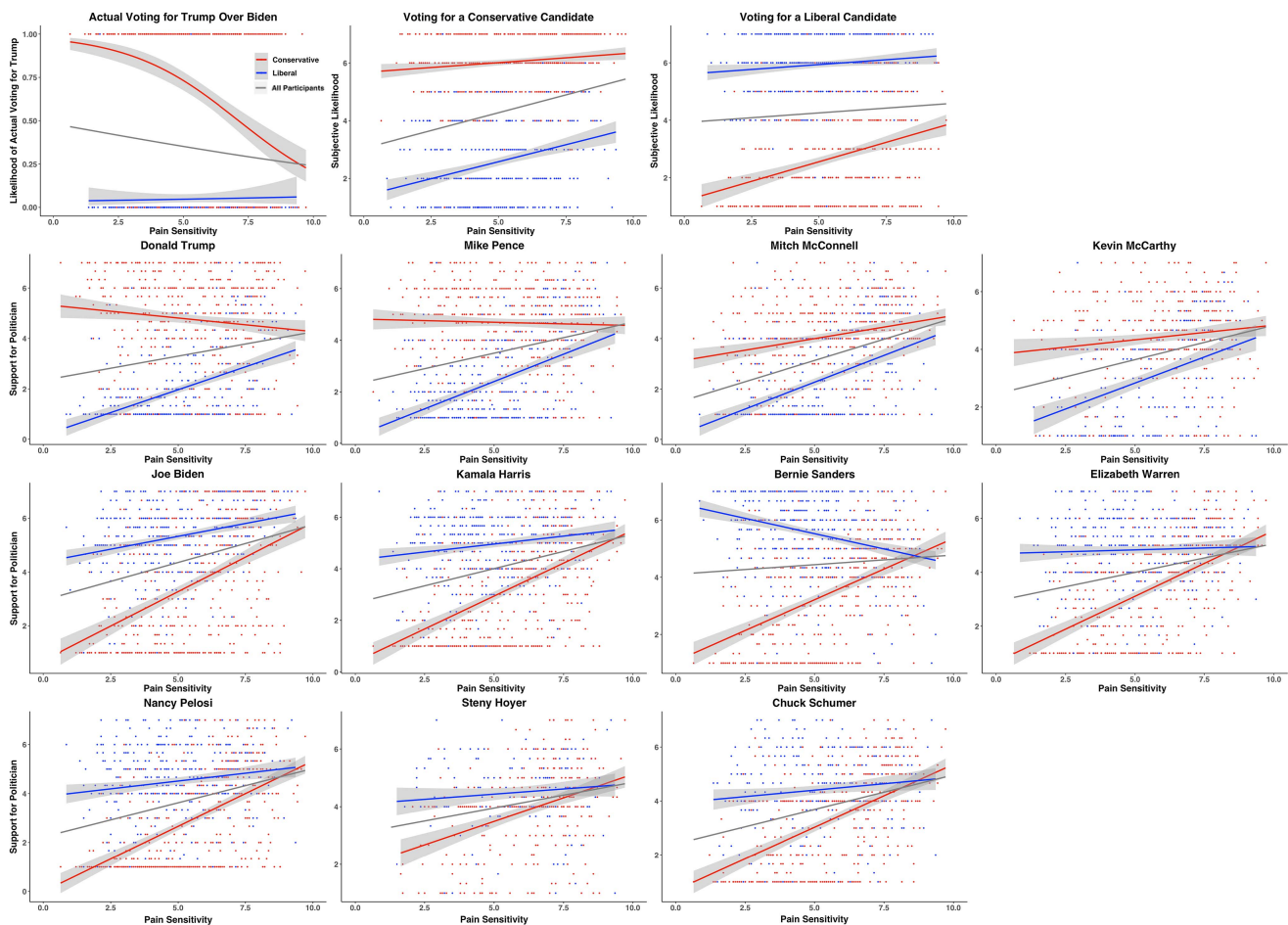
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Figure 7*Preregistered Interaction Effects of Pain Sensitivity × Political Orientation on Voting or Support for Political Figures in Study 2b*

Note. Ninety-five percent confidence intervals are shown around the lines for conservative participants (i.e., political orientation above scale midpoint; $n = 453$) and liberal participants (i.e., political orientation below scale midpoint; $n = 424$). For ease of reference, an overall line is shown for all participants who indicated any political orientation (i.e., regardless of whether it was above, below, or at scale midpoint; $N = 1,015$). Statistical details are available in Table S11. See the online article for the color version of this figure.

choice (Biden vs. Trump), a higher probability of voting across the aisle.

All together, results from Studies 2a–2b support Hypothesis 3 (heightening other side). As in Studies 1a–1c, the cross-aisle effects of pain sensitivity on political views could not be attributed to moderate ideology because throughout all of our studies, more pain-sensitive liberals and conservatives did not place themselves closer to the midpoint of the ideological spectrum (see the General Discussion section for details).

Testing the Process: Perception of Harm (Study 3, Preregistered)

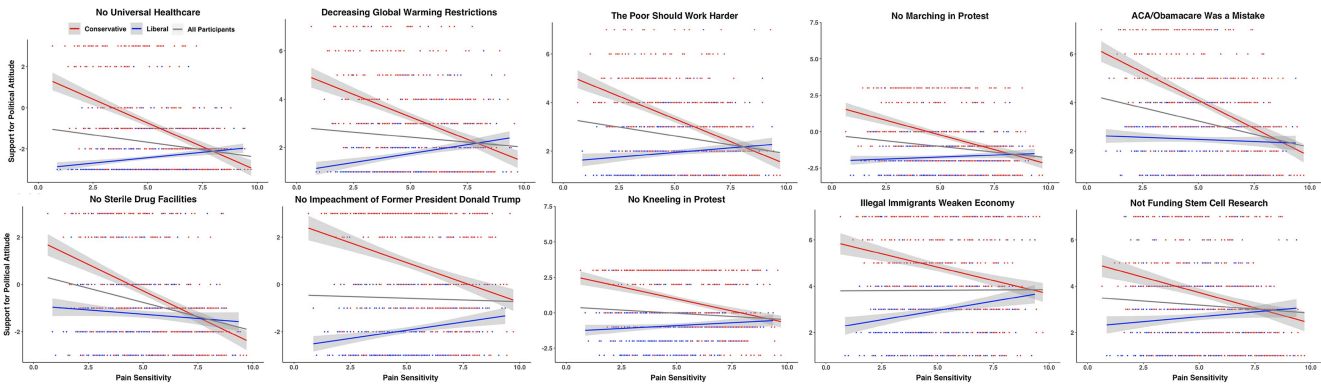
The findings reported so far support the outcomes derived from Hypothesis 3 but have not examined the process per se. Study 3 (preregistered) directly tested the process model (Figure 1b), wherein political orientation moderates the effect of pain sensitivity on harm perception, which drives moral and political views.

