

# Is Dissonance Reduction a Special Case of Fluid Compensation? Evidence That Dissonant Cognitions Cause Compensatory Affirmation and Abstraction

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Cognitive dissonance theory shares much in common with other perspectives that address anomalies, uncertainty, and general expectancy violations. This has led some theorists to argue that these theories represent overlapping psychological processes. If responding to dissonance and uncertainty occurs through a common psychological process, one should expect that the behavioral outcomes of feeling uncertain would also apply to feelings of dissonance, and vice versa. One specific prediction from the meaning maintenance model would be that cognitive dissonance, like other expectancy violations, should lead to the affirmation of unrelated beliefs, or the abstraction of unrelated schemas when the dissonant event cannot be easily accommodated. This article presents 4 studies ( $N = 1124$ ) demonstrating that the classic induced-compliance dissonance paradigm can lead not only to a change of attitudes (dissonance reduction), but also to (a) an increased reported belief in God (Study 2), (b) a desire to punish norm-violators (Study 1 and 3), (c) a motivation to detect patterns amid noise (Study 3), and (d) polarizing support of public policies among those already biased toward a particular side (Study 4). These results are congruent with theories that propose content-general fluid compensation following the experience of anomaly, a finding not predicted by dissonance theory. The results suggest that dissonance reduction behaviors may share psychological processes described by other theories addressing violations of expectations.

*Keywords:* dissonance, meaning, fluid compensation, affirmation

Arguably the most prominent theory in social psychology, the conceptualization of cognitive dissonance has traversed a long and meandering path since it was first proposed by Leon Festinger (1957). Despite an unusually large number of revisions and rerevisions of the theory (Aronson, 1969; Cooper & Fazio, 1984; Greenwald & Ronis, 1978; Harmon-Jones, Amodio, & Harmon-Jones, 2009; Harmon-Jones, Brehm, Greenberg, Simon, & Nelson, 1996; Steele & Liu, 1983; Tedeschi, Schlenker, & Bonoma, 1971; Zanna & Cooper, 1974), the core of dissonance theory remains relatively

unchanged: People are bothered by inconsistencies between their mental representations and will work toward reducing those inconsistencies (Festinger, 1957; Harmon-Jones, Amodio, & Harmon-Jones, 2010; Harmon-Jones et al., 1996).

Recently, it has been argued that dissonance theory shares a number of similarities with other uncertainty theories (Heine, Proulx, & Vohs, 2006; Proulx & Inzlicht, 2012). In particular, both dissonance and uncertainty reduction theories describe inconsistent cognitions or unexpected events as leading to an aversive arousal state, which leads to predictable behavioral change in the service of reducing the arousal. Despite these and other similarities (Proulx, Inzlicht, & Harmon-Jones, 2012), there are also a number of key predictive differences. This article focuses on one such difference described by the meaning maintenance model (MMM; Heine et al., 2006): Dissonance theory does not predict that inconsistencies will lead to compensatory affirmation in domains unrelated to the dissonance-inducing event (Festinger, 1957; Harmon-Jones et al., 2009), while the MMM argues that affirming any committed belief may provide a palliative to the arousal elicited by inconsistencies. Thus, we propose an extension to classical dissonance theory by arguing that dissonance not only changes attitudes

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and behavior regarding the perceived inconsistency, but also attitudes in other unrelated domains, because people aspire to engage in any behavior that reduces the unpleasant arousal.

### The MMM

According to the MMM (Heine et al., 2006; Proulx & Heine, 2010), any violated expectation (i.e., a meaning violation) produces aversive arousal, motivating individuals to address the violation. This arousal is context general; people require contextual cues to identify the proximal cause of their aversive feeling. As such, inconsistent cognitions, experiences that do not match expected outcomes, interruptions to salient goals, or information that defies one's understanding of the world may all elicit the same arousal, signaling to the individual that something is not as expected (Proulx & Inzlicht, 2012). The MMM argues that people are motivated to dispel the arousal by resolving it through accommodation (see Kuhn, 1962/1996; Piaget, 1960), by which their meaning frameworks are adjusted so that the offending anomaly is no longer at odds with their expectations (as is the case with dissonance reduction). However, if an individual does not have sufficient available resources to resolve the violation, they may seek to dispel the arousal in another indirect way, which is termed fluid compensation (Allport, 1943, 1954). This fluid compensation is domain general in that cognitive efforts in one domain can dispel the arousal caused by a threat in an entirely different domain, and there are at least two distinct ways that it can occur (Proulx & Heine, 2010).

First, the arousal stemming from the original anomaly may lead people to affirm their commitment to another currently accessible but unrelated belief. By increasing their commitment to an alternative meaning framework that has not been damaged by violated expectations, people can dispel the bothersome arousal by focusing on aspects of the world that make sense. Much research has shown evidence for this mode of fluid compensation, across a broad range of meaning violations that may be as explicit and disturbing as considering one's own death (Burke, Martens, & Faucher, 2010) or reflecting upon a social rejection (Nash, McGregor, & Prentice, 2011), down to implicit and trivial experiences such as subliminally seeing incoherent word pairs (e.g., "quickly blueberry"; Randles, Proulx & Heine, 2011) or reading an unexpectedly absurd story (Proulx, Heine, & Vohs, 2010). All of these manipulations have led people to affirm their commitment to unrelated beliefs, such as increasing their identification with their culture, becoming critical of someone who mocks their country, or becoming especially punitive toward a lawbreaker (for reviews, see Heine et al., 2006; Proulx & Heine, 2010; Proulx & Inzlicht, 2012).

Second, when alternative meaning frameworks are not readily accessible, people may instead be motivated to seek out and learn novel meaning frameworks, a process that we term abstraction (Proulx & Heine, 2009). For example, upon encountering violations to meaning as diverse as considering the contradictory nature of one's self-concept, reading a surreal Kafka story, or seeing incoherent word pairs, participants have demonstrated heightened motivation (Proulx & Heine, 2009; Study 1) and accuracy (Proulx & Heine, 2009; Study 2; Randles et al., 2011) on an implicit pattern-learning task. In a similar line of work, being made to feel uncertain can increase illusory perceptions of patterns among noisy images or stock market information (Whitson & Galinsky,

2008) and leads to a preference for scientific explanations that emphasize clear order or patterns when describing reality (Rutjens, van der Pligt, & van Harreveld, 2010; Rutjens, van Harreveld, van der Pligt, Kreemers, & Noordewier, 2013). Thus, evidence coming from multiple paradigms speaks to increased motivation to detect patterns, with some data suggesting that ability may also increase, independent of motivation. It remains unclear whether this process serves to reduce arousal, or is a component of the searching process that identifies the source of one's feeling that something is not right.

### Dissonance and the Meaning Maintenance Model

According to the MMM, dissonance may prompt unpleasant arousal for the same reason as other violations of expectations: The relevant cognitions are inconsistent with available meaning frameworks. Although a number of theorists argue that dissonance reduction is primarily related to self-consistency, in that the inconsistency represents a threat to one's self-esteem (Aronson, 1999; Steele & Liu, 1983), the original articulation of dissonance theory (Festinger, 1957), as well as some current ones (e.g., Harmon-Jones et al., 2009; Harmon-Jones et al., 2010) represent the perspective that any psychologically or logically inconsistent cognitions that occur simultaneously can create aversive arousal. For example, Festinger (1957, p. 14) writes that "If a person were standing in the rain and yet could see no evidence that he was getting wet, these two cognitions would be dissonant with each other." Hence, the original formulation of dissonance and the MMM both share the view that *any* kinds of inconsistent cognitions, including those that do not involve the self, motivate efforts to dispel the associated arousal.

