Knowledge Distortion in Direct Democracy: A Longitudinal Study of Biased Empirical Beliefs on Statewide Ballot Measures

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Abstract

This study extends a model of political knowledge distortion by tracing the influence of cultural orientations, information exposure, and prior beliefs on changes in knowledge distortion and issue attitudes during the 2010 Oregon general election. Results show strong associations between voters’ cultural orientations and their knowledge distortion in the first survey wave and over time. As hypothesized, orientations had stronger effects on the issues that showed greater cultural divergence. Self-reported exposure to issue-relevant information during the campaign, however, had no direct or interactive effects on voters’ changing factual beliefs. Changes in issue attitudes were associated with voters’ changing factual beliefs and their orientations, with the level of cultural divergence having no consistent influence on the strength of those associations.

Political debates often feature sharp disagreement over values and policies, but partisans also clash over facts. Dubious factual claims that recently gained prominence (and still linger) in American political discourse include the myth of health-care “death panels” under the Affordable Care Act, the outsourcing of jobs to China by presidential candidate Mitt Romney, and the issuing of a “stand down” order that led to deaths of U.S. diplomats in Benghazi, Libya (FactCheck.org, 2009, 2012, 2015). The prevalence and power of misleading claims may have reached a high-water mark during the 2016 election. A New York Times analysis concluded, “The strongest bias in
American politics is not a liberal bias or a conservative bias; it is a confirmation bias, or the urge to believe only things that confirm what you already believe to be true” (Roller, 2016).

Recent research has examined this problem from many angles. Key factors include the media’s influence on spreading political myths (Meirick, 2013), the role of attitudinal biases in shaping empirical beliefs (Jerit & Barabas, 2012; Kahan, 2013), and the challenge of correcting misperceptions through fact-checking and other means (Lewandowsky, Ecker, Seifert, Schwarz, & Cook, 2012; Nyhan & Reifler, 2010).

We aim to advance existing theories of political bias and misperception in three respects. First, we use longitudinal data to examine how voters’ issue-related factual beliefs and issue attitudes change over the course of an election. We aim to clarify how misperceptions develop in response to deeply held cultural orientations (Kahan, 2013) and political information (Jerit & Barabas, 2012; Redlawsk, 2002). Our investigation should clarify whether issue-relevant beliefs and issue attitudes change in tandem over the course of an election. Second, we provide an ecologically valid test of such dynamics by studying false claims linked directly to voter decision-making in initiative elections. Some research has focused on beliefs that have political significance, such as claims about welfare or Social Security (Jerit & Barabas, 2006; Kuklinski, Quirk, Jerit, Schwieder, & Rich, 2000), but those connect only indirectly to voting choices. Less common are studies of how misperceptions directly influence voter decision-making, and these typically focus on candidates rather than issues (Redlawsk, 2002). We examine initiative elections in which voters must make judgments about confusing policy questions, the resolution of which may depend partly on one’s empirical beliefs. Third, we look at these dynamics across three ballot measures that vary in their cultural divergence—that is, the degree to which people with contrasting cultural worldviews diverge in their initial attitudes toward the measures themselves.

Before presenting our findings, we review recent scholarship to extend and amend previous models of political knowledge distortion. We adapt these models to take into account cultural divergence and consider how the relationships between values, beliefs, political information, and attitudes change over time. We test our hypotheses via a two-wave panel study of knowledge distortion during a statewide general election, and then conclude by drawing out implications of our findings for theories of political misperception and voter decision-making.

Misperception and Cultural Cognition

Political misperception frequently flows from motivated reasoning, a cognitive process that can lead one to accept some claims and reject others because of
one’s underlying predispositions (Taber & Lodge, 2006). When such reasoning occurs in politics, it can lead to believing in myths like Medicare “death panels” (Meirick, 2013) or misperceptions about other government programs (Jerit & Barabas, 2006). General political knowledge, which can help citizens participate effectively in politics (Delli Carpini & Keeter, 1996), often makes these distortions more severe (Zaller, 1992) by helping citizens recognize which factual claims are in line with their underlying values, regardless of whether those claims are true.

Misleading claims litter the public sphere; yet, only mixed evidence shows precisely how media and campaign messages lead to distorted beliefs: Biased messages may sometimes be the culprit, but other times, citizens themselves may more spontaneously conjure beliefs in line with their values (Meirick, 2013; Reedy, Wells, & Gastil, 2014). Even those citizens who are exposed to counter-attitudinal information still engage in biased processing of that information (Taber & Lodge, 2006). Moreover, corrective media messages, such as the ubiquitous fact-checking sites and reporting, have a limited ability to counter misinformation, let alone undo misconceptions that have formed already (Garrett, Nisbet, & Lynch, 2013; Nyhan & Reifler, 2010). In the wake of Donald Trump’s 2016 U.S. presidential campaign, a Washington Post fact-checker conceded that the candidate’s success was frustrating because “even though he’s corrected or fact-checked, he keeps [making the same claims] over and over” (Bertolini, 2016).

