

Some Moral Judgments may be Immune to Hindsight Bias

by

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Abstract

Decades of hindsight bias has shown it to be a robust phenomenon exhibited in many different hypothetical and real-world situations. Two competing models of hindsight bias, the cognitive sense-making model and the motivational model, were used to predict hindsight bias effects for a situation dealing with strongly polarized opinions. Participants read about a physician who prescribed medical marijuana to a child with self-injurious behaviors and then received a positive outcome, negative outcome, or no outcome at all (control group). Those holding a negative view of illegal drugs exhibited hindsight bias following both positive ($d = 1.13$) and negative outcomes ($d = .36$). Those with a positive view of illegal drugs showed no hindsight effect for either positive ($d = .19$) or negative outcomes ($d = .09$). Participants exhibiting the bias appear to have had less extreme views than those who showed no hindsight bias. Results are partially consistent with previous research that examined motivational and sense-making components of hindsight bias. Future research should focus on examining different strongly held beliefs (e.g., attitudes towards the death penalty or gun control laws) to further understand the mechanisms associated with hindsight bias judgments.

Introduction

Hindsight bias, or the tendency to believe in hindsight that one would have judged an outcome's likelihood to be higher than they actually would in foresight, was first documented by Fischhoff (1975). Although its effect size varies somewhat (Christensen-Szalanski & Willham, 1991; Guilbault, Bryant, Brockway, & Posavac, 2004), the hindsight bias is a remarkably robust phenomenon, having been demonstrated in numerous domains including medicine (Arkes, Wortmann, Saville, & Harkness, 1981), decision making (Sligo & Stirton, 1998), and politics (Holzl & Kirchler, 2005).

Ironically, the bias is strongest for those outcomes that are least expected and results from our attempt to make sense of such outcomes (Pezzo, 2003). Sense-making tends to overemphasize antecedents believed to cause the outcome and underemphasize antecedents that would lead to alternative outcomes (Hawkins & Hastie, 1990; Blank & Peters, 2007). This evaluation culminates in the integration of this biased information into memory, ultimately leading us to misremember our own predictions and actually believe we were better at estimating the probability of the outcome than we really were (Blank & Peters, 2000). It is important not only to examine conditions under which hindsight bias is exhibited but also those in which the bias does not occur. Specifically, there are three competing models that predict when hindsight bias will and will not occur; the motivational model that takes into account defensive processing (Mark & Mellor, 1991; Louie, 1999), the cognitive sense-making model that takes into account outcome

expectation (Pezzo, 2003), and the motivated sense-making model that combines aspects of both (Pezzo & Pezzo, 2007).

Since the bias has been exhibited in both hypothetical and real-world situations with negative effects, a number of attempts at reducing the bias have been made, most notably, by Arkes and colleagues (1988). Participants in their study were randomly assigned to either a foresight condition - where they were not given any outcome information at any point during the study - or one of three hindsight conditions and read an identical patient case history. All participants were given three possible diagnoses and asked to provide a probabilistic rating for each. Those in the hindsight conditions received an extra line informing them which of the three possible diagnoses was the patient's actual diagnosis. Then, adapting a procedure from Koriat, Lichtenstein, and Fischhoff (1980), half of the participants were asked to provide reasons for all possible diagnoses in addition to their ratings. This required them not only to consider supportive reasons for their diagnosis but also for the alternative diagnoses as well. Consistent with Koriat and colleagues' (1980) findings, those not asked to generate reasons showed hindsight bias when the correct diagnosis was included in the case history. When participants were asked to include reasons for each possible diagnosis, however, they were much less likely to show the bias. Essentially, such a debiasing technique extends the sense-making process to include not only the actual diagnosis, but also alternative (counterfactual) diagnoses. In doing so, people may realize that the known outcome is not as "obvious" as they first perceived it to be.

Using counterfactuals as a debiasing method may backfire, however, if generating reasons for the alternative is difficult. Sanna and Schwarz (2003) randomly assigned

students to generate either four or twelve ways in which the previous weekend's college football game could have turned out differently. Participants were then asked to indicate what they would have guessed the score for each team would be, disregarding the actual outcome. Although participants in the twelve-thoughts condition did generate more alternatives than those in the four-thoughts condition, they actually showed more hindsight bias for the known outcome than those only asked to generate four.

Presumably, the task of coming up with twelve different outcomes is more difficult than generating only four, and this difficulty indicates that the sense-making process is failing. Typically, of course, most people do not spontaneously try to generate twelve ways in which the outcome could have been different, or hindsight bias would be considerably less robust.