Method

Procedure

Participants ($N = 1,658$) first rated their endorsement of moral foundations as in Studies 1a–1c, followed by their attitudes toward 10 contentious political issues as in Studies 2a and 2b (five issues with item-specific scale labels and five issues with items-general scale labels). Next, participants completed measures of perceived harm. Specifically, they rated how much harm they perceived in behavioral violations of each moral foundation and in attitudinal disagreements with each moral foundation, using 32 items we modified from the Moral Foundations Questionnaire (Graham et al., 2011). They also rated how much harm they perceived in the liberal attitude and the conservative attitude toward each contentious political issue, using 20 items we modified from the aforementioned measure of attitudes toward political issues; for each issue, the difference score (perceived harm in the liberal attitude minus perceived harm in the conservative attitude; $PH_{lib-con}$) served as the

Figure 8
Preregistered Interaction Effects of Pain Sensitivity × Political Orientation on Support for Political Issues in Study 2b



Note. Ninety-five percent confidence intervals are shown around the lines for conservative participants (i.e., political orientation above scale midpoint; $n = 453$) and liberal participants (i.e., political orientation below scale midpoint; $n = 424$). For ease of reference, an overall line is shown for all participants who indicated any political orientation (i.e., regardless of whether it was above, below, or at scale midpoint; $N = 1,015$). All items are coded and labeled in the figure such that higher scores represent more conservative views. Items are listed in descending order of magnitude of the interaction effect β . Statistical details are available in Table S12. See the online article for the color version of this figure.

preregistered measure of interest. Finally, participants completed the PSQ (Ruscheweyh et al., 2009, 2012; Sellers et al., 2013), attention check, and demographic measures (including political orientation).

Analyses

All preregistered analyses are presented in Table 3 and summarized below.

1. To test the interaction effect of Pain Sensitivity × Political Orientation on perceived harm (i.e., the moderated first path of our conceptual model in Figure 1b), we ran three sets of regression models (first column of results in Table 3). In each regression model, the predictors were the interaction effect of Pain Sensitivity × Political Orientation and their main effects. The outcome was (a) perceived harm in attitudinal disagreements with each moral foundation (Rows 1–5 of results in Table 3), (b) perceived harm in behavioral violations of each moral foundation (Rows 6–10), or (c) perceived harm in the liberal attitude minus perceived harm in the conservative attitude ($PH_{lib-con}$) toward each contentious political issue (Rows 11–20).
2. To test the effect of perceived harm on moral and political views (i.e., the second path of our conceptual model in Figure 1b), we ran three sets of regression models (second column of results in Table 3). In each regression model, the predictor was each kind of perceived harm as described in the last paragraph. The outcome was (a) support for each moral foundation (Rows 1–5 of results in Table 3), (b) relevance of each moral foundation (Rows 6–10), or (c) attitude toward each contentious political issue (Rows 11–20).
3. To test for moderated mediation (i.e., the full conceptual model in Figure 1b), we implemented three sets of structural equation models with 10,000 bootstraps using

the lavaan package V0.6-10 (Rosseel et al., 2022) in R 4.1.3 (R Core Team, 2022). Results are presented in the last column of Table 3. (a) Support for each moral foundation was predicted by perceived harm in attitudinal disagreements with the corresponding foundation, which in turn was predicted by the interaction effect of Pain Sensitivity × Political Orientation and their main effects (Rows 1–5 of results in Table 3). (b) Relevance of each moral foundation was predicted by perceived harm in behavioral violations of the corresponding foundation, which in turn was predicted by the interaction effect of Pain Sensitivity × Political Orientation and their main effects (Rows 6–10). (c) Attitude toward each contentious political issue was predicted by $PH_{lib-con}$ toward the corresponding issue, which in turn was predicted by the interaction effect of Pain Sensitivity × Political Orientation and their main effects (Rows 11–20).

In addition to the above preregistered analyses, multilevel modeling analyses were conducted. Both pain sensitivity and political orientation were between-participant and continuous. Moral foundations were within-participant and effects coded: -1 (care/harm, fairness/cheating) versus 1 (loyalty/betrayal, authority/subversion, sanctity/degradation). Political issues were also within-participant and all coded such that higher scores represented more conservative views.

Results

The hypothesized moderated mediation was significant in 19 of the 20 preregistered statistical models (nine on moral views, $ps \leq .02100$; 10 on political views, $ps \leq 1.92e-8$; last column in Table 3). Starting with moral views (Rows 1–10 in Table 3), higher pain sensitivity predicted perceived harm in behavioral violations of and attitudinal disagreements with loyalty/betrayal, authority/subversion, and sanctity/degradation more strongly among liberals than among conservatives (Pain Sensitivity × Political Orientation interaction β s = -0.117 – 0.050). In contrast, higher pain sensitivity

Table 3
Preregistered Moderated Mediation Analyses in Study 3

Support for moral foundation	Interaction Effect of Pain Sensitivity \times Political Orientation on Perceived Harm in Attitudinal Disagreements With Moral Foundation			Effect of perceived harm in attitudinal disagreements with moral foundation on support for moral foundation			Index of moderated mediation		
	β	<i>SE</i>	<i>p</i>	β	<i>SE</i>	<i>p</i>	β	<i>SE</i>	<i>p</i>
Care/harm	−0.007	0.02	.778	0.399	0.02	<.001	−0.003	0.01	.782
Fairness/cheating	0.072	0.02	.003	0.340	0.02	<.001	0.021	0.01	.010
Loyalty/betrayal	−0.093	0.02	<.001	0.451	0.02	<.001	−0.027	0.01	.001
Authority/subversion	−0.113	0.02	<.001	0.383	0.02	<.001	−0.031	0.01	<.001
Sanctity/degradation	−0.117	0.02	<.001	0.469	0.02	<.001	−0.035	0.01	<.001

Relevance of moral foundation	Interaction Effect of Pain Sensitivity \times Political Orientation on Perceived Harm in Behavioral Violations of Moral Foundation			Effect of perceived harm in behavioral violations of moral foundation on relevance of moral foundation			Index of moderated mediation		
	β	<i>SE</i>	<i>p</i>	β	<i>SE</i>	<i>p</i>	β	<i>SE</i>	<i>p</i>
Care/harm	0.117	0.02	<.001	0.464	0.02	<.001	0.057	0.01	<.001
Fairness/cheating	0.139	0.02	<.001	0.440	0.02	<.001	0.063	0.01	<.001
Loyalty/betrayal	−0.082	0.02	<.001	0.616	0.02	<.001	−0.048	0.01	<.001
Authority/subversion	−0.050	0.02	.014	0.607	0.02	<.001	−0.028	0.01	.021
Sanctity/degradation	−0.112	0.02	<.001	0.695	0.02	<.001	−0.078	0.01	<.001