Cultural Bias

Misinformation, misperception, and biasing involve systemic variables, such as media systems and political environments, down to individual-level variables, such as one’s personal worldview to partisan commitments (Lewandowsky et al., 2012). Within that larger paradigm, past research on biased information processing and polarization in the United States typically focuses on people’s self-placement on a liberal–conservative scale, along with their political party identification (Jerit & Barabas, 2012; Zaller, 1992).

For this study, we choose to focus on what appears a more robust approach to underlying values than the left–right political distinction. Research on “cultural cognition” suggests that the problem may go deeper than biased filtering of incoming political information, \textit{per se}. In this view, underlying cultural values shape not only the formation of opinions and attitudes (Gastil, Reedy, Braman, & Kahan, 2008; Kahan, Braman, Slovic, Gastil, & Cohen, 2009; Thorisdottir, Jost, Liviatan, & Shrout, 2007) but also factual beliefs (Kahan, Jenkins-Smith, & Braman, 2011). Past research has also shown that cultural orientation measures can outperform left–right measures as
predictors of policy attitudes, particularly for persons with lower levels of political knowledge (Gastil, Braman, Kahan, & Slovic, 2011).

Messages from ideologically biased sources get much of the attention in misperception research (e.g., conservative outlets spreading the death panel myth during the health-care reform debate), but cultural cognitive research shows that even ostensibly neutral information can activate biases to yield systematically distorted empirical beliefs (Kahan, Braman, Cohen, Gastil, & Slovic, 2010; Kahan et al., 2009). Motivated reasoning scholarship also supports the view that citizens may apply their cognitive biases to any and all political information, whether neutral (Lodge & Taber, 2005; Redlawsk, 2002). People scan the broader information environment, which can include a combination of ideologically skewed messages and neutral factual claims, and simply pick up those messages and claims that are consistent with their underlying ideology and reject or ignore those that are not (Jerit & Barabas, 2012).

In addition to engaging in biased selection of information sources or biased filtering of ostensibly neutral information, people can also develop distorted beliefs whenever they discern that one’s worldview or cultural orientation necessitates taking a culturally (or ideologically) consistent position on both the issue and factual claims relevant to it, a finding supported by both motivated reasoning and cultural cognition research (Lewandowsky et al., 2007a). As Kahan and colleagues (Kahan, Braman, Gastil, Slovic, & Mertz, 2007a) concluded after studying cultural cognition and biased risk perceptions, people credit or discredit empirical claims about potential hazards and benefits through “a form of motivated cognition aimed at protecting persons’ cultural identities” (p. 497). The typical cultural cognitive study conceives of cultural orientation or “worldview” as having two contrasting dimensions: egalitarianism versus hierarchism and collectivism versus individualism (Kahan, 2013; see also Ripberger, Song, Nowlin, Jones, & Jenkins-Smith, 2012). A small set of survey items can locate a person on both dimensions, and the two dimensions—separately or through interactions—can predict how people respond to messages and form attitudes (Gastil et al., 2011; Kahan, 2013).

**Cultural Divergence**

Though past research has established the ubiquity of cultural influence, even on factual beliefs, it has not clarified the degree to which such influence varies depending on the salience of an issue to contrasting cultural groups. We call this concept “cultural divergence.” A policy proposal with high divergence is one on which people with contrasting cultural worldviews differ sharply in their initial attitudes toward it. In contrast, a low-divergence issue might show people with contrasting cultural orientations holding similar attitudes, such as when both groups support a given policy, albeit by slightly different degrees.
Because cultural orientations operate along two dimensions, however, the level of divergence also can vary between those two dimensions on a given issue. For example, on climate change, the egalitarian–hierarch dimension appears to drive both policy preferences and biased responses to new information to a greater extent than the individualist–collectivist dimension (Kahan, Braman, Slovic, Gastil, & Cohen, 2007b). Moreover, one or the other dimension often has a stronger association with a given policy position, owing to the way each issue gets framed along those same dimensions (Gastil et al., 2011). Thus, one can assess separately the level of cultural divergence for each of the two cultural dimensions on a given policy issue.

Knowledge Distortion Model Development and Hypotheses

By adding these conceptions of cultural orientations and divergence to a previously developed model of political knowledge distortion (Wells, Reedy, Gastil, & Lee 2006), we can generate new hypotheses about how such distortions form and how they influence policy attitudes over time. Previous research using this model found that cultural values shape the direction and degree of voters’ factual misperceptions (Reedy et al., 2014), though without longitudinal data and only at the close of an election.

We assume that our data will replicate that effect, but our data permit us to test the strength of that link early in an election cycle, 3 months before Election Day. We anticipate that cultural orientations will be associated with issue-related empirical beliefs even before a campaign gets underway on a specific policy issue because cultural signaling is ubiquitous, even on issues that may not yet appear politicized (Wildavsky, 1987). Cultural biasing can be found even among those with advanced scientific reasoning abilities or technical capacity (Kahan et al., 2012), as well as people who lack political sophistication (Gastil et al., 2011).