Although some versions of dissonance theory and the MMM agree on the conditions that cause this disrupted state, they differ in explaining how people respond to the corresponding arousal. In the case of the typical dissonance experiment, participants seek to directly reduce the offending inconsistency by accommodating their attitudes (e.g., "I just agreed to write an essay in favor of a tuition increase; it must be because I actually am in favor of such an increase"). Direct accommodation is possible only when participants are consciously aware of the anomaly that lies at the source of their arousal. In contrast, the inconsistent cognitions involved in many MMM studies are either not consciously accessible (e.g., a change blindness task; Proulx & Heine, 2008), or have included a number of distractor tasks following the manipulation and prior to the measure of fluid compensation (Burke et al., 2010; Proulx & Inzlicht, 2012; Randles, Heine, & Santos, 2013). All else being equal, people may prefer to directly deal with the inconsistency rather than indirectly reduce their arousal (Stone & Cooper, 2001; Stone, Wiegand, Cooper & Aronson, 1997; Tullett, Teper, & Inzlicht, 2011). However, given that in these situations there is no direct way to accommodate the inconsistencies or affirm related beliefs, and it is easy to misattribute the cause of one's state, people may use alternative indirect tactics to dispel the arousal, such as affirmation or abstraction of unrelated meaning frameworks. Self-affirmation theory has produced some of the strongest indirect support for this hypothesis. A number of studies have shown that self-affirmation can provide a buffer for, or resolution of, dissonant arousal (Sherman & Cohen, 2006; Steele & Liu, 1983). From this perspective, dissonance interferes with self-

integrity and as such is resolvable via any experience that restores a global sense of a positively viewed self.

Although findings from the self-affirmation perspective are consistent with our predictions, the theory argues for a narrowing of the dissonance process to pertain only to events that threaten the self. Some dissonance researchers challenge this revision on the grounds that young children who lack a complex sense of self, as well as many nonhuman animals, still show evidence of dissonance reduction (Egan, Santos, & Bloom, 2007; Harmon-Jones et al., 2009; Lydall, Gilmour, & Dwyer, 2010). This same criticism applies to the proposed function of self-affirmation in general, which has been described as maintaining goal-pursuit in the face of frequent failure. For instance, Sherman and Cohen (2006) note that “for a ‘good’ [baseball] hitter who bats .300 but fails nearly 70% of the time, it seems important to maintain a sense of self-worth and efficacy in order to take advantage of those few opportunities where one could get a ‘hit’” (p. 227). Many nonhuman animals struggle with goal pursuit in the face of low-frequency stochastic rewards (e.g., McLinn & Stephens, 2006), and the brain regions identified to manage these processes (Amiez, Joseph, & Procyk, 2005; Seo & Lee, 2007) have analogues in the human brain (Behrens, Woolrich, Walton, & Rushworth, 2007; Rushworth & Behrens, 2008; Shackman et al., 2011). In addition, violated expectations that are neither consciously perceived nor related to the self can nonetheless lead to affirmation (Proulx & Heine, 2008; Proulx et al., 2010; Randles et al., 2011, 2013). In brief, we suggest that self-affirmation findings support our predictions for dissonance leading to fluid compensation. However, rather than restrict dissonance processes to self-relevant threats, they may hint at a much broader process, where the self is neither a critical component of either dissonant arousal or repair.

Empirical results from the MMM also provide indirect support for fluid compensation following dissonance. First, some of the meaning violations that have been found to prompt fluid compensation are similar to cognitive dissonance manipulations. For example, participants showed enhanced implicit pattern learning if they were reminded of situations where they had acted inconsistently (i.e., they were shy in one situation and outgoing in another) and were asked to argue against their own unified self-concept (Proulx & Heine, 2009). To the extent that dwelling on behavioral inconsistencies could be seen as a dissonance manipulation, this would be evidence that dissonance leads not only to dissonance reduction, but also to abstraction.

Second, the role of arousal is apparently key in mediating the compensation process for both types of manipulations. When participants are given a placebo that they believe will cause them to feel tense or anxious, they show less motivation to reduce dissonance (Zanna & Cooper, 1974), affirm beliefs following a meaning violation (Proulx & Heine, 2008) or affirm alternative controlling agents following a control violation (Kay, Moscovitch, & Laurin, 2010b), presumably because they have a benign explanation for their arousal that reduced the need for further palliative action. The reverse is also true when directly altering the subsequent arousal. The motivation to reduce dissonance can be dampened if the person has consumed alcohol, pain relievers or tranquilizers (Cooper, Zanna, & Taves, 1978; DeWall, Chester, & White, 2015; Steele, Southwick, & Critchlow, 1981), but it can also be increased by stimulants such as amphetamines, provided the person is unaware that they have consumed a stimulant (Coo-

per et al., 1978). Likewise, pain medication (acetaminophen) reduces compensatory affirmation if taken prior to completing the meaning violation (Randles et al., 2013). The implication is that arousal is a necessary component for both dissonance and meaning violations.

Beyond behavioral parallels, both theories have outlined similar neurological processes to explain their observed effects (Proulx et al., 2012). For instance, in both a postchoice (Izuma et al., 2010; Kitayama, Chua, Tompson, & Han, 2013) and induced-compliance dissonance paradigm (van Veen, Krug, Schooler, & Carter, 2009), participants showed increased activation in the anterior cingulate cortex (ACC). It is argued that this area functions to detect and emotionally react to incompatible information being processed in the brain (Botvinick, Braver, Barch, Carter, & Cohen, 2001; Botvinick, Cohen, & Carter, 2004; Inzlicht & Al-Khindi, 2012; Luu, Collins, & Tucker, 2000), regardless of whether the incompatibility is a low level perceptual discrepancy such as a flanker task error (Gehring, Goss, Coles, Meyer, & Donchin, 1993), or a more complex violation of meaning, such as being told that one’s performance is better or worse than expected (Oliveira, McDonald, & Goodman, 2007), being denied performance feedback when it was expected (Hirsh & Inzlicht, 2008), or contemplating one’s impending death (Quirin et al., 2012; for a review, see Proulx & Inzlicht, 2012). In addition, misattributions of arousal appear to reduce activity in this region following errors (Inzlicht & Al-Khindi, 2012), in the same way that they reduce the motivation to respond to dissonance, meaning violations, or control threats.

Thus far, dissonance studies have not investigated whether encounters with dissonant cognitions will lead people to affirm unrelated beliefs or to abstract new patterns, as participants have never been provided with opportunities to do so. We hypothesize that participants will use any means at their disposal to alleviate their aversive arousal, and although in traditional dissonance studies this has been largely limited to attitude change or affirmation of important personal attributes, we propose that affirmation of unrelated beliefs and abstraction could also occur, if those options are made available. We conducted four studies to test this hypothesis, using two versions of the induced-compliance dissonance paradigm. In the first two studies we employ a classic induced-choice dissonance paradigm and give participants the opportunity to affirm their moral position on prostitution (Study 1) and their belief in God (Study 2). In the third study, we employ a different version of the induced-choice paradigm and additionally test whether abstraction as well as affirmation can occur following dissonance. Study 4 directly compares the effects of induced-choice dissonance relative to a meaning violation on the motivation to affirm unrelated beliefs.

## Study 1

### Method

**Participants and procedure.** Four hundred forty-six participants (35% women) with a mean age of 30 ( $SD = 10.6$ ) were recruited online through MTURK ([www.mturk.com](http://www.mturk.com)). Participants were largely White (76%), followed by Black (7%), South Asian (4.5%), East Asian (4%), or other (8.5%). Participants were given 50 cents to complete the study, and up to an additional dollar based on their success in a memory task.