Political issue	Interaction Effect of Pain Sensitivity \times Political Orientation on PH _{lib-con}			Effect of PH _{lib-con} on attitude toward political issue			Index of moderated mediation		
	β	<i>SE</i>	<i>p</i>	β	<i>SE</i>	<i>p</i>	β	<i>SE</i>	<i>p</i>
Decreasing global warming restrictions	−0.324	0.02	<.001	0.585	0.02	<.001	−0.198	0.02	<.001
No universal health care	−0.287	0.02	<.001	0.689	0.02	<.001	−0.196	0.02	<.001
No impeachment of former president Donald Trump	−0.241	0.02	<.001	0.727	0.02	<.001	−0.176	0.02	<.001
Illegal immigrants weaken the U.S. economy	−0.272	0.02	<.001	0.570	0.02	<.001	−0.174	0.02	<.001
ACA/Obamacare was a mistake	−0.288	0.02	<.001	0.570	0.02	<.001	−0.167	0.02	<.001
The poor should work harder	−0.275	0.02	<.001	0.478	0.02	<.001	−0.149	0.01	<.001
No marching in protest	−0.220	0.02	<.001	0.606	0.02	<.001	−0.133	0.02	<.001
Not funding stem cell research	−0.196	0.02	<.001	0.639	0.02	<.001	−0.126	0.02	<.001
No sterile drug facilities	−0.181	0.02	<.001	0.671	0.02	<.001	−0.120	0.02	<.001
No kneeling in protest	−0.146	0.02	<.001	0.652	0.02	<.001	−0.097	0.02	<.001

Note. PH_{lib-con} = perceived harm in the liberal attitude minus perceived harm in the conservative attitude toward a contentious political issue. Attitudes toward all political issues were coded such that higher scores represented more conservative views. *SE* = standard error; ACA = Affordable Care Act.

predicted perceived harm in behavioral violations of care/harm and fairness/cheating and in attitudinal disagreements with fairness/cheating (but not care/harm) more strongly among conservatives than among liberals (interaction β s = 0.072–0.139). Greater perceived harm in behavioral violations of or attitudinal disagreements with each moral foundation consistently predicted endorsement of the foundation (β s = 0.340–0.695).

Turning to political views (Rows 11–20 in Table 3), across all 10 political issues, higher pain sensitivity consistently predicted PH_{lib-con} more strongly among liberals than conservatives (interaction β s = −0.324 to 0.146). Greater PH_{lib-con} consistently predicted more conservative attitudes toward political issues (β s = 0.478–0.727).

To enhance understanding of the preregistered difference score (PH_{lib-con}) for each political issue, we present its descriptive statistics and its correlation with political orientation in Table S13.

Higher PH_{lib-con} for every issue was associated with a more conservative political orientation. We also conducted exploratory analyses that broke down PH_{lib-con} into its two components and analyzed them separately (Table 4). Specifically, perceived harm in the liberal attitude toward each issue was regressed on the interaction effect of Pain Sensitivity \times Political Orientation and their main effects. Perceived harm in the conservative attitude toward each issue was analyzed in the same way. For ease of comprehending the results, readers might think of “perceived harm in the liberal attitude toward each issue” as a conservative tendency and “perceived harm in the conservative attitude toward each issue” as a liberal tendency. Results showed that higher pain sensitivity predicted greater perceived harm in the liberal attitude toward every issue (i.e., conservative tendency) more strongly among liberals than among conservatives. Likewise, higher pain sensitivity predicted greater

Table 4

Exploratory Analyses That Separately Examined the Interaction Effect of Pain Sensitivity × Political Orientation on Perceived Harm in the Liberal Attitude and on Perceived Harm in the Conservative Attitude Toward Each Political Issue in Study 3

Political issue	Interaction Effect of Pain Sensitivity × Political Orientation on ...					
	Perceived harm in liberal attitude toward political issue			Perceived harm in conservative attitude toward political issue		
	β	<i>SE</i>	<i>p</i>	β	<i>SE</i>	<i>p</i>
Decreasing global warming restrictions	−0.15	0.02	<.001	0.33	0.02	<.001
No universal health care	−0.17	0.02	<.001	0.29	0.02	<.001
No impeachment of Former President Donald Trump	−0.15	0.02	<.001	0.22	0.02	<.001
Illegal immigrants weaken the U.S. economy	−0.14	0.02	<.001	0.28	0.02	<.001
ACA/Obamacare was a mistake	−0.17	0.02	<.001	0.26	0.02	<.001
The poor should work harder	−0.14	0.02	<.001	0.24	0.02	<.001
No marching in protest	−0.14	0.02	<.001	0.19	0.02	<.001
Not funding stem cell research	−0.10	0.02	<.001	0.20	0.02	<.001
No sterile drug facilities	−0.13	0.02	<.001	0.16	0.02	<.001
No kneeling in protest	−0.15	0.02	<.001	0.06	0.02	<.001

Note. *SE* = standard error; ACA = Affordable Care Act.

perceived harm in the conservative attitude toward every issue (i.e., liberal tendency) more strongly among conservatives than among liberals. In short, both components of the preregistered difference score ($PH_{lib-con}$) showed the cross-aisle effects of pain sensitivity.

Overall, these results supported the moderated mediation process model (Figure 1b) in Hypothesis 3 (heightening other side). They further replicated the interaction effects of Pain Sensitivity × Political Orientation on moral and political views found across Studies 1a–2b (see multilevel modeling analyses in Table 2).

Lay Intuitions About Pain Sensitivity (Study 4, Descriptive)

Are the robustly observed interaction effects consistent with laypeople's intuitions about pain sensitivity? We addressed this question empirically in our final study, which sought to describe lay intuitions about the effects of pain sensitivity and compare them with the actual effects of pain sensitivity observed in Studies 1a–3.

Method

Procedure

Participants received introductory sample items from the PSQ (Ruscheweyh et al., 2009, 2012; Sellers et al., 2013) and were asked to imagine a [person] who responded to the PSQ items with generally high ratings and thus had high sensitivity to physical pain. Participants were then asked to rate their intuitions about a [person] with high sensitivity to physical pain (compared with a [person] with low sensitivity to physical pain) on a number of measures, including the [person]'s moral foundations, political orientation, voting preference, support for political figures, and attitudes toward political issues. The text in the [person] placeholder was either "person," "politically liberal person," or "politically conservative person." This manipulation (with three between-participant conditions) allowed us to examine lay intuitions about the interaction

effects of Pain Sensitivity × Political Orientation in two ways (see the Analyses section).