That said, we expect cultural orientation’s strength of association with empirical beliefs to vary, so we compare three issues that introduce variance in levels of cultural divergence. Even if cultural orientations shape empirical beliefs on issues where people with opposing cultural values have only modest policy disagreement, the association should be greater when the corresponding cultural divergence is greater. Prior research finds that cultural orientations have the strongest ties to beliefs on those issues that are controversial and highly salient to at least one cultural group (Kahan, 2013; Kahan et al., 2007b). Thus, if the issue positions are similar between people with opposite cultural orientations, there is less pressure to diverge on empirical beliefs related to that issue.

H1. The stronger the initial association between cultural orientations and knowledge distortion, the more culturally divergent the public’s attitudes toward a ballot measure.
Next, we consider the degree to which cultural orientations continue to shape knowledge distortion over the course of the election. We begin by assuming that cultural orientations exert additional influence during an election, owing to the ubiquity of relevant information and the decision that lies ahead for voters concerning that issue. Putting a policy question on a ballot puts it on the voter’s mind, even if only until Election Day (Bowler & Donovan, 1998), and voters are adept at seeking and gleaning ideological and cultural cues in political information (Lau & Redlawsk, 2006; Lupia, 1994). The more culturally divergent the issue, therefore, the stronger the differential cultural biasing anticipated during the course of an election between people with opposing cultural orientations.

H2. The stronger the association between cultural orientations and changes in knowledge distortion over the course of an election, the more culturally divergent the public’s initial attitudes toward a ballot measure.

As campaigns target voters differentially and voters vary in the attention they give to politics, presumably the level of cultural influence on an individual depends on the level of information exposure for that same person. Ballot issues vary widely in the attention they receive from both media and political elites (Bowler & Donovan, 1998), and political news, campaign messages, political discussion, and even state-provided voters’ pamphlets could all play a role in distorting voters’ factual beliefs (Meirick, 2013; Zaller, 1992), though at least one previous study found no clear connection between such messages and distorted beliefs (Reedy et al., 2014).

We equivocate, however, on the relative impact of new information for low- versus high-salience issues. On the one hand, culturally salient issues—by definition—activate cultural biasing such that new information might widen the existing gap in beliefs between persons of opposite cultural orientations. On the other hand, new information may be less significant for voters once issues become culturally and politically saturated (Gastil et al., 2008). In contrast, experimental studies have found that new information on issues such as nanotechnology and vaccines can trigger cultural divergence (Kahan et al., 2009, 2010). Given these countervailing effects, we hypothesize simply that information exposure moderates the effect of cultural orientation on changes in knowledge distortion:

H3. Voter exposure to issue-related information during an election will strengthen the association between cultural orientations and changes in knowledge distortion.

Finally, previous research on knowledge distortion has found that systematically distorted beliefs appear to have an independent effect on individuals’ self-reported voting preferences (Reedy et al., 2014; Wells et al., 2009). Those
prior investigations, however, relied on cross-sectional data in the final weeks of an election. It would shed new light on this relationship if changing empirical beliefs were shown to be associated with changing issue attitudes, apart from the direct influence of cultural orientation.

When theorized in relation to cultural divergence, this dynamic link between knowledge distortion and issue attitudes might manifest only when culture itself did not dictate policy choice. When cultural values dominate an issue, the factual claims related to that issue may lack any independent predictive power (Gastil et al., 2008). For example, discussions of political issues can cause simultaneous polarization of both issue positions and related empirical questions (Binder, Dalrymple, Brossard, & Scheufele, 2009), such that one’s distorted beliefs would have no distinct bearing on issue attitude shifts. Because culturally polarized policy debates result in stronger cultural cueing (Kahan et al., 2011), the independent effect of knowledge distortion may be clearest when cultural divergence is lowest.

\( H_4 \). On issues with less initial cultural divergence, changes in knowledge distortion will have a stronger independent association with changes in corresponding issue attitudes.

Method

Survey Sample

To test these hypotheses, we conducted a two-wave survey during the 2010 Oregon general election. YouGov/Polimetrix provided access to an online survey panel, and after exclusions made for missing data, we had a sample of 588 registered Oregon voters who completed both survey waves. The first survey was conducted August 5–11, and the second wave of data was collected October 22 to November 1. The total sample provided sufficient statistical power to detect even small effect sizes, and missing value analysis showed that no variable was missing >1.3% of cases.

When comparing respondents’ Wave 2 voting preferences to the official ballot count for each of the three initiatives studied (see measurement details below), the voter sample drawn for this study resembled the statewide population. Only 46.8% of voters supported the initiative establishing a medical marijuana dispensary system (Measure 74), which approximates the 47.3% of the sample favoring the measure. A majority (53.9%) of respondents supported a measure to increase mandatory minimum sentences for some sexual felonies and repeat Driving Under the Influence (DUIs) (Measure 73), which was close to the 56.7% of ballots supporting that initiative. Finally, 56.0% of respondents supported a measure to spend lottery funds on parks and natural resources (Measure 76), compared with 69.2% of all voters statewide.
Our survey sample was broadly representative of the Oregon population, but it differed from U.S. Census data for the state on key demographics. Our sample had a higher percentage of college graduates (46.7 vs. 30.8%), a slightly lower percentage of women (48% vs. 50.5%), more White, non-Hispanic respondents (88.7 vs. 83.6%), and respondents with a higher median household income ($60,000 vs. $48,000).