After giving informed consent and completing some demographic questions, participants were told they would read a randomly selected article from a set, but they were actually all given the same boring article to read. The participants were asked to read the article thoroughly and were informed that there would be a memory test based on the content.

After this task, participants were told that the researchers were interested in studying whether the act of describing an event as interesting or not interesting affects recall memory for the event. In the control condition, participants were told that they had been randomly assigned to write that the passage they read was very interesting. In the dissonance condition, participants were told they could freely choose to write a paragraph describing the passage as very interesting or not at all interesting. However, before they began, a prompt informed them that it would be helpful to the researchers if they could choose to write that the passage was interesting, as follows:

A large number of people have chosen to write about why they thought the article was not very interesting. Thus, in order to finish the study with a good number of people on both sides, we need people to now write that they thought the passage they read was very interesting. Although it is your choice, we would really appreciate it if you would write one short paragraph that firmly says that the passage you read was very interesting.

Participants then completed a measure of compensatory affirmation (the social judgment survey), and a question measuring dissonance reduction: "Despite what you wrote earlier, how interesting was the passage you read?" The order of these two items was counterbalanced. Finally, participants completed a manipulation check question: "How much choice do you feel you had over which type of sentence you wrote?"

#### Materials.

**Boring passage.** A three-page advertisement for Gerbrands Tachistoscopes was selected as a boring passage, where the tachistoscope is described in highly specific and technical terms. This passage was picked because it is very difficult to read, has no narrative, and contains no information that an individual would find meaningful or worthwhile, unless they were purchasing a tachistoscope. This passage has been used in previous induced-compliance dissonance paradigms (Harmon-Jones et al., 1996; Harmon-Jones, Harmon-Jones, Serra, & Gable, 2011).

**Social judgment survey.** Participants read a hypothetical arrest report about a prostitute and were asked to set the amount of the bail, between \$0 and \$999. This identical measure has been used in several meaning violation studies (e.g., Proulx & Heine, 2008; Rosenblatt, Greenberg, Solomon, Pyszczynski, & Lyon, 1989; Randles et al., 2013). Participants should increase the bond value following a meaning violation because sex for money is at odds with commonly held views of relationships in North American culture, and is against the law throughout most of the continent. Thus, increasing the penalty provides an opportunity to affirm what most of our participants already believe: that prostitution is morally wrong.

**Oppenheimer instructional manipulation check.** This measure contains a short, dense paragraph, explaining to the participant that researchers are concerned about people not reading instructions, and that to show that they are paying attention, certain questions should be left blank. This measure has been shown to

effectively remove people who complete the study, but who are not paying attention to the materials. There is evidence showing that people who fail the check are not different in demographics or psychological characteristics, other than that they are not attending to the study (Oppenheimer, Meyvis, & Davidenko, 2009).

## Results

For all studies, we report the observed means and *SDs* for each group, but control for sex and age in the analyses. We control for these variables, because they are related to most of our dependent variables across the studies (e.g., attitudes toward prostitution, belief in god, and support for affirmative action) independent of condition. This allows us to remove unrelated error variance and adjust for incidental imbalances across any conditions.

Twenty-eight participants were removed for failing the Oppenheimer Instructional Manipulation Check, and six were removed for taking more than 3 *SDs* longer than average to complete the study. Nineteen participants in the control condition refused to write that the passage was interesting (90.4% compliance), and 68 in the dissonance condition refused (68.5% compliance).

Recently, a concern about the free-choice dissonance paradigm (Chen & Risen, 2010) has also generated concern about the induced-choice paradigm that we use in this article. The concern is that the induced-choice condition often has higher rates of non-compliance relative to the forced-choice condition (as is the case in our studies). Although participants who choose not to write against their beliefs have not experienced dissonance, and thus should not feel motivated to reduce it, they are also likely the most strongly opposed to the topic at hand. Selectively removing a larger number from the induced-choice condition will confound the result and inflate the estimated magnitude of the effect. It is also possible that an uncontrolled third variable (e.g., low agreeableness) is somehow related to noncompliance and the affirmation measure; without true random assignment, the premise of experimental causality is undermined. At the same time, those participants who did not comply were never made to feel dissonance, thus they should have neither motivation to reduce dissonance nor to engage in fluid compensation. To address this, we report the analyses in two ways: In a more conservative analysis that achieves random assignment, we include noncompliers and test for a main effect of condition. In addition, we also ran follow-up analyses, including compliance as a 2-factor moderating variable, allowing us to assess the strength of the effect for only those who comply versus those who do not.

Our manipulation check indicated that the dissonance prime was effective; participants in the dissonance condition claimed they had more choice in writing about the paragraph ( $M = 4.20$ ,  $SD = 2.12$ ) compared with the control group ( $M = 2.34$ ,  $SD = 1.94$ );  $B = 1.87$ ,  $p < .0001$ ,  $d = .93$ , confidence interval (CI)<sub>.975</sub> [.74, 1.12]. The dissonance condition reported significantly more interest in the paragraph ( $M_{\text{Diss}} = 2.70$ ,  $SD = 1.8$ ;  $M_{\text{Cont}} = 2.28$ ,  $SD = 1.56$ );  $B = .43$ ,  $p = .01$ ,  $d = .26$ , CI<sub>.975</sub> [.06, .45] (Table 1), supporting the original dissonance reduction finding, even accounting for the methodological concern caused by asymmetric noncompliance. However, when compliance was included as a moderating variable, there was a significant interaction for dissonance reduction between condition and willingness to comply ( $B = 1.07$ ,  $p = .02$ ). Among those who complied with instructions, we observed a classic dissonance effect, such that

Table 1  
*Dissonance Reduction and Fluid Compensation Across Studies*

Study	Compliers only		Full sample	
	Dissonance reduction	Compensatory affirmation	Dissonance reduction	Compensatory affirmation
Study 1	.47***	.28**	.26**	.18†
Study 2		.24†		.10
Study 3 affirmation	.96***	.48**	.54***	.35**
Study 3 motivation		.48**		.28**
Study 3 sensitivity		.07		.06
Study 4 polarization		.38** <sup>a</sup> /.32* <sup>b</sup>		.23* <sup>a</sup> /.32* <sup>b</sup>

*Note.* Both dissonance reduction and fluid compensation are presented as estimated Cohen's *d* effect sizes (Nakagawa & Cuthill, 2007) between the forced-compliance (control) condition and the induced-compliance (dissonance) condition. For Study 4, the first effect size (a) represents increased attitude polarization following dissonance, and the second (b) follows a meaning violation.

†  $p < .10$ . \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

participants in the dissonance condition claimed that the passage was more interesting ( $M = 3.14$ ,  $SD = 1.81$ ) than those in the forced choice condition ( $M = 2.31$ ,  $SD = 1.56$ );  $B = .86$ ,  $p < .0001$ ,  $d = .47$ ,  $CI_{.975} [.28, .66]$ . Those who did not comply showed no difference between conditions, ( $M_{Diss} = 1.74$ ,  $SD = 1.3$ ;  $M_{Cont} = 2.0$ ,  $SD = 1.60$ );  $B = -.21$ ,  $p = .62$ ,  $d = .05$ ,  $CI_{.975} [-.15, .25]$ .

We anticipated an order effect, such that if a person affirmed an unrelated belief first, they would not feel as motivated to reduce dissonance and vice versa. Noncompliers were included, but to prevent interpreting a  $2 \times 2 \times 2$  with some unstable cells, compliance was not added as a moderating term.<sup>1</sup> Order did not moderate the effect of the manipulation on either dissonance reduction ( $B = .47$ ,  $p = .16$ ) or the prostitution bond ( $B = -43.92$ ,  $p = .43$ ). Given the null interactions, the remaining analyses are collapsed across order.