Analyses

To probe whether participants' intuitions would reflect the interaction effects of Pain Sensitivity × Political Orientation observed in Studies 1a–3, we used two methods. Both methods found the same pattern of results.

In Method 1, participants were asked to think of a pain-sensitive person and compare this target with a less pain-sensitive person, both of whom were specified as either politically liberal or politically conservative (two between-participant conditions). In Method 2, a separate group of participants was asked to think of a pain-sensitive person and compare this target with a less pain-sensitive person, and political orientation was not mentioned at all. We measured the participants' inferred political orientation of the pain-sensitive person.

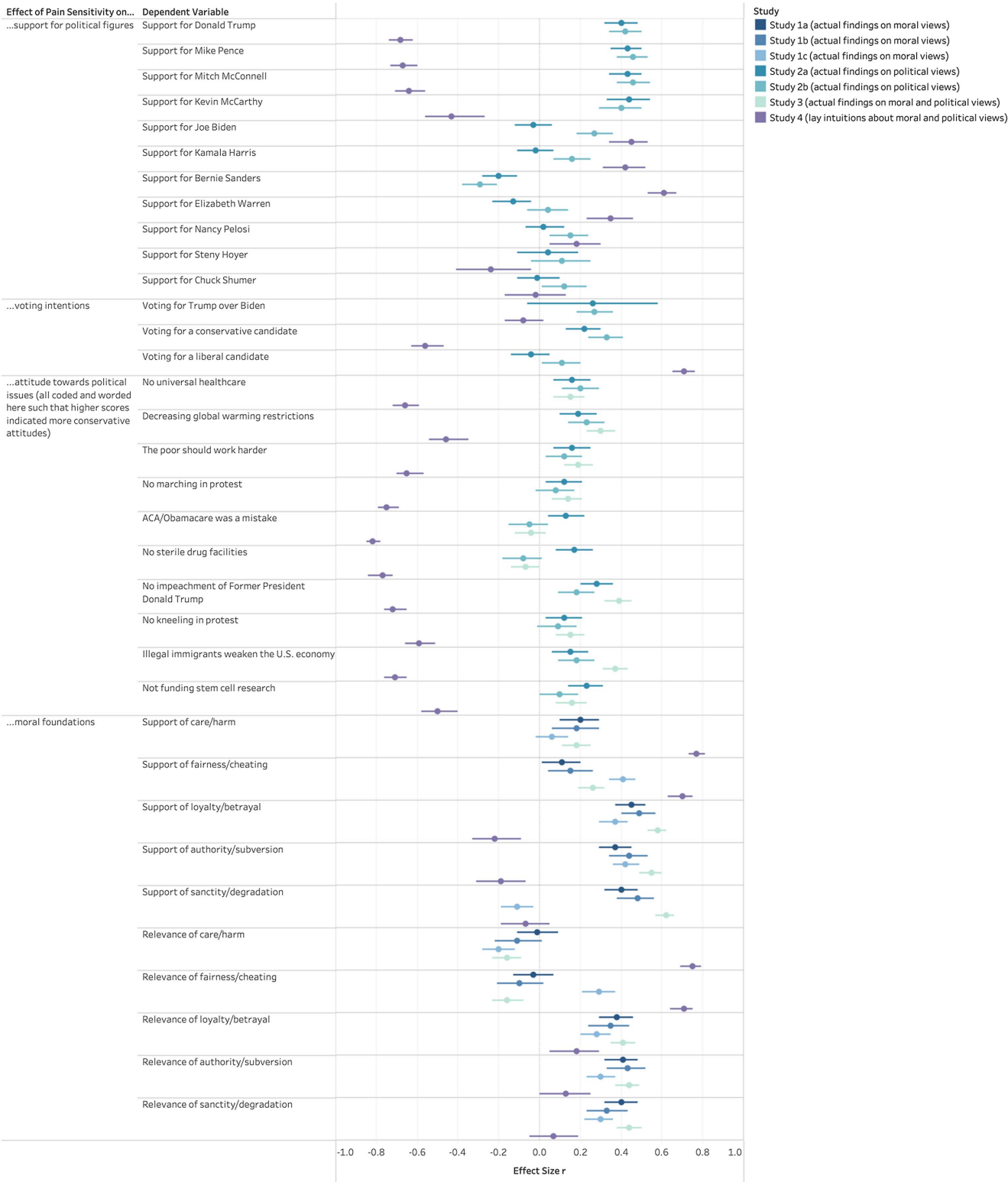
Regardless of whether the hypothetical pain-sensitive person was specified as liberal or conservative (Method 1; Figure 9), or inferred as liberal or conservative (Method 2; Figure S1), all lay intuitions regarding the hypothetical pain-sensitive person (expected support for political figures, expected voting preference, expected attitudes toward political issues, expected moral foundations) were tested against the scale midpoint using one-sample *t* tests (for all continuous measures) or against equal frequency distribution using a chi-square test (for the one categorical measure: expected voting preference between Trump and Biden). Effect sizes were converted to the metric of *r* for data visualization.

Results

Lay intuitions about pain sensitivity turned out to be mostly wrong, often in diametric opposition to the actual effects of pain sensitivity. Specifically, participants expected that a more pain-sensitive target (relative to a less pain-sensitive target) would be

Figure 9
Actual Effects of Pain Sensitivity in Studies 1a–3 Versus Lay Intuitions About Pain Sensitivity When the Target’s Political Orientation Was Specified in Study 4

(a)
Liberal participants in Studies 1-3 and participants in the “target’s political orientation specified as liberal” condition in Study 4



(figure continues)

Figure 9 (continued)**(b)**

Conservative participants in Studies 1-3 and participants in the "target's political orientation specified as conservative" condition in Study 4



Note. (a) Actual effects of pain sensitivity among liberal participants in Studies 1a, 1b, 1c, 2a, 2b, and 3 ($n_s = 406, 287, 583, 455, 424, \text{ and } 717$) versus lay intuitions about pain sensitivity for a target specified as liberal in Study 4 ($n = 240$). (b) Actual effects of pain sensitivity among conservative participants in Studies 1a, 1b, 1c, 2a, 2b, and 3 ($n_s = 404, 288, 554, 434, 456, \text{ and } 705$) versus lay intuitions about pain sensitivity for a target specified as conservative in Study 4 ($n = 237$). To facilitate comparison, all actual effects and lay intuitions were converted to the same metric of effect size, r . Error bars represent 95% confidence intervals. ACA = Affordable Care Act. See the online article for the color version of this figure.

more supportive of political figures and attitudes typically supported by the target's ideological allies, but more opposed to political figures and attitudes typically supported by the target's ideological opponents. These lay intuitions were found regardless of whether the target was specified (Method 1) as liberal (Figure 9a) or conservative (Figure 9b). They were also found regardless of whether the target was inferred (Method 2) as liberal (Figure S1a) or conservative (Figure S1b). Yet these lay intuitions are exactly opposite to the actual effects of pain sensitivity.