Because there was significant attrition between the two waves, with 39.7% of Wave 1 panelists declining to take the second survey, we made comparisons between these populations. For Wave 1 measures of support and opposition to ballot measures, there were no differences, but those who completed both waves were significantly more likely to have completed college (46 vs. 38% for those who only completed Wave 1) and were older on average (53.5 vs. 46.1 years).

We also compared the sample presented in this article with those Wave 2 respondents who began the survey but did not complete it (13.1%). There were no significant differences in their support of the measures, though there were some differences on other variables.

Cultural Orientations

A standard set of four-point, forced-choice scales measured the two dimensions of cultural orientation (Gastil et al., 2008; Kahan et al., 2007b). Six items on a scale from 1 (strongly disagree) to 4 (strongly agree) were included to measure hierarchism/egalitarianism. When treated as a single scale, the items produced a reliable measure ($M = 2.40, SD = 0.99, \alpha = .93$), as did the six items measuring individualism/collectivism ($M = 3.00, SD = 0.74, \alpha = .90$). Because the two cultural dimensions are typically correlated (Kahan et al., 2007b), as they were in this sample ($r = .70$), the 12 cultural orientation items were entered into a confirmatory factor analysis using varimax rotation. The results showed two distinct factors; these standardized and independent factor scores ($r = .04$) were used in subsequent analyses.

1Demographically, our final sample was slightly less balanced in terms of gender (48% female) than the set of individuals who began the survey (50% female), $X^2 (df = 1, N = 971) = 9.35, p < .05$; similarly, older respondents were more likely to complete the survey (average age 55 years) than those who started but did not finish (average age 44 years); there were no significant differences in terms of race, education, income, or party identification. Not surprisingly, those who completed the survey were somewhat politically knowledgeable ($M = 4.02$ as opposed to $M = 3.77$ among those who did not complete it; Welch’s $t (df = 159.61, N = 971) = 2.28, p < .05$). Finishers also scored slightly higher on the hierarchical orientation scale (Welch’s $t = 1.98, df = 177.98, N = 971, p < .05$), and had slightly more distorted perceptions of one of the initiatives, $M_{73}$ (Welch’s $t = 2.20, df = 195.69, N = 971, p < .05$). This kind of attrition results in less change, at least in terms of demographic characteristics, than often found in panel studies of this kind (Eveland, Hayes, Shah, & Kwak, 2005).
Issue Attitudes

Attitudes toward the ballot measures in both waves were measured through a question and probes that yielded a seven-point scale from *strong opposition* (−3) to *strong support* (+3). Phrasing of these questions varied by the measure in question and depending on whether the respondent had already voted (in Wave 2). For instance, those who had not yet voted saw this item, regarding Measure 73: “One of the issues in this year’s general election is statewide, Measure 73, which would increase mandatory minimum sentences for certain sex crimes and DUI charges. If you plan on voting on MEASURE 73, do you plan to vote YES or NO, or have you NOT DECIDED yet?” Follow-ups probed the level of certainty for yes/no votes, or asked undecided voters which way they leaned. For the sentencing measure, means on the seven-point scale declined between Wave 1 (\(M = 0.74\), \(SD = 2.04\)) and Wave 2 (\(M = 0.14\), \(SD = 2.27\)), and the same pattern was observed for the marijuana measure (Wave 1 \(M = 0.49\), \(SD = 2.45\); Wave 2 \(M = -0.02\), \(SD = 2.37\)) and the parks measure (Wave 1 \(M = 1.24\), \(SD = 1.91\); Wave 2 \(M = 0.44\), \(SD = 2.23\)).

Cultural Divergence

The three ballot measures chosen for this study were intended to vary in their cultural divergence both between issues and potentially between the two...
cultural dimensions on any given issue. To assess levels of divergence, we collapsed issue attitude scales into a binary measure of support or opposition and split each cultural orientation score at the scale median. This resulted in simple cross-tabulations of support and opposition for each issue for each pair of contrasting cultural orientations. Table 1 shows that the greatest divergence was for the hierarch–egalitarian dimension on the medical marijuana issue, with 78% of those on the egalitarian side of the median split favoring the measure compared with only 31% on the hierarch side of the divide. The lowest divergence was for the measure providing lottery funds to parks, with support for the measure among individualists (70%) being within 15 points of collectivists (85%).

Table 1 also shows that the marijuana issue was the only one for which a majority on one side of each cultural scale supported the measure, with the other side’s majority standing in opposition. On the sentencing measure, small majorities of egalitarians (52%) and collectivists (59%) joined their cultural counterparts in supporting the initiative, and on the parks measure, the lowest level of support among any cultural orientation was still nearly a two-thirds majority (65.4% of hierarchs). We should note that these three issues differ on more than just cultural divergence, so any differences we see in our analysis may be because of a combination of factors.