In the context of successfully replicating dissonance reduction, we tested our main hypothesis of interest; that feeling dissonant would also lead to compensatory affirmation. A main effect emerged for affirmation ( $M_{Diss} = 429.59$ ,  $SD = 289.99$ ;  $M_{Cont} = 382.26$ ,  $SD = 277.44$ );  $B = 50.03$ ,  $p = .07$ ,  $d = .18$ ,  $CI_{.975} [-.02, .37]$  (Table 1), but we again found an interaction between condition and willingness to comply ( $B = 255.3$ ,  $p = .001$ ). As hypothesized, dissonance caused those who complied to reaffirm their cultural worldview by increasing the value of the bond ( $M_{Diss} = 447.68$ ,  $SD = 304.6$ ;  $M_{Cont} = 364.76$ ,  $SD = 264.67$ );  $B = 86.18$ ,  $p = .006$ ,  $d = .28$ ,  $CI_{.975} [.08, .47]$ . For those who did not comply, we anticipated a null effect, because participants who did not experience dissonance should presumably not feel a greater need to affirm unrelated beliefs. However, there was a significant effect for this group in the opposite direction, such that those who refused to write a supporting paragraph despite not being given any choice set the bond higher than those who refused but were given a choice ( $M_{Diss} = 389.63$ ,  $SD = 252.28$ ;  $M_{Cont} = 547.11$ ,  $SD = 343.52$ );  $B = -169.22$ ,  $p = .02$ ,  $d = .23$ ,  $CI_{.975} [.04, .43]$ .

In Study 1, we produced both a classic dissonance effect and compensatory affirmation. However, it is possible that dissonance only increases negative affect (Harmon-Jones et al., 2009), which led to a more punitive action. In Study 2, we attempt to replicate these findings with a different form of cultural affirmation that should be less focused on antagonistic attitudes. We selected belief

in God, because it is unclear why feeling frustration may lead someone to espouse stronger beliefs, in the same way that it might lead them to be more aggressive toward law-breakers. In addition, some have argued that belief in God is an especially effective form of affirmation, because it serves as a reminder that the world is orderly and intentional, and that one's identity is part of a larger purposed world (Inzlicht, Tullett, & Good, 2011; Kay, Gaucher, McGregor, & Nash, 2010a; Norenzayan & Gervais, 2013). To this end, past research has shown that people will affirm their belief following primes related to lack of control (Kay et al., 2010b) or mortality salience (Norenzayan & Hansen, 2006).

## Study 2

### Method

**Participants and procedure.** Students completed the same dissonance paradigm online as in Study 1, in exchange for partial credit in a psychology class at the University of Toronto Scarborough. Instead of a scenario about norm or law violations, participants were asked about their belief in God and the role of God in creating and maintaining the world. Specifically, they were asked how strongly they would endorse the following items: "I believe in God," "I think that God is in control of the events in our universe," "I think that the actions of God explain what happens in our world," and "I think that God created all life on the planet."

Two hundred twenty-four students participated (72% women, mean age = 19.1,  $SD = 2.03$ ). The ethnicity of the sample was primarily of South Asian (34.6%), East Asian (29.5%), Western European (12.4%), and other ethnicities (23.7%).

### Results

Twenty participants were removed for completing the study too quickly (less than 7 min) or taking 3  $SD$ s longer than the average to complete. This study did not include an Oppenheimer-type manipulation check. In the dissonance condition, 42 participants

<sup>1</sup> For example, there are only nine participants in the control condition who refused to comply and received the bond before dissonance reduction.

refused to write that the paragraph was interesting (61% compliance), with 12 participants in the control condition refusing (87.5% compliance). As with the previous studies, we include noncompliers and moderate the experiment by willingness to comply, including age and sex as covariates. In addition, despite random assignment, there were more self-described atheists in the dissonance condition ( $N_{\text{Cont}} = 9$ ;  $N_{\text{Diss}} = 17$ ), a group that strongly predicts low endorsement on the belief in God scale ( $d = 1.09$ ,  $p < .0001$ ) and is unlikely to affirm belief. To address this imbalance, we additionally control for self-reported atheism for our key analysis on belief in God.

The manipulation check indicated that the dissonance paradigm had been successful. Participants in the dissonant condition claimed they had more choice to write that the article was interesting,  $p < .0001$ ,  $d = .62$ ,  $CI_{.975} [.34, .90]$ . In this study, we did not include a measure of direct dissonance reduction. Looking at our key dependent variable (belief in God), dissonance does not cause a significant change in belief as a main effect ( $M_{\text{Diss}} = 3.29$ ,  $SD = 1.20$ ;  $M_{\text{Cont}} = 3.30$ ,  $SD = 1.21$ );  $B = .11$ ,  $p = .48$ ,  $d = .1$ ,  $CI_{.975} [-.18, .39]$  (Table 1), but there was again a significant interaction when willingness to comply was entered as a moderating term ( $B = .75$ ,  $p = .054$ ). When participants complied with instructions, those in the dissonance condition reported marginally higher belief in God relative to the control ( $M_{\text{Diss}} = 3.41$ ,  $SD = 1.20$ ;  $M_{\text{Cont}} = 3.27$ ,  $SD = 1.21$ );  $B = .29$ ,  $p = .098$ ,  $d = .24$ ,  $CI_{.975} [-.05, .52]$ . For those who did not comply, the control group again had a stronger indication of affirmation than the dissonant group, although not significantly so ( $M_{\text{Diss}} = 3.10$ ,  $SD = 1.20$ ,  $M_{\text{Cont}} = 3.5$ ,  $SD = 1.25$ );  $B = -.46$ ,  $p = .18$ ,  $d = .19$ ,  $CI_{.975} [-.09, .47]$ . Despite this effect not being significant, it is worth noting it is in the same direction and of a similar magnitude to the affirmation effect for noncompliers in Study 1.

In Study 3, we attempted to replicate the cultural affirmation effect using a different dissonance paradigm: arguing in favor of increased tuition. We also attempted to extend the fluid compensation findings by showing that dissonance leads to increased abstraction, as well as affirmation. Recent work in areas of uncertainty, meaninglessness, and lack of control show that violations increase a person's motivation for identifying patterns in the environment. This includes being more likely to perceive illusory visual patterns among noise, but can also increase the motivation to see behaviors among people as connected, such as with conspiracy theories (Whitson & Galinsky, 2008). Some studies have found that when actual patterns are present, participants show not only increased motivation to detect patterns, but increased ability as well (Proulx & Heine, 2009; Randles et al., 2011).

### Study 3

#### Method

**Participants and procedure.** A total of 212 students (73% women) participated in exchange for partial credit in their psychology classes at The University of British Columbia. We used the classic dissonance paradigm (Pittman, 1975; Steele et al., 1981), where students were either instructed, or politely asked, to write in favor of a tuition increase at their university. Participants were 40% East Asian, 34% Western European, 8% South Asian, and 18% other or mixed ethnicities.