Likewise, participants expected that a more pain-sensitive target (relative to a less pain-sensitive target) would much more strongly endorse moral foundations typically endorsed by the target's ideological allies, but either oppose or less strongly endorse moral foundations typically endorsed by the target's ideological opponents. Contrary to these lay intuitions, higher pain sensitivity actually predicted stronger endorsement of moral foundations typically endorsed by one's ideological opponents more than those typically endorsed by one's ideological allies.

General Discussion

A series of exploratory and preregistered confirmatory studies (total $N = 7,360$) provides both theory-building and theory-testing evidence that individuals with higher sensitivity to physical pain are more inclined to support moral and political views typically exhibited by their ideological opponents (Studies 1a–3). Specifically, more (vs. less) pain-sensitive liberal Americans show greater endorsement of moral foundations typically endorsed by conservatives (loyalty to in-group, respect for authority, sanctity of oneself; Studies 1a–1c), even after controlling for a variety of variables that are known to predict moral foundations (e.g., disgust sensitivity, emotion reactivity, empathy). More pain-sensitive liberals also show a higher likelihood of voting for Trump over Biden in the 2020 Presidential Election, stronger support for leading Republican politicians, and more conservative attitudes toward contentious political issues (Studies 2a–2b). In contrast, more (vs. less) pain-sensitive conservatives show greater endorsement of moral foundations typically endorsed by liberals (caring for the vulnerable and equality for all; Studies 1a–1c), a higher likelihood of voting for Biden over Trump, stronger support for leading Democratic politicians, and more liberal attitudes toward contentious political issues (Studies 2a–2b). These cross-aisle effects of pain sensitivity are driven by the heightened perception of harm (Study 3) such that more pain-sensitive individuals perceive greater harm in behaviors or issues where their political orientation does not typically lead them to perceive harm (Figure 1d). Overall, the interaction effects of Pain Sensitivity \times Political Orientation are highly consistent across a wide variety of measures and analyses, often large in effect size, and robustly supported in well-powered and preregistered studies and replications.

The cross-aisle effects of pain sensitivity on moral and political views are distinct from the effects of other intrapersonal variables of basic sensitivity. Those tend to show main effects, not interaction effects. For example, higher disgust sensitivity (Inbar et al., 2009; Petersen et al., 2020; Pizarro et al., 2011), higher gustatory sensitivity (Ruisch et al., 2020), and lower interoceptive sensitivity (Ruisch et al., 2022) all predict more conservative moral and political views. Unlike these main effects, higher pain sensitivity predicts more conservative moral and political views among liberals, but more liberal moral and political views among conservatives. The

interaction effects of Pain Sensitivity \times Political Orientation are not only distinct from the main effects of other variables but also contrary to lay intuitions (Study 4). Laypeople wrongly expect pain sensitivity to predict moral and political views typically favored by one's ideological allies. In reality, it predicts views typically favored by one's ideological opponents. The fact that laypeople mispredict the effects of pain sensitivity also implies that the observed effects of pain sensitivity in Studies 1a–3 are unlikely to have resulted from demand characteristics.

Our findings across studies highlight the counterintuitive role of pain sensitivity, as a low-level attribute, in higher order moral and political views. The relevance of pain sensitivity to morality and politics has received little attention in prior theorizing and research. Our theoretical approach is, to our knowledge, the first that integrates insights from multiple previously unconnected perspectives, which are individually insufficient and jointly necessary for deriving our predictions. Without prior work on the social properties of pain (Dewall et al., 2010; Eisenberger et al., 2003; Goubert et al., 2005; Keyesers et al., 2010; Kross et al., 2011; Lamm et al., 2011; Langford et al., 2006; Lidhar et al., 2021; Lieberman & Eisenberger, 2015; Loggia et al., 2008; Macdonald & Leary, 2005; Singer et al., 2004; Smith et al., 2016), it would be unclear why higher sensitivity to physical pain should predict heightened perception of harm. Without prior work on harm perception as an intuitive template underlying moral judgment (Gray et al., 2012, 2022; Schein & Gray, 2018), it would be unclear why heightened perception of harm should predict stronger moral views. Without prior work on the different moral foundations of liberals and conservatives (Graham et al., 2009, 2013), it would be unclear why political orientation should be a moderator of the effects of pain sensitivity. Without prior work on the basic principle of multiple determinants in higher mental processes (Bless et al., 2003), it would be unclear how exactly political orientation should moderate the effect of pain sensitivity. These perspectives, each by itself, would not predict our results. We integrate them into a coherent model. We demonstrate the utility of this model in generating novel predictions. And we find robust evidence supporting these predictions.

Note that our integrative model highlights the mediating role of harm perception (Gray et al., 2012, 2022; Schein & Gray, 2018) in the predictive effects of pain sensitivity on people's moral views. An alternative prediction could have been derived from a hypothetical model that ignores the notion of harm perception and simply focuses on the unique content of each moral foundation (Graham et al., 2009, 2013). Among the five established moral foundations, the only one that has an obvious link to pain is the care/harm foundation, which taps into our "ability to feel (and dislike) the pain of others" and "underlies virtues of kindness, gentleness, and nurturance" (Ditto et al., 2019). At this surface level, the care/harm foundation might have been expected as the only moral foundation with a direct association with pain sensitivity. But it turns out that pain sensitivity is associated with all moral foundations—and it is not a straightforward main effect. Among liberals, pain sensitivity predicts endorsement of "conservative moral foundations" more strongly than endorsement of "liberal moral foundations" (to which care/harm belongs); among conservatives, pain sensitivity predicts endorsement of "liberal moral foundations" more strongly than endorsement of "conservative moral foundations." These interaction effects of Pain Sensitivity \times Political Orientation are incompatible with the simplistic hypothetical model, but compatible with our integrative model, which specifies that higher

pain sensitivity predicts heightened perception of harm in moral issues where one's political orientation does not typically lead one to perceive harm, a pattern that is aligned with the general principle of multiple determinants in higher mental processes (Bless et al., 2003).