Knowledge Distortion

Knowledge distortion was measured using a method that paralleled prior research on this phenomenon (Reedy et al., 2014; Wells et al., 2009). For each initiative, six statements were varied in terms of their accuracy and as to whether they lent support to the advocates or opponents of a measure (see Supplementary Appendix for full item list). For each statement, respondents indicated whether they believed it was “true” or “false,” which prompted the follow-up, “Would you say that’s definitely [true/false] or probably [true/false]?” Correct answers, nonresponses, and “not sure” responses were all coded as zero, with all other responses indicating degrees of bias for or against a given ballot measure.

To maintain consistency with prior research, biased responses were coded positively and negatively such that the resulting Knowledge Distortion scores would be positive when systematically biased in favor of conservative ballot measures and negative when favoring liberal ballot measures. Prior survey data were used to confirm that the parks and marijuana measures were favored by liberals, with the sentencing measure favored by conservatives. As in past

2As in previous research (Reedy et al., 2014; Wells et al., 2009), treating “not sure” responses as scores of zero versus missing data had no effect on the overall findings presented herein.
research (Gastil et al., 2011), hierarchical and individualist cultural orientations were correlated with conservative political beliefs.3

Incorrect answers that respondents thought were “probably” accurate were coded as −0.5 if they favored a liberal position on a ballot measure and +0.5 if favoring a conservative belief. Incorrect answers that respondents believed were “definitely” accurate were coded in the same manner, with −1 for liberal bias and +1 for conservative bias. For all three measures, means remained relatively stable and variance increased slightly: parks measure Wave 1 $M = −0.04 \ (SD = 0.15)$ and Wave 2 $M = −0.08 \ (SD = 0.16)$; sentencing measure Wave 1 $M = 0.16 \ (SD = 0.18)$ and Wave 2 $M = 0.16 \ (SD = 0.20)$; marijuana measure Wave 1 $M = −0.02 \ (SD = 0.20)$ and Wave 2 $M = −0.01 \ (SD = 0.22)$.

**Issue Information Exposure**

Additional measures included in the Wave 2 survey focused on exposure to political information. A trio of questions asked how many times in the past week respondents had heard “balanced or objective analysis” on each measure, as well as “arguments or information” either in support or opposition to each measure. In each case, the modal response was having heard nothing about each measure in the past week. Responses were highly correlated (minimum $r = .61$), so the three items were recoded into a dichotomous variable indicating whether one had heard anything about a given ballot measure: 46.1% recalled recent information about the parks measure, 44.8% recalled hearing about the sentencing measure, and 56.6% had heard something about the marijuana measure.

**Control Variables**

The first wave of the survey also included demographic and other control variables. Standard items measured sex (48% female), ethnicity (89% white),

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3For this study, we chose to focus on the two-dimensional approach afforded by cultural cognitive theory, but for comparative purposes, we also included in our survey conventional measures of partisanship and ideology (see the full survey instrument in the “supplementary data” link for this article at the journal Web site). Simultaneously including partisanship, ideology, and cultural orientation risks multicollinearity distortions in regression equations. Hierarchical orientation is strongly associated with a scale from strong Democrat to strong Republican ($r = .67$) and with liberal–conservative self-identification ($r = .72$). Individualist orientation has more modest correlations with those variables ($r = .45$ and .44, respectively). If one sets aside fears of post-treatment bias, these variables can be included in the same regressions reported in our “Results” section, which results in multicollinearity indicators near critical thresholds (in the range of .30 tolerance and 2–3.5 for variance inflation factor (VIF). To test the robustness of our results, we ran alternative models that added to our set of predictors partisanship, liberal–conservative self-identification, or both. In nearly every instance, the coefficients for cultural orientation measures remained nearly identical, with their $p$-values unchanged, whereas coefficients for party identification and liberal–conservative self-identification were small and not statistically significant. These appear as Supplementary Tables A1–A3 accompanying this article.
age (median = 57-year old), household income (median bracket = $60–70,000), and education (15% high school or less, 37% some college, and 48% college graduate or higher). As an additional control, we included a six-item political knowledge index (\(M = 4.20, SD = 1.14\)) consisting of standard knowledge measures (e.g., “Who has the final responsibility to decide if a law is constitutional or not? Is it the President, the Congress, or the Supreme Court?”).

**Results**

Hypotheses were tested through linear regression analyses, with Z scores ([\(B_1 - B_2\)/sqrt(\(SE_1 + SE_2\))] used to compare regression coefficients within and between equations and two-tailed tests used for all significance testing (Paternoster, Brame, Mazerolle, & Piquero, 1998). Multicollinearity tests showed, for the main effects, no tolerances below 0.67 and no VIF statistics above 1.5. Tests of interaction terms yielded one tolerance figure at 0.37, with a corresponding VIF of 2.7.