The study was advertised as soliciting student opinions on university policy. After completing basic demographic materials, participants were told that the university Board of Governors was soliciting student opinions on whether tuition should be raised by 20% for the following academic year. Students in the control condition were told that they had been selected to write in favor of the increase, and to offer valid reasons for it. In the dissonance condition, the researcher explained to the participant that many people had written against the idea, and the researcher would appreciate if they could write a paragraph in favor of an increase. After participants submitted their paragraph, they completed the Positive and Negative Affect Schedule (Watson, Clark, & Tellegen, 1988) as a delay and distractor between the manipulation and dependent variable. It has become common practice to use the PANAS as a filler task for manipulations of uncertainty or meaning, and doing so appears to increase the effect size of the manipulation (Burke et al., 2010). As this measure almost never shows a change following manipulations (e.g., Landau et al., 2006; Proulx & Heine, 2008; Randles et al., 2011), we did not expect to see significant differences between conditions in either self-reported positive or negative affect. This is not to suggest that there is no arousal component to manipulations of uncertainty or dissonance, but that the PANAS is typically insensitive to it. This study was run prior to recent work pointing toward new approaches to measuring affect that may be more sensitive to this type of experience (Lambert et al., 2014; Spunt, Lieberman, Cohen, & Eisenberger, 2012).

Participants were then given an implicit grammar task previously used in other meaning violation studies (Proulx & Heine, 2009; Randles et al., 2011). In this measure, participants are asked to copy a series of letter strings (e.g., XXRVTM), with no additional instructions. Every string adheres to the same strict syntactical grammar (e.g., M can follow X, M, or V, but not T, unless T is preceded by V.; see Dienes & Scott, 2005, for full description). Once completed, they were presented with new strings one at a time on a computer, half of which were based on the same grammar, and half were not. Participants were told to identify the strings that adhered to the grammar of the previously copied strings, and were not told how many of the new strings were correct. Participants were scored for how many strings they selected (a measure of their motivation to detect patterns) and their actual success on the task. Given past work, we anticipated that those in the dissonant group would both select a greater number of strings, but also be more accurate in selecting strings that correctly matched the previously viewed pattern.

Following the grammar task, participants then completed the social judgment survey dependent variable, as in Study 1, and a measure of dissonance reduction where we asked participants to tell us how they really felt about tuition increases, regardless of what they had written previously. The mean of the items "I support an increase in tuition," "I think there are many valid reasons why tuition should be increased," and "students can handle an increase in tuition" were used as a score to measure dissonance reduction. Afterward, participants were fully debriefed.

## Results

Because this was an in-lab study, we did not monitor participants for taking an unusually short or long time to complete the study. Seven participants were removed because of procedural error in the study, or because the participant had been in a similar study, leaving 205 participants. Nineteen participants in the forced choice condition (81% compliance) and 46 participants in the dissonance condition (55% compliance) refused to write in favor of a tuition increase. The manipulation check indicated that the dissonance paradigm had been successful. Participants in the dissonant condition claimed they had more choice to write their essay ( $M = 6.18$ ,  $SD = 2.63$ ) compared with the control ( $M = 2.96$ ,  $SD = 2.62$ );  $B = 3.20$   $p < .0001$ ,  $d = 1.23$ ,  $CI_{.975} [ .95, 1.51 ]$ .

As with Study 1, the main effect for dissonance is significant ( $M_{Diss} = 2.86$ ,  $SD = 1.33$ ;  $M_{Cont} = 2.54$ ,  $SD = 1.23$ );  $B = .64$ ,  $p = .0002$ ,  $d = .54$ ,  $CI_{.975} [ .26, .82 ]$ . Also as with the previous studies, a significant interaction emerged when compliance was included as a moderator of condition ( $B = 1.19$ ,  $p = .0008$ ). Among those who complied with instructions, we observed a classic dissonance effect, such that participants in the dissonance condition more strongly supported an increase in tuition ( $M = 3.51$ ,  $SD = 1.17$ ), compared with those in the forced choice condition ( $M = 2.30$ ,  $SD = 1.07$ );  $B = 1.24$ ,  $p < .0001$ ,  $d = .96$ ,  $CI_{.975} [ .67, 1.24 ]$  (Table 1). Those who did not comply showed no difference between conditions ( $M_{Diss} = 2.05$ ,  $SD = 1.04$ ;  $M_{Cont} = 1.90$ ,  $SD = .91$ );  $B = .05$   $p = .87$ ,  $d = .02$ ,  $CI_{.975} [ -.30, .26 ]$ .

We used the same analyses to assess whether participants showed increased motivation and success at detecting implicitly learned patterns; again the main effect of condition was significant ( $M_{Diss} = 23.333$ ,  $SD = 10.27$ ;  $M_{Cont} = 20.41$ ,  $SD = 10.48$ );  $B = 2.86$   $p = .052$ ,  $d = .28$ ,  $CI_{.975} [ .0, .56 ]$  (Table 1), with a significant interaction between compliance and condition ( $B = 8.32$ ,  $p = .014$ ). Consistent with our hypothesis, the dissonant group who agreed to write the essay showed increased motivation to identify patterns among noise,  $B = 5.93$ ,  $p = .001$ ,  $d = .48$ ,  $CI_{.975} [ .20, .77 ]$ , with the dissonant group selecting a mean of 25.98 strings ( $SD = 9.93$ ) compared with the control ( $M = 19.99$ ,  $SD = 10.11$ ). For those who refused to comply, the control group showed increased motivation, though this result was not significant ( $M_{Diss} = 20.11$ ,  $SD = 9.84$ ;  $M_{Cont} = 22.21$ ,  $SD = 12.011$ );  $B = 2.38$ ,  $p = .40$ ,  $d = .12$ ,  $CI_{.975} [ -.16, .40 ]$ .

Beyond increasing motivation, we anticipated that the dissonant group would actually perform better on the task. This was assessed using two approaches. The first is a measure of overall success, assigning a score based on correct hits minus false alarms. This approach however, confounds response bias with actual implicit learning, because randomly selecting is progressively less likely to lead to a hit with each successful selection. To address this, we also established participant sensitivity using  $d'$  (not to be confused with Cohen's  $d$ ; Brophy, 1986). This index is based on signal-detection theory, and attenuates the response-bias confound by giving relatively stronger weight to each successive hit and false alarm. Using either approach, we did not find a main effect, though both overall success ( $M_{Diss} = 7.12$ ,  $SD = 6.12$ ;  $M_{Cont} = 6.21$ ,  $SD = 5.63$ );  $B = .92$   $p = .27$ ,  $d = .16$ ,  $CI_{.975} [ -.44, .12 ]$ , and sensitivity ( $M_{Diss} = .80$ ,  $SD = .69$ ;  $M_{Cont} = .76$ ,  $SD = .71$ );  $B = .04$   $p = .685$ ,  $d = .06$ ,  $CI_{.975} [ -.34, .22 ]$ , were in the predicted direction of dissonance leading to improved performance. We also did not find an interaction between condition and willingness to comply ( $p = .76$  for success and  $p = .80$

for sensitivity). This suggests that the participants were more motivated to identify patterns regardless of whether a signal was present or absent (Whitson & Galinsky, 2008), but were not actually more effective at identifying patterns, as was seen with past meaning violation studies (Proulx & Heine, 2009; Randles et al., 2011).

Fifteen participants were familiar with the social judgment survey from having participated in previous studies, and so were removed only from this analysis. The main effect for condition was significant, such that the dissonant group showed greater affirmation ( $M_{Diss} = 503.58$ ,  $SD = 276.49$ ;  $M_{Cont} = 411.31$ ,  $SD = 265.91$ );  $B = 93.87$ ,  $p = .02$ ,  $d = .35$ ,  $CI_{.975} [ .06, .65 ]$ . As in Study 1 and 2, there was a moderated effect on affirmation between condition and compliance ( $B = 216.19$ ,  $p = .018$ ). Among those who complied, higher fines were assigned for the prostitution scenario in the dissonance condition ( $M = 539.21$ ,  $SD = 245.03$ ), compared with the control condition ( $M = 387.01$ ,  $SD = 243.36$ );  $B = 157.24$ ,  $p = .002$ ,  $d = .48$ ,  $CI_{.975} [ .19, .78 ]$ . There was no significant effect for those who did not comply, though as with Studies 1 and 2, the control group numerically showed a greater tendency to affirm ( $M_{Diss} = 458.4$ ,  $SD = 309.09$ ;  $M_{Cont} = 509.83$ ,  $SD = 332.70$ );  $B = 58.65$ ,  $p = .44$ ,  $d = .12$ ,  $CI_{.975} [ -.18, .41 ]$ .