As people's moral views are closely linked to their political views (Graham et al., 2013; Schein & Gray, 2018), our model also predicts the same conceptual pattern of interaction effects (Pain Sensitivity \times Political Orientation) on political views. We find remarkably consistent results across all measures of political interest. Higher pain sensitivity predicts a higher likelihood of voting for the presidential candidate typically favored by one's ideological opponent (i.e., liberals voting for Trump; conservatives voting for Biden), regardless of whether voting preference was measured before the election (i.e., whom participants intended to vote for) or after the election (i.e., whom participants had actually voted for). Higher pain sensitivity predicts stronger support for leading political figures typically favored by one's ideological opponent (i.e., liberals supporting Trump, Pence, McConnell, McCarthy; conservatives supporting Biden, Harris, Pelosi, Schumer, etc.). Higher pain sensitivity predicts attitudes that are typically favored by one's ideological opponent toward contentious political issues. In short, higher pain sensitivity predicts "cross-aisle" political views, be they measured as a dichotomous choice (voting for either Trump or Biden), on a unipolar continuum (support for a leading Republican, support for a leading Democrat), or on a bipolar continuum (more conservative or more liberal attitude toward a political issue).

As we consistently find that more pain-sensitive individuals are more inclined to support moral and political views typically exhibited by their ideological opponents, one may wonder: Are more pain-sensitive individuals simply more ideologically moderate? That is, do the cross-aisle effects of pain sensitivity on moral and political views emerge because more pain-sensitive liberals and conservatives are closer to the ideological midpoint? Not according to participants' ideological self-placement (Table S14). Across studies, among liberals, higher pain sensitivity was not associated with rating oneself as less liberal; among conservatives, higher pain sensitivity was generally associated with rating oneself as slightly more conservative, never less. That is, while pain sensitivity consistently predicted cross-aisle moral and political views, it did not predict moderate ideological self-placement. Furthermore, we conducted additional analyses to explore the potential role of moderate (or extreme) ideological self-placement in our primary phenomenon of interest. Across Studies 1a–3, we created a new variable, ideological extremity, by recoding political orientation (1 = liberal, 5 = centrist, 9 = conservative) in terms of difference from the midpoint (such that 1, 2, 3, 4, 5, 6, 7, 8, 9 became 4, 3, 2, 1, 0, 1, 2, 3, 4). Even after controlling for ideological extremity, 141 of the 142 significant interaction effects of Pain Sensitivity \times Political Orientation found in Studies 1a–3 remained significant (Table S15). These Supplemental Results suggest that the cross-aisle effects of pain sensitivity are not reducible to moderate (or extreme) ideological self-placement. Instead, they are driven by the heightened perception of harm in behaviors or issues where one's political orientation does not typically lead one to perceive harm, as specified in our theoretical model.

One may also wonder if the cross-aisle effects of pain sensitivity are attributable to methodological artifacts such as multicollinearity or response set. They are not (see the Potential Artifacts section). These consistent cross-aisle effects, together with our integrative

model, open up uncharted territory for considerable theoretical and empirical work (see the Future Directions section).

Potential Artifacts

Multicollinearity

Given our primary interest in the interaction effects of Pain Sensitivity \times Political Orientation, Studies 1a–3 involved regressing the outcomes on the interaction effect of Pain Sensitivity \times Political Orientation and their main effects. In regression analyses, substantial correlations among predictors would constitute the problem of multicollinearity, which would (a) destabilize the predictors' partial coefficients and (b) inflate their standard errors, resulting in wider confidence intervals and higher Type II error rates (Cohen et al., 2013). To probe the possibility of multicollinearity, we used the `ols_vif_tol`, `ols_eigen_cindex`, and `ols_coll_diag` functions of the `olsrr` package V0.5.3 (Hebbali, 2020) in R 4.1.3 (R Core Team, 2022) to run collinearity diagnostics across studies. Variance inflation factor, tolerance (i.e., the reciprocal of variance inflation factor), and condition index (i.e., the square root of the ratio of the largest eigenvalue among all orthogonal dimensions extracted from principal components analysis to the eigenvalue of a particular orthogonal dimension) suggested minimal multicollinearity (Table S16) and thus no collinearity concern in our regression analyses (Cohen et al., 2013; Thompson et al., 2017).

Response Set

Considering the robust interaction effects of Pain Sensitivity \times Political Orientation observed across Studies 1a–3, a potential concern could be response set, the notion that some participants might have simply completed all measures with higher ratings, other participants with lower ratings, regardless of the measures' content, resulting in spurious effects. Three observations argue against this concern. First, a number of items were reverse worded (and thus reverse scored in analysis), yet the measures showed reliabilities resembling those in prior research (Table S17), indicating that participants were likely responding to the measures' content. Second, additional analyses (Table S18) showed that ignoring reverse wording and reverse scoring (which should not be ignored) would result in no coherent pattern of effects (which would have been found as a result of the response set). Third, the response set would not be able to account for the fact that pain sensitivity predicted the same participants' responses to some measures differently than their responses to other measures (e.g., pain sensitivity predicted liberal participants' endorsement of loyalty/betrayal, authority/subversion, and sanctity/degradation differently than their endorsement of care/harm and fairness/cheating; Figures 2–4, Tables 1 and 2, Tables S1–S5). These observations suggest that the robust interaction effects of Pain Sensitivity \times Political Orientation were unlikely to be a mere consequence of the response set.

Future Directions

Pain Sensitivity and Political Orientation

We found robust interaction effects between pain sensitivity and political orientation. Both variables involve a number of nuances that deserve future investigation.

Starting with political orientation, as noted in the General Methodological Information Across Studies section, it was treated as a continuous variable throughout our statistical analyses. As such, it captured variations across the ideological spectrum, from highly liberal to moderately liberal to moderately conservative to highly conservative. But more fine-grained aspects of political orientation may be examined. For example, social/cultural and economic/fiscal aspects of ideology, while overlapping with each other, have proven dissociable (Azevedo et al., 2019; Johnston & Ollerenshaw, 2020). They may interact with pain sensitivity in different ways or to different degrees. Also, the extremity of one's ideology is not the same as the strength or centrality of one's political identity (Huddy, 2001), especially in the American bipartisan context (Huddy et al., 2015). Whether these related but distinct variables show the same patterns of interaction with pain sensitivity remains to be explored.

Turning to pain sensitivity, the PSQ we used came with the advantage that it had been validated multiple times in prior psychophysical studies (Ruscheweyh et al., 2009, 2012; Sellers et al., 2013) as a reliable measure that predicts subjective intensity of pain experience across a variety of sensory modalities (heat pain, cold pain, pressure pain, and pinprick pain) that are common in daily life situations and thus relatable to participants. Our psychophysical validation study further supports and extends the validity of the PSQ by showing that higher PSQ scores predicted overall higher subjective pain intensity, steeper increases in subjective pain intensity with increases in objective pressure amount, and lower pain tolerance. Despite this range of validity evidence, one disadvantage of the PSQ is that its wording focuses on the subjective *intensity* of pain experience, which is only one psychophysical parameter of pain sensitivity.