**H1: Predicting Wave 1 Knowledge Distortion**

The first regression analysis compared the cultural predictors of knowledge distortion on the three ballot measures, after controlling for demographics and political knowledge. Table 2 shows the six relevant unstandardized coefficients (i.e., for the two cultural orientations for each of the three initiatives). Even in the early Wave 1 survey, cultural orientation predicted knowledge distortion in the expected direction (i.e., positive associations for the hierarchical and individualist orientations), with five of the six coefficients reaching statistical significance. More importantly, the more the associations trended toward larger coefficients, the greater the corresponding cultural divergence. Figure 1 shows an imperfect linear pattern of coefficients arrayed from the lowest cultural divergence (individualism/collectivism on the parks measure) to the highest (hierarch/egalitarian on marijuana). Z-score comparisons showed that on the hierarch dimension, the marijuana coefficient (\(B = .095\)) was significantly greater than the one for the sentencing measure (\(B = .067\)), and both of these were larger than the parks measure coefficient (\(B = .021\)). For individualism, the coefficients for marijuana and sentencing (\(B_s = .031\) and .036,

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4Our approach uses the two cultural orientations as independent predictors, as was done by Gastil et al. (2011). One can use these cultural measures in many different ways (Ripberger et al., 2012), including testing for an interaction between the two cultural dimensions. We ran alternative regressions that added this interaction term, but it was not significant in any of our models.
respectively) were both significantly greater than the one for the parks initiative ($B = .004$).

### H2 and H3: Predicting Change in Knowledge Distortion

The second set of regression equations looked at predictors of change in knowledge distortion over time by predicting Wave 2 distortion scores after controlling for Wave 1 scores.

As noted in the “Method” section, average distortion scores did not change substantially between the two survey waves, though their variances increased. The consistency of these scores over time varied by issue, from a low of $r = .29$ for the parks initiative, to $r = .54$ on sentencing, and to a high $r = .68$ for marijuana. Regressions tested whether this instability in knowledge distortion scores was shaped by prior cultural orientations—potentially moderated by the level of cultural divergence and self-reported information exposure.

Regarding $H2$, the results presented in Table 3 show clear cultural influence on changing knowledge distortion scores over the course of the election, with the relevant regression coefficients aligning in an even more linear pattern when arrayed by cultural divergence (see Figure 2). Once again, Z-score comparisons were all significant on the hierarchy dimension, with the highest for the marijuana initiative ($B = .068$), moderate for the sentencing measure ($B = .047$), and lower for the parks measure ($B = .027$). For individualism, the

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parks (M76)</th>
<th>Sentencing (M73)</th>
<th>Marijuana (M74)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.031 (0.039)</td>
<td>0.103 (0.044)*</td>
<td>0.034 (0.045)</td>
</tr>
<tr>
<td>Gender (female=1)</td>
<td>-0.014 (0.012)</td>
<td>0.004 (0.013)</td>
<td>-0.014 (0.014)</td>
</tr>
<tr>
<td>Ethnicity (White=1)</td>
<td>-0.011 (0.018)</td>
<td>0.005 (0.021)</td>
<td>-0.026 (0.021)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>-0.001 (0.000)</td>
<td>0.000 (0.000)</td>
<td>0.001 (0.000)</td>
</tr>
<tr>
<td>Income (household)</td>
<td>0.000 (0.001)</td>
<td>0.000 (0.002)</td>
<td>-0.001 (0.002)</td>
</tr>
<tr>
<td>Education</td>
<td>-0.006 (0.009)</td>
<td>0.006 (0.010)</td>
<td>-0.014 (0.010)</td>
</tr>
<tr>
<td>Political knowledge</td>
<td>-0.003 (0.005)</td>
<td>-0.003 (0.006)</td>
<td>-0.012 (0.006)*</td>
</tr>
<tr>
<td>Hierarchical orientation</td>
<td>0.021 (0.006)**</td>
<td>0.067 (0.007)**</td>
<td>0.095 (0.007)**</td>
</tr>
<tr>
<td>Individualist orientation</td>
<td>0.004 (0.006)</td>
<td>0.036 (0.006)**</td>
<td>0.031 (0.007)**</td>
</tr>
</tbody>
</table>

$R^2$ values are unstandardized regression coefficients with standard errors in parentheses.

$^* p < .05$, $^** p < .01$, two-tailed tests.
coefficients for marijuana and sentencing ($B_s = .036$ and .032, respectively) were both significantly greater than the one for the parks initiative ($B = .011$). $^5$

$H_3$ predicted that political information exposure would moderate these associations between cultural orientations and changes in knowledge distortion. Regression models adding in these interaction terms yielded no significant interactions. Thus, we chose not to display in tabular form the regressions that included those nonsignificant interactions.