Although we anticipated no difference between conditions on the PANAS, the dissonant group reported significantly more positive affect ( $M_{Diss} = 2.57$ ,  $SD_{Diss} = .57$ ;  $M_{Cont} = 2.41$ ,  $SD_{Cont} = .613$ );  $B = .16$ ,  $p = .054$ ,  $d = .27$ ,  $CI_{.975} [ 0.00, .57 ]$ . Negative affect was not significantly different ( $M_{Diss} = 1.86$ ,  $SD_{Diss} = .494$ ;  $M_{Cont} = 1.79$ ,  $SD_{Cont} = .45$ );  $B = .07$ ,  $p = .32$ ,  $d = .01$ ,  $CI_{.975} [ -.14, .42 ]$  relative to the control group. Controlling for positive and negative affect does not change the effect of dissonance on implicit grammar motivation, or compensatory affirmation.

It is worth noting that, although this study did not explicitly assess order effects, because order was not manipulated, we observed classic dissonance reduction following participants' affirmations. The implication is that the affirmation has not significantly attenuated the motivation to reduce dissonance. This is a replication of what we observed in Study 1 and is considered in the general discussion. We also ran follow-up analyses to test whether those who showed high motivation on the grammar task were also the ones to affirm the bond, but the two effects appear to be independent. The correlation between motivation to identify strings and affirmation is  $r = .01$ ,  $p = .9$ , and controlling for one of the variables does not meaningfully change the effect of dissonance on the other. One implication is that there may be distinct individual differences regarding how strongly someone feels the motivation to see new patterns versus explicitly affirm an important belief following dissonance.

In Studies 1–3, we showed that classic dissonance manipulations lead to compensatory affirmation as well as attempts to reduce dissonant cognitions. In Study 4, we attempt to show parallel effects of a dissonance manipulation and a meaning violation.

## Study 4

### Method

**Participants and procedure.** Two hundred forty-two participants were recruited from Tilburg University, (71% women; mean age = 20.8 years,  $SD = 2.46$  years) in exchange for partial credit in a psychology class. All participants were Western European

nationals who spoke English and Dutch as a first or second language. All materials were presented in Dutch, except for the boring paragraph and video manipulations, which were presented in English.

Participants entered the lab room and were seated in front of a computer. The experiment began with participants filling out a demographics questionnaire. Participants then had their attitudes toward positive discrimination assessed prior to the experimental manipulation. Positive discrimination, another term for affirmative action, refers to efforts toward elevating the status of minority groups to increase their representation in society. We anticipated that experiencing either dissonance or a meaning violation would motivate participants to affirm their recently assessed positive discrimination attitudes in the direction that they already associate with. Participants should produce a main effect for affirmation when most people in the study generally hold similar opinions (such as we'd expect almost all students to be in favor of punishing someone who has broken a law); we would expect that people are in fact affirming the perspective they already hold, rather than shifting toward the same pole on a topic regardless of prior belief (e.g., Ben-Ari, Florian, & Mikulincer, 1999; Kosloff, Greenberg, Weise, & Solomon, 2010; Proulx & Major, 2013; Vess, Arndt, Cox, Routledge, & Goldenberg, 2009).

Following this, participants engaged in one of 3 experimental conditions. Participants either completed a neutral (control) task, experienced induced-compliance dissonance using the boring paragraph paradigm from Studies 1 and 2, or were exposed to a surreal video previously used as a meaning violation (Randles et al., 2013). In the control condition, participants were firmly told (without choice) to write that the boring paragraph was interesting, and they then viewed the control version of the video clip (described in Materials section). Participants in the dissonance condition completed the induced compliance dissonance manipulation and viewed the control version of the video clip. Participants in the meaning violation condition were also firmly told to write that the article was interesting, identical to the control condition instructions, but they then viewed the surreal version of the video clip. After these videos, participants completed the PANAS and then our dependent variable, an affirmation measure of positive discrimination. Participants were then debriefed and excused from the experiment.

#### Materials.

**Premanipulation Positive Discrimination Scale.** Participants completed a 4-item measure of their relevant attitudes: "I think it is positive that the Dutch government tries to increase the number of women and minority policemen", "Women must be given more opportunities, compared with men, to occupy chief executive or general management positions", "It is a good thing that the European parliament compensates small countries for their potential lack of influence by giving them more parliament seats per citizen. (e.g., Luxembourg receives 1 seat per 80.000 citizens were Germany receives 1 seat per 800.000 citizens)", "I think it is a good idea or the Dutch Organization for Scientific Research (NWO) to encourage the promotion of female academics to senior lecturer (or professorial) level."

**Meaning threat and control videos.** All participants watched three video clips, under the pretense that they would be asked questions regarding various details later on. This manipulation was previously used in Randles et al. (2013) and has been

shown to lead to compensatory affirmation. The first and last clips were the same for both conditions, including a segment from a Disney cartoon starring Donald Duck, and a Peanuts cartoon starring Snoopy. The first clip was intended to help participants get comfortable with the task, while the latter clip added a delay between the manipulation and dependent variable, a practice that has been shown to increase the robustness of meaning violations (e.g., Burke et al., 2010). In the meaning violation condition, participants watched a 4-min clip from the short film, *Rabbits*, created by David Lynch (2002). The film at first appears to resemble a sitcom, but includes nonsequiturs and a complete lack of narrative, random laugh and applause tracks, and all characters dressed in rabbit costumes with no explanation or reference. The control group watched a clip from *The Wizard of Oz*. This clip replaced the original control video (Randles et al., 2013) featuring a clip from *The Simpsons* cartoon show, to reduce potential positive affect as a confounding explanation for the effect.

**Positive discrimination affirmation.** Our dependent variable was a 1-item measure of support for affirmative action on a 6-point Likert scale: "How do you generally feel about acts, policies, and measures that are driven by the idea of positive discrimination?"

## Results

We expected that after experiencing either dissonance or a meaning violation, participants would feel motivated to more strongly affirm elements of their committed social justice worldview relevant to positive discrimination (Proulx & Major, 2013). That is, those who held general attitudes in favor of positive discrimination should make a postmanipulation judgment that endorses positive discrimination *more* strongly than in the control condition, and those who were relatively opposed to positive discrimination and experienced either manipulation should make a postmanipulation judgment that *less* strongly endorses positive discrimination, relative to their like-minded participants in the control condition. To test this, initial positive discrimination attitudes scores were mean-centered and entered as a continuous covariate and moderator of condition. Experimental conditions were entered as dummy coded variables referencing the control group. We anticipated that participants would polarize their judgment concerning positive discrimination more strongly following both the meaning violation and dissonance condition, relative to the control. Because almost no participants in the control ( $N = 1$ ) and meaning violation ( $N = 4$ ) conditions refused to comply, it is impossible to conduct the analysis with compliance as a moderator. To allow for comparison with the previous studies, we report results here first including noncompliers, then excluding them. A total of 38 participants in the dissonance condition refused to write that the paragraph was interesting (52% compliance). As with the previous studies, we control for sex and age.