Other parameters exist, such as awareness, tolerance, threshold, and just noticeable difference. These parameters are distinct from each other. Subjective intensity refers to the subjective experience of pain intensity when a person receives a specified objective level of pain-inducing physical stimulation (e.g., 490 Kpa pressure, 80 °C temperature, 10 mA electric shock). Awareness is the frequency with which a person is aware of and attentive to their experience of pain in naturalistic settings. Tolerance is the maximum level of pain-inducing physical stimulation a person can tolerate. Threshold is the minimum level of physical stimulation at which a person starts experiencing pain. Just noticeable difference is the smallest difference between two levels of pain-inducing physical stimulation at which a person can detect a difference consistently and accurately 50% of the time. Which of these specific parameters of the broad construct of pain sensitivity are most robustly linked to individual variations in moral and political views? Answering this question will require further, laborious psychophysical assessment and, according to our power analyses based on effect sizes of the interaction effects of Pain Sensitivity \times Political Orientation, probably fairly large sample sizes ($N \sim 1,000$).

Additional psychophysical assessments of pain sensitivity will also serve the methodological function of either corroborating or challenging the present findings based on self-report measurement of pain sensitivity. The utility of self-report measurement of psychological factors underlying political attitudes has been a subject of debate due to several concerns. First, for some low-level constructs (e.g., interoceptive sensitivity), people may be unable to provide accurate self-assessment (Ruisch et al., 2022). Second, even if people are able to provide accurate self-assessment, they may be

unwilling to provide truthful responses to measures of certain psychological constructs underlying political attitudes (e.g., cognitive rigidity and intolerance of ambiguity underlying right-wing attitudes) due to social desirability and related motivations (Taber & Young, 2013); indeed, self-report measures and behavioral measures of these constructs do not always show the same pattern of associations with political attitudes (Van Hiel et al., 2016). Third, political attitudes often need to be measured via self-report (by asking people what they think about certain topics), and when the psychological factors of interest are also measured via self-report, common method variance may inflate the magnitude of association between the two (Brannick et al., 2010; Podsakoff et al., 2003).

It is useful to be aware of these general concerns, but it is also important to contextualize them in specific studies to gauge the likelihood that they pose validity threats. Our stance is that in the present context of pain sensitivity measurement, the first concern does not pose substantial validity threats, the second concern is unlikely though cannot be ruled out, and the third concern is most complex and worth addressing. More broadly, we also believe that adding a psychophysical assessment of pain sensitivity will be a useful direction for future research.

Regarding the first concern, as noted earlier, the PSQ has been validated multiple times in prior studies (hence our choice of it) and in our own validation study such that people are able to provide self-report assessments of their subjective intensity of pain in ways that reliably map onto psychophysical assessments of their pain experience in situ. Such mapping may be more reliable in the case of pain sensitivity than in the case of interoceptive sensitivity because pain is a more specific notion and is easily understandable to laypeople, whereas interoception is a broader, more nebulous notion and is less readily comprehensible to laypeople.

The validation of reliable mapping between self-report and psychophysical measures also partly relieves the second concern, namely, social desirability. Social desirability is most likely to shape responses to topics that carry clear social-evaluative implications (e.g., being "rigid" or "intolerant"). In the case of the PSQ, participants were asked to read statements about relatable experiences in daily life (e.g., "You burn your tongue on a very hot drink," "You trap your finger in a drawer") and rate how painful they imagined the experience to feel. Rating oneself as feeling more or less pain in these situations does not seem to bear any obvious relation to social evaluation. And these ratings do map onto objective psychophysical measures. Nevertheless, the extent to which responses to the PSQ are susceptible to social desirability is ultimately an empirical question.

Regarding the third and last concern, common method variance might be at work but was unlikely to be the sole driver of the present findings for several reasons (Brannick et al., 2010; Podsakoff et al., 2003): (a) Self-report pain sensitivity predicted the same participants' responses to some self-report measures differently than their responses to other self-report measures (e.g., pain sensitivity predicted liberal participants' endorsement of loyalty/betrayal, authority/subversion, and sanctity/degradation differently than their endorsement of care/harm and fairness/cheating; Figures 2–4, Tables 1 and 2, Tables S1–S5). (b) Other psychological factors (beyond pain sensitivity) that were also measured via self-report did not show the same patterns of association with self-report measures of moral views (Table 1, Tables S3 and S5). (c) A number of near-zero correlations exist among other self-report measures in our studies (e.g., between anxiety and moral foundations; Table S19). (d) More broadly,

experts on common method variance have pointed out that “we should not take as default mode the position that self-report data are inherently full of serious problems of method variance that automatically lead to fallacious inferences” (Brannick et al., 2010, p. 417). In fact, “self-report is sometimes the preferred method of measurement” (p. 418). Still, we cannot eliminate the possibility that common method variance might have inflated the magnitude of the associations we observed. Psychophysical assessment of pain sensitivity will address this concern (though it will introduce a different and less widely appreciated concern, namely, method variance due to the use of different methods; Brannick et al., 2010). It will also provide useful data for triangulating the present findings.

Mediation by Harm Perception

We found that the interaction effects of Pain Sensitivity \times Political Orientation on moral and political views were mediated by harm perception (Study 3). Although the evidence bearing on the mediation was robust across the variety of moral and political views we examined, it was correlational in nature, which involves limitations and invites further investigation on two fronts. First, methodologically, experimental work that manipulates the mediating variable (Jacoby & Sassenberg, 2011; Spencer et al., 2005) or that manipulates the independent variable in ways that encourage changes in the putative mediating variable (Bullock & Green, 2021; West & Aiken, 1997) would provide corroborative evidence. Second, a substantive concern might be that the mediating variable was conceptually too close to the dependent variable. Recall that the dependent variable was support for certain moral views, perceived relevance of certain behaviors to morality, or attitude toward certain contentious political issues. The mediating variable was perceived harm in opposition to those moral views, perceived harm in those behaviors or their opposites, or the difference between perceived harm in the liberal attitude and perceived harm in the conservative attitude toward those political issues. The concern about conceptual proximity between the mediating and dependent variables might be alleviated by the recognition that perceived harm is only one of the elements—not the sole determinant—of judgments in moral (Schein & Gray, 2018) and political realms (Kubin et al., 2021). Other elements such as social norm and identity matter as well. In other words, one’s moral and political views are not identical or reducible to one’s perception of harm in disagreement with those views. This suggests that evidence for the mediating role of perceived harm should not be trivialized.