**H4: Predicting Change in Issue Attitudes**

The first regression equation tested whether changes in knowledge distortion (i.e., Wave 2 scores minus Wave 1 scores) could predict change in attitudes toward the three ballot measures, with the stronger associations coming in the cases of lowest cultural divergence. Table 4 showed that changing distortion scores did have an independent effect on Wave 2 issue attitudes, even after

$^5$As noted in the “Method” section, these three issues differ in many ways, not just on cultural divergence. Because of this, the findings for this hypothesis should be seen as suggestive that cultural divergence is responsible for some of the different results seen across issues.
controlling for Wave 1 issue attitudes, both cultural orientation scores, demographic controls, and political knowledge. The regression coefficients for knowledge distortion change were all significant; however, Z score comparisons found no differences across the coefficients for the parks measure ($B = -0.966$), sentencing initiative ($B = 1.162$), and the marijuana measure ($B = -1.035$). All of these coefficients, along with those for cultural orientation, were in the anticipated directions, but there was not a clear pattern across different levels of cultural divergence.

**Multilevel Model Alternative**

To check the robustness of the main longitudinal findings, we conducted a multilevel analysis to estimate the fixed effects for key results shown in Tables 3 and 4. Data were restructured to create two observations (Wave 1 and Wave 2) for each respondent. In the model estimating knowledge distortion change, hierarchical and individualist orientations predicted change to a degree equivalent that shown in Table 3 (i.e., parameter estimates and standard errors were similar, with matching significance levels). In the model predicting changing attitudes toward initiatives (Table 4), both cultural orientations and knowledge distortion achieved statistical significance at $p < .01$ for all three initiatives, with lower standard errors for each variable. In general, the pattern of

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parks (M76) $B (SE)$</th>
<th>Sentencing (M73) $B (SE)$</th>
<th>Marijuana (M74) $B (SE)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.040 (0.043)</td>
<td>0.181 (0.048)**</td>
<td>-0.081 (0.042)</td>
</tr>
<tr>
<td>Knowledge distortion (Wave 1)</td>
<td>0.264 (0.045)**</td>
<td>0.180 (0.044)**</td>
<td>0.479 (0.038)**</td>
</tr>
<tr>
<td>Gender (female=1)</td>
<td>-0.008 (0.013)</td>
<td>0.010 (0.014)</td>
<td>0.015 (0.013)</td>
</tr>
<tr>
<td>Ethnicity (White=1)</td>
<td>-0.002 (0.020)</td>
<td>0.003 (0.022)</td>
<td>-0.011 (0.019)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>-0.001 (0.000)</td>
<td>0.000 (0.000)</td>
<td>0.001 (0.000)</td>
</tr>
<tr>
<td>Income (household)</td>
<td>0.000 (0.002)</td>
<td>-0.001 (0.002)</td>
<td>0.000 (0.002)</td>
</tr>
<tr>
<td>Education</td>
<td>-0.002 (0.009)</td>
<td>0.002 (0.011)</td>
<td>0.009 (0.009)</td>
</tr>
<tr>
<td>Political knowledge</td>
<td>-0.012 (0.006)*</td>
<td>-0.015 (0.006)*</td>
<td>-0.001 (0.005)</td>
</tr>
<tr>
<td>Heard information on measure</td>
<td>-0.008 (0.013)</td>
<td>0.013 (0.014)</td>
<td>0.012 (0.012)</td>
</tr>
<tr>
<td>Hierarchical orientation</td>
<td>0.027 (0.007)**</td>
<td>0.047 (0.008)**</td>
<td>0.068 (0.007)**</td>
</tr>
<tr>
<td>Individualist orientation</td>
<td>0.011 (0.006)</td>
<td>0.032 (0.007)**</td>
<td>0.036 (0.006)**</td>
</tr>
<tr>
<td>$R$</td>
<td>.355**</td>
<td>.460**</td>
<td>.722**</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>.111</td>
<td>.198</td>
<td>.514</td>
</tr>
</tbody>
</table>

$N = 591$ for Parks, $N = 592$ for Sentencing, $N = 592$ for Marijuana.

* $p < .05$. ** $p < .01$, two-tailed tests.
parameter sizes were equivalent to Table 4, except that the estimates were much higher for knowledge distortion ($-2.90 [.381]$ for the parks measure, $2.88 [.312]$ for the sentencing measure, and $-3.61 [.348]$ for the marijuana measure).

**Conclusion**

This study of political misperceptions provides stronger evidence that voters’ factual beliefs on policy issues can become systematically distorted to align with prior cultural orientations. Using longitudinal data, we found this effect taking place both during and before initiative campaigns getting underway. Over the course of an election, distorted beliefs can change in tandem with changing initiative attitudes, even after controlling for cultural orientations and other background variables.