Prior positive discrimination attitudes significantly predicted the postmanipulation positive discrimination judgment in the control condition ( $B = .31, p = .016$ ). This effect was qualified by a predicted (though marginal) interaction with the dissonance group,  $B = .32, p = .09, d = .23, CI_{.975} [-.04, .51]$  and significant interaction with the meaning violation group,  $B = .42, p = .022, d = .32, CI_{.975} [.06, .59]$ , such that both showed



a stronger predictive relationship between premanipulation positive discrimination attitudes and postmanipulation positive discrimination judgment relative to the control (Table 1, Figure 1). To observe the relationship between prior attitude/post judgment positive discrimination for each condition, we reran the model after centering the condition dummy variables on the meaning violation condition, and then dissonance. This approach allows evaluation of the main effect at different levels of the critical variable (in our case, condition) without inflating Type I error by running separate models (Aiken & West, 1996). For the dissonance group, the slope was  $B = .63, p < .0001$ , and for the meaning violation group it was  $B = .73, p < .0001$  (Figure 1). When noncompliers are removed, the interaction between pre/post measure of positive discrimination and control versus dissonance conditions becomes significant,  $B = .50, p = .03, d = .38, CI_{.975} [.04, .73]$ , with the main effect of positive discrimination attitudes increasing to  $B = .80, p < .0001$ , for the dissonance condition; The interaction for the meaning violation group reduces slightly and become marginally significant,  $B = .347, p = .07, d = .32, CI_{.975} [-.03, .67]$ .

In both cases, whether participants wrote against their beliefs or watched a surreal video, those who already held relatively negative attitudes toward positive discrimination became increasingly disapproving, while those who had relatively positive attitudes toward it further affirmed this belief.

As is typical for meaning violation studies, participants showed no difference in either positive or negative affect, as measured by the PANAS, relative to the control condition, all  $ps > .17$ . Given that we did not anticipate significant PANAS results in Study 3 or 4, we are hesitant to interpret the effects in Study 3.

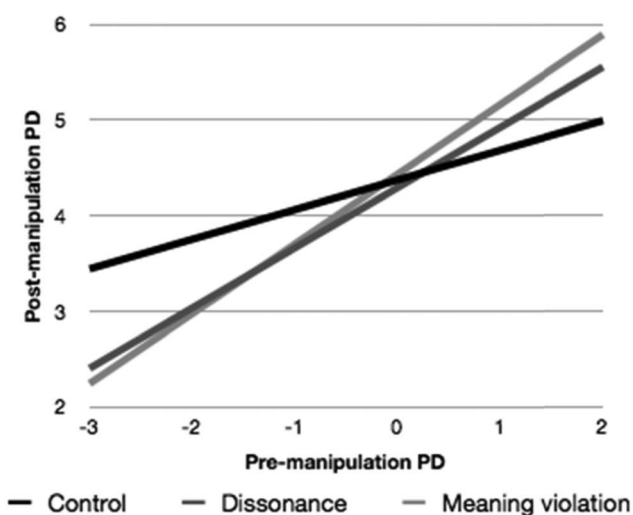


Figure 1. Increased polarization of positive discrimination attitudes by condition. Slopes represent the unstandardized beta coefficient of premanipulation positive discrimination attitudes predicting postmanipulation support for positive discrimination. All three conditions predict significantly increased polarization of attitudes on the postmanipulation measure. The slopes for both the dissonance and meaning violation groups are significantly greater than the control slope.

### Additional Analyses Across Combined Studies

Because all four studies investigated measures of fluid compensation following manipulations of dissonance, additional analyses were conducted with the combined sample.

### Metasummary of Effect Size for Fluid Compensation Following Dissonance

We employed a fixed-effects meta-analysis model to obtain the weighted average effect size of fluid compensation following dissonance; six effects across the four studies were included. For Study 3, we included the sensitivity index but not the overall score of the artificial grammar task, because the two are different measures of the same effect. For Study 4, we used the interaction term, representing the increase in polarized attitudes when moving from the control to the dissonance condition. We conducted the meta-analysis both for the main effect and the effect just for compliers from the moderated analysis (effect for Study 4 was reestimated with noncompliers excluded). The average estimated main effect size across the 4 studies is  $d = .20, CI_{.975} [.09, .30]$  (Figure 2). Looking at the effect only for compliers, the estimated effect size is  $d = .31, CI_{.975} [.19, .44]$ .

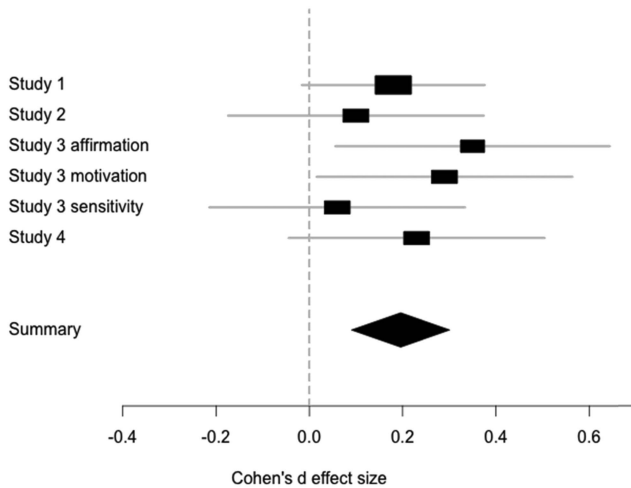
In Study 1, noncompliers in the *control* condition showed a significant increase on the affirmation measure. In Studies 2 and 3, this same trend emerged, although none of the following effects were significant. We analyzed these effects as a group using the same meta-analytic strategy and found that the combined statistic was situated close to an effect of 0,  $d = .11, CI_{.975} [-.13, .35]$ . The most sensible conclusion to the Study 1 effect is that it was a Type I error.

### Secondary Analysis of Cultural Moderation

Given that the samples in Studies 2 and 3 contained a diverse range of ethnicities, we tested whether cultural differences in responding to dissonance might be present. To boost power, the samples were merged after participants' dependent variable scores were Z-transformed within their own sample. Using Hofstede's (2001) regional scores of individualism/collectivism as a guide, we assigned participants into either group in a binary manner. Participants who reported mixed ethnicity were only included if both identities were coded the same way. We then reran the analysis including collectivism status as both a covariate and moderating term. The result was a nonsignificant interaction term between condition and collectivist/individualist grouping ( $p = .654$ ), while the main effect for condition reflected the effects in Studies 2 and 3 ( $p = .064$ ). This suggests that our effects were largely invariant across cultural backgrounds, at least in terms of ethnicities associated with collectivism, living within North America (cf., Heine & Lehman, 1997; Kitayama, Snibbe, Markus, & Suzuki, 2004).

### General Discussion

Across four studies, induced-compliance dissonance manipulations led not only to classic dissonance reduction, but also to greater affirmation of committed, unrelated beliefs. Participants were more likely to punish a norm violator, espouse a stronger belief in God, and had increasingly polarized views of positive discrimination. In addition, participants in Study 3 also showed an



**Figure 2.** Metasummary of fluid compensation effects following dissonance, including participants who refused to comply. Effect sizes are main effects generated from models that include noncompliers, but do not use compliance as a moderating variable. This represents the “classic” dissonance analysis, but including noncompliers. 95% confidence intervals are based on the normal distribution. Effect size for Study 4 represents the increase in attitude polarization from the control to the dissonance condition. Summary statistic represents 95% confidence interval containing the true effect.

increased likelihood of perceiving congruent patterns in an implicit grammar task, which is evidence for abstraction motivations. These results indicate that the process involved in dissonance reduction also leads to fluid compensation, just as with other meaning violations. However, our initial prediction that meaning maintenance and dissonance may be the same process, did not receive unequivocal support. Compensatory affirmation failed to prevent dissonance reduction (Study 3) or significantly attenuate it (Study 1). One interpretation of these findings is that dissonance may additionally lead to feelings of uncertainty, which is ultimately responsible for affirmation. Another possibility is that there may not be a unique “dissonance-reduction” psychological mechanism, but rather, dissonant cognitions lead to general arousal, and this arousal causes but is not fully resolved through compensatory affirmation. Our findings are somewhat in conflict with past work showing that self-affirmation does in fact eliminate the need to reduce dissonance. This may suggest that affirmations used in these other studies, such as writing about a cherished value or receiving positive personality feedback (Heine & Lehman, 1997; Matz & Wood, 2005; Steele & Liu, 1983; Steele, Spencer, & Lynch, 1993), are more palliative than affirming one’s attitudes that do not directly reference the self.