There is a catch though. The concept of harm has exhibited expanded meanings and uses over time, a historical pattern known as “concept creep” (Haslam, 2016). Against this semantic backdrop, it is plausible that when laypeople rate how much harm they perceive, at least some of them interpret the concept of harm loosely and rely on the same intuitive understanding that forms the basis of their moral and political views. If true, it would constitute a case of content overlap between the mediating and dependent variables and thus undermine the theoretical value of the mediational evidence, regardless of whether the mediation is based on measurement (as we did) or manipulation (as we suggested above). Future research may address this issue by carefully probing what participants actually think of when they provide these ratings and by triangulating it with manipulations of harm perception that clearly establish the meaning of harm to avoid problems of ambiguous interpretation and concept

overuse within the experimental context. In so doing, fine distinctions may be made about where exactly the perceived harm is directed. For example, perceivers may focus on how harmful a target person’s view on a particular issue is (as we measured in Study 3) or on how harmful a policy is (which we did not measure).⁵ The former is more likely to tap into perception of the target person’s character; the latter is more likely to tap into perception of the policy’s consequences. These different perceptions may or may not show the same effects. Identifying such differences will clarify which kinds of harm are most salient on participants’ minds and most responsible for driving the effects of pain sensitivity.

The link from pain sensitivity to harm perception may also be further unpacked. Recall that our argument for this link is rooted in neuroscientific, physiological, behavioral, and linguistic evidence for two social properties of pain: overlap between sensing physical and social pain (Dewall et al., 2010; Eisenberger et al., 2003; Kross et al., 2011; Lieberman & Eisenberger, 2015; Macdonald & Leary, 2005) and overlap between experiencing pain oneself and perceiving pain in one’s conspecifics (Goubert et al., 2005; Keyesers et al., 2010; Lamm et al., 2011; Langford et al., 2006; Lidhar et al., 2021; Loggia et al., 2008; Singer et al., 2004; Smith et al., 2016). Based on these social properties of pain, we proposed that individuals with higher sensitivity to their own physical pain may be more sensitive not only to their own social pain but also to others’ physical and social pain (e.g., others’ distress, social ills, harms being committed), hence their heightened perception of harm. Does social pain sensitivity fully mediate the effect of physical pain sensitivity on harm perception? Or do physical pain sensitivity and social pain sensitivity actually exert differential influences (because, despite their overlap, they are still different constructs; for related evidence, see Riva et al., 2016)?

More broadly, what other mediators may contribute to pain-sensitive individuals’ heightened perception of harm in violations of moral and political views that their ideological opponents typically care about? For instance, is reactivity to negative events, which is linked to higher sensitivity to sensory processing (Van Reyn et al., 2022), one of those mediators? Furthermore, is heightened perception of harm associated with other psychological correlates such as greater attitude importance and stronger moral conviction? If so, do these correlates further mediate or crowd out the mediating role of harm perception? Teasing apart the unique contributions of physical pain sensitivity, social pain sensitivity, and other potential mediators will be important next steps.

One may even argue that harm perception is a downstream consequence, not a mediator, of the effects of pain sensitivity. In other words, it may be that pain sensitivity predicts cross-aisle moral and political views for reasons unrelated to perception of harm in the issues at hand. For example, building on the premise that physical pain sensitivity is associated with social pain sensitivity, individuals with higher physical and social pain sensitivity may be more worried about upsetting others and thus be more inclined to adopt others’ perspectives and be “fence-sitters” in their moral and political views.⁶ Those views, in turn, may motivate the perception of greater harm in contradictory views through a process of motivated reasoning and post hoc justification of one’s views (Haidt, 2001; Kunda, 1990). It is even possible that harm perception is both a

⁵ The authors thank a reviewer for suggesting this distinction.

⁶ The authors thank a reviewer for suggesting and inspiring these ideas.

mediator and a downstream consequence: Pain sensitivity predicts heightened harm perception, which shapes moral and political views as we have found, and once those views are formed, they motivate post hoc justification and further identification of harm in contradictory views. This feedback loop seems highly plausible to us, especially considering our evidence for the strong correlations between moral/political views and perceived harm in contradictory views. Our cross-sectional data, however, fall short of being able to diagnose the feedback loop. We are excited to see future evidence for or against it, using experimental or longitudinal designs or both.

Generalizability and Applicability

Beyond integrating theoretical insights and generating new predictions, our model (Figure 1b) and findings also open up new research questions along the lines of generalizability and applicability. In terms of generalizability, recall that we collected data from American adults of diverse demographic backgrounds and spanning the ideological spectrum, from very liberal to very conservative, in order to test the interaction effects of Pain Sensitivity \times Political Orientation. Although the samples' age and gender distributions were fairly representative of the American population, they were limited to one nation. And the studies were conducted at various time points between May 2019 and October 2021—a highly polarized era in the United States. Do the cross-aisle effects of pain sensitivity generalize to other time periods and other populations, especially those in calmer political climates?

The applicability of our findings to various contexts also deserves empirical attention. For example, in interpersonal communicative contexts, several strategies have been found effective for facilitating cross-aisle persuasion and interaction, such as framing liberal policies around moral themes that conservatives care about and vice versa (Feinberg & Willer, 2019), correcting overestimation of how negative one's political opponents feel toward one's political allies (Lees & Cikara, 2020; Ruggeri et al., 2021), discussing personal experience rather than arguing about facts with one's political opponents (Kubin et al., 2021), prompting the belief in the utility of cross-partisan empathy (Santos et al., 2022), and using language that de-moralizes people's attitudes and thus increases their willingness to compromise (Kodapanakkal et al., 2022). May these communicative strategies be more effective among more pain-sensitive individuals but less effective among less pain-sensitive individuals? In light of the robust associations of pain sensitivity with explicitly measured moral and political views, does pain sensitivity also predict implicit attitudes and nonverbal behaviors toward ideological opponents?

Experimentally, does temporary induction of physical pain (e.g., electric shock, extreme temperature, sharp pressure) produce similar effects (for suggestive evidence, see Xiao et al., 2015)? Does temporary reduction of physical pain (e.g., through the provision of social support; Brown et al., 2003) or temporary inhibition of physiological pathways of pain sensitivity (e.g., by taking acetaminophen; Dewall et al., 2010) produce opposite effects? Extrapolating our findings to clinical contexts, do interventions that reduce patients' chronic pain (Driscoll et al., 2021) produce unintended effects on their social views? Do clinical conditions associated with lower pain sensitivity, such as depression, which is associated with higher pain tolerance in certain pain modalities (Bär et al., 2005; Dickens et al., 2003), also predict social views?

To pursue these future directions, we encourage behavioral, pharmacological, clinical, and neuroscientific research to start disentangling how the affective (Eisenberger et al., 2003; Lieberman & Eisenberger, 2015; Singer et al., 2004) and sensory (Kross et al., 2011; Loggia et al., 2008) components of physical pain may differentially contribute to its role in morality and politics.

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