This study also found that cultural divergence can account for variation in some of these associations. In particular, cultural orientations exert a stronger initial and overtime influence on knowledge distortion when there is more
Table 4  
*Predictors of Attitudes Toward Three Oregon Ballot Measures in Survey Wave 2 After Controlling for Wave 1 Attitudes*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parks (M76)</th>
<th>Sentencing (M73)</th>
<th>Marijuana (M74)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.146 (0.581)</td>
<td>0.850 (0.503)</td>
<td>-1.075 (0.582)</td>
</tr>
<tr>
<td>Support level (Wave 1)</td>
<td>0.116 (0.448)*</td>
<td>0.547 (0.402)**</td>
<td>0.286 (0.043)**</td>
</tr>
<tr>
<td>Gender (female=1)</td>
<td>0.155 (0.176)</td>
<td>-0.088 (0.152)</td>
<td>0.146 (0.175)</td>
</tr>
<tr>
<td>Ethnicity (White=1)</td>
<td>0.406 (0.269)</td>
<td>-0.085 (0.233)</td>
<td>0.070 (0.268)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>-0.003 (0.006)</td>
<td>-0.009 (0.005)</td>
<td>-0.001 (0.006)</td>
</tr>
<tr>
<td>Income (household)</td>
<td>-0.028 (0.022)</td>
<td>0.008 (0.019)</td>
<td>0.006 (0.022)</td>
</tr>
<tr>
<td>Education</td>
<td>-0.007 (0.129)</td>
<td>-0.079 (0.112)</td>
<td>0.076 (0.129)</td>
</tr>
<tr>
<td>Political knowledge</td>
<td>0.057 (0.076)*</td>
<td>-0.082 (0.066)*</td>
<td>0.144 (0.075)</td>
</tr>
<tr>
<td>Heard information on measure</td>
<td>-0.129 (0.172)</td>
<td>-0.223 (0.149)</td>
<td>0.138 (0.171)</td>
</tr>
<tr>
<td>Hierarchical orientation</td>
<td>-0.614 (0.003)**</td>
<td>0.308 (0.085)**</td>
<td>-0.493 (0.103)**</td>
</tr>
<tr>
<td>Individualist orientation</td>
<td>-0.402 (0.086)**</td>
<td>0.282 (0.074)**</td>
<td>-0.142 (0.088)</td>
</tr>
<tr>
<td>Knowledge distortion change</td>
<td>-0.966 (0.472)*</td>
<td>1.162 (0.409)**</td>
<td>-1.035 (0.502)*</td>
</tr>
<tr>
<td>R</td>
<td>.420**</td>
<td>.632**</td>
<td>.509**</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>.161</td>
<td>.388</td>
<td>.243</td>
</tr>
<tr>
<td>N</td>
<td>589</td>
<td>591</td>
<td>588</td>
</tr>
</tbody>
</table>

*Note. Values are unstandardized regression coefficients with standard errors in parentheses.*

*p < .05, **p < .01, two-tailed tests.*

initial divergence in support for a ballot measure between people who hold different cultural orientations. In other words, the greater the cultural stake in those issues, the stronger the empirical biases generated by voters’ cultural commitments. (Lewandowsky et al., 2012). That said, it appears that shifts in knowledge distortion may correspond to equivalent shifts in policy attitudes, regardless of the level of cultural divergence.

What this study did not find was evidence that the influence of values on knowledge distortion during a campaign depends on exposure to political information. This finding should contribute to ongoing debates over the competing roles of underlying values and information exposure in belief and opinion formation (Jerit & Barabas, 2012). Nevertheless, that particular non-finding warrants caution owing to the information measures used in this study, which were simple self-report data from respondents about whether they had heard anything about the ballot measure in the week previous to the survey.

Though our study benefitted from the ecological validity of surveying voters on real issues appearing on their ballot during a general election, this also presented a limitation of its own. Our research investigated three particular issues from a vast population of policy issues on which voters might form systematically distorted beliefs. By having an issue on parks, drugs, and sentencing, this study covered some ground (as shown in the variation of cultural
divergence scores in Figures 1 and 2), but our sample did not contain the highest-profile cultural issues that might have appeared in 2010 (e.g., gay marriage or abortion) nor did it include a high-stakes fiscal measure that would have raised state taxes or cut government spending dramatically.

This study’s other greatest limitation may be on the strength of its causal inferences. Our research has started with a theoretical model that posits a directional influence from values to beliefs and, ultimately, to voting choices. In that respect, using longitudinal data represent an advance over previous cross-sectional surveys. Coupled with related experimental research that tested discrete exposure effects in a more controlled environment (Kahan et al., 2009, 2010), there is considerable support for these causal paths.

Nonetheless, critics are right to posit that under different circumstances, a reverse causal flow is possible. As Persson, Sahlin, and Wallin (2015) argue in regard to cultural orientations and beliefs about climate change, “It may well be that, in another manifestation of the dynamic, new scientific evidence slowly brings about modifications in group values” (p. 4). Reversing the causal flow might be implausible in the case of deep-seated cultural orientations (Kahan et al., 2007b; Wildavsky, 1987), but future research should continue to investigate the conditions under which misperceptions can be corrected—and accurate information accepted regardless of its fidelity with one’s prior cultural or ideological commitments. Scholars have examined the mixed effects of corrective messages and misperception-reducing campaigns (Nyhan & Reifler, 2010, 2015; Nyhan, Reifler, Richey, & Freed, 2014), as well as the impact of deliberative interventions like the Oregon Citizens’ Initiative Review (Gastil, Richards, & Knobloch, 2014). Efforts such as these might ultimately encourage voters to seek out more reliable information, rather than perpetuating a cycle of ever-worsening knowledge distortion.

Supplementary Data

Supplementary Data are available at IJPOR online.

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References


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