Regarding the broader concern of the dissonance paradigm, our estimated effects of dissonance reduction are considerably smaller when condition is not moderated by compliance (Table 1), suggesting that selective attrition has influenced previously reported effect sizes in most dissonance studies. Inferring causality from an experiment requires random assignment, and as such the main effect including compliers is the most rigorous estimate. However, we suspect the true effect likely falls somewhere in between these two approaches. Those participants who chose not to comply

would never have felt any dissonance, and thus had not received the manipulation, reducing the estimate of the dissonance effect. On the other hand, those who chose not to comply may have had more strongly opposed attitudes to begin with, which is why they opted to defy the experimenter’s instructions. Excluding this type of person would thus lead to a biased inclusion strategy and an inflated estimate of the effect.

In contrast to the estimates of the effect size of dissonance effects, the asymmetric attrition rate should not be as clearly related to the magnitude of fluid compensation effects. Refusing to comply with a request to say a boring task was interesting, or to argue in favor of a tuition increase, is not conceptually related with people’s attitudes toward God, prostitutes, positive discrimination, or pattern-detection. The noncompliers did not experience dissonance or any kind of meaning violation and we thus expect the “true” effect of our meta-analysis should be closer to the estimate based on those who complied ( $d = .31$ ) than the main effect for both compliers and noncompliers ( $d = .20$ ).

Although not a direct focus of our work, these results have implications for self-affirmation theory. It is reasonable to consider punishment of a law-breaker, belief in God, or support for positive discrimination as examples of self-affirmation, and these findings are thus consistent with both perspectives. However, the finding that dissonance leads to increased motivation to detect patterns is a harder fit with self-affirmation. In addition, that watching a surreal video can lead to these same effects, calls into question the exclusivity of self-threats in triggering affirmation, a challenge that is further evident in looking at the broad range of meaning violations that do not implicate the self (e.g., Proulx & Heine, 2008; Proulx et al., 2010; Randles et al., 2011, 2013).

There are a number of limitations across the studies. First, in the abstraction results in Study 3, dissonance only appeared to increase motivation to identify patterns, but not accuracy, as has been seen in other studies (Proulx & Heine, 2009; Randles et al., 2011). An additional limitation is that our participants, although varied in ethnic background, were largely from Western countries; although our analyses revealed no moderation effect based on individualistic leanings, suggesting that the results may generalize even more broadly. Finally, the results for dissonance in Study 2 were not clearly different from a null effect when noncompliers were included, although the results are sensible in the context of the other studies and our sample sizes. One apparent limitation is that our rates of noncompliance appear higher than much of the past literature. However, many dissonance studies do not report rates of compliance (e.g., Cooper et al., 1978; Croyle et al., 1983; Zanna et al., 1974) and those that do, report from 50% up to 100% compliance, spread somewhat evenly across the range (based on studies referenced in this article). Many past dissonance studies have also employed very small samples (e.g.,  $N < 15$  per condition; Harmon-Jones et al., 1996; Steele et al., 1983), making it difficult to assess whether differences in compliance were because of the paradigms or noisy estimates.

Although these results support our claim that dissonance and other threat-compensation theories are discussing similar phenomena, there are still a number of unaddressed questions. Most manipulations of uncertainty or expectancy violation show little or no change in self-reported affect, while dissonance is consistently associated with negative affect (Elliot & Devine, 1994; Harmon-Jones, 2000; Harmon-Jones et al., 2009) and has a detectable

arousal component (Croyle & Cooper, 1983; van Veen et al., 2009), something that has not yet been shown in other meaning violation paradigms. However, studies conducted under the MMM have found that arousal is produced, insofar as participants are able to misattribute it (e.g., Proulx & Heine, 2008), and that the effects are reduced when people have taken acetaminophen, even though they are not able to consciously report a change in arousal via the PANAS (Proulx & Heine, 2008; Randles et al., 2013); dissonance reduction has also been shown to be eliminated through these same methods of misattributions of arousal (Zanna & Cooper, 1974) and acetaminophen (Dewall et al., 2015).

This lack of self-conscious affect has been discussed more broadly in the uncertainty literature (Proulx & Inzlicht, 2012; Tritt, Inzlicht, & Harmon-Jones, 2012), where it is noted that subjective experience, physiological arousal and behavioral expression often do not correlate as much as might be predicted following an affective trigger (Lang, 1968), and that the experience of anxiety may occur without conscious awareness (Winkielman & Berridge, 2004). In general though, there has been growing consensus that the PANAS is simply the wrong tool for the job (e.g., Jonas et al., 2014). Some recent work has explored other approaches to assess changes in affect, and is showing promising results (Lambert et al., 2014; Spunt et al., 2012). We are of the perspective that meaning violations are mediated by changes in some form of anxiety, and encourage continued work to directly assess measures that consistently identify changes following unexpected events.

An additional consideration is what types of opinions would fail to show compensatory affirmation. In contrast to theories of existential anxiety (Greenberg, Solomon, & Pyszczynski, 1997), self-integrity (Sherman & Cohen, 2006), and control (Kay et al., 2010a), we do not believe that fluid compensation only solves a specific self-relevant concern. Rather, we submit that the experience of violated expectations is itself bothersome, irrespective of other concerns, and focusing on any meaningful belief that one has prior commitment to will help to down-regulate the anxiety and shift focus away from the problem at hand. Our results in Study 4 highlight this perspective, where participants more strongly endorsed their prior attitudes on affirmative action causing a polarization, rather than all shifting in one direction. Past research also finds that meaning threats only lead to affirmations of beliefs that our participants were committed to—they do not lead to extreme responses on just any measure (e.g., Harmon-Jones et al., 1997; Heine, Harihara, & Niiya, 2002; Kosloff et al., 2010; Proulx & Major, 2013). That said, it is still possible that some topics may be more appealing as targets of affirmation. McGregor, Nash, and Prentice (2011) suggest that abstract goals may have a distinct advantage, in that they are never satisfied but always perceived as progressing, and can be largely maintained within the confines of one's own mind. Abstract goals also tend to involve illusions (unverifiable beliefs; Baumeister, 1991), which may be particularly appealing because they cannot be violated themselves. The question of whether certain classes of beliefs are more palliative than others has only recently emerged as a topic of central interest (McGregor, Nash, Mann, & Phillips, 2010; Proulx & Inzlicht, 2012) and will likely receive more attention, because many theorists are coming to general agreement regarding the basic processes of uncertainty detection and response (e.g., Jonas et al., 2014).

## Conclusion

While cognitive dissonance theory and the MMM may be referring to a similar psychological process, the fact that they come from different perspectives creates a rich and likely fertile ground for advancing a more unified theory. Further attention to the overlap in both theories may help build a more complete understanding of human cognition and behavior in response to unexpected or dissonant cognitions.

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