Nevertheless, there are instances where hindsight bias is decreased or may not occur naturally, even when researchers do not actively use debiasing techniques. Bodenhausen (1990), for example, asked participants to read a court case either dealing with a violent assault or a molestation accusation. While some participants were not told the outcome of the case, some were told that the defendant was found guilty and others were told the defendant was found not guilty. What participants did not know was that some received court cases dealing with stereotypical defendants while others received non-stereotypical defendants. Authors manipulated the information about the defendant to be consistent or inconsistent with popular stereotypes about groups that are more likely to commit crimes. For example, in one version of the violent assault, the defendant's name was "Roberto Garcia" and in another version his name was "Robert Garner." Hindsight bias occurred for participants who received the non-stereotypical case; those

who received a particular verdict overestimated the likelihood of that verdict based on the evidence compared to those who did not receive any outcome information. Interestingly, and regardless of the verdict, the stereotypical defendant was much more likely to be viewed as guilty.

Motivational Model of Hindsight Bias: A Case for Defensive Processing

There also exist a small number of studies that have shown that internally driven, *motivational* processes can reduce or remove the bias, particularly when the outcome is embarrassing (see Pezzo, 2011 for a review). In the first of such defensive processing studies (Mark & Mellor, 1991), laid off union workers were asked how foreseeable their layoff was. The laid off workers were compared to other union workers who had survived the layoff and to non-union community members in the surrounding area. The community members reported that the outcome was more foreseeable than the layoff survivors, who in turn reported the outcome more foreseeable than the laid off workers. If the outcome had been foreseeable, then the laid off workers presumably could have done something to reduce its likelihood (e.g., improve their work performance). Thus, in order to reduce self-blame they must believe that the outcome was unforeseeable. Mark and Mellor suggest that when asked to think about the event, laid off workers presumably experienced very vivid and upsetting memories. The shock of those memories may have prevented the typical hindsight bias. This study, however, did not include a control group in which predictions were collected before the layoffs. Thus, it is impossible to know if differences in foreseeability reflect a real hindsight bias or merely differences in foresight across the conditions.

Louie (1999) addressed this concern by including a true (no outcome) control condition in her research. Participants in two studies were presented with information about a company's stock and then were asked whether they would recommend buying into the stock. After making their decision, participants were randomly assigned to receive no feedback or feedback (i.e., the stock value either increased or decreased) and were asked to predict the stock's change over the next year. Results suggest that people show more hindsight bias when the outcome is favorable with their prior decision than if the outcome is unfavorable. For example, participants who predicted that the stock value would increase and then received feedback that the stock dramatically decreased exhibited less hindsight bias than participants who received feedback that the stock value increased. Presumably, the former did not want to seem incompetent during this task, so defensive processing allowed them to assume that it was unforeseeable that the stock value would decrease, essentially displacing any blame that may fall on them for making such a prediction. Additionally, when participants were asked to list thoughts about the outcome, those who received a favorable outcome tended to make internal attributions for their ability to make the correct decision (e.g., buy the stock when it increased in value; sell the stock when it decreased in value).

Pezzo and Beckstead (2008) extended this finding beyond the laboratory. They asked participants to rate the likelihood of numerous positive and negative real-world events that might occur in their near future. Weeks later, participants indicated whether each event had actually occurred and to recall their original likelihood judgment. Participants showed a reduction in the bias for negative or upsetting outcomes, which further supports the defensive processing model of hindsight bias.

Protected Values. Most people have strongly held beliefs. For example, the belief in the right to bear arms, or the safety of one's child may be so woven into the fabric of our being that almost no challenge or threat to these beliefs will be considered. Commitment to such "sacred" (Tetlock, 2003) or "protected" values (Baron and Spranca, 1997) has been shown to be so strong that people refuse to sacrifice them at any price. Indeed, studies (Baron & Leshner, 2000) have shown that people can become threatened or offended when they are asked to make - or even consider - such a compromise.

Belief Perseverance. Research on belief perseverance shows that beliefs may persist in the face of damning contradictory evidence (Anderson, Lepper, & Ross, 1980). Consider Nyhan and colleagues' (2014) study on message effectiveness in vaccine promotion. Parents of children under the age of 17 were assigned to one of four interventions regarding the Measles, Mumps, and Rubella (MMR) vaccine. They were given information (from the Centers for Disease Control and Prevention) explaining the lack of evidence that MMR causes autism, the dangers of the diseases prevented by MMR, images of children with diseases prevented by MMR, or dramatic narrative about an infant who almost died after contracting the measles. These interventions were designed to reduce vaccine misperceptions and increase knowledge regarding the intentions of vaccination. Nevertheless, these parents seemed to hold on to their false beliefs in the face of readily available, salient (and scary) information about the dangers of not vaccinating their child.

Anderson and Kellam (1992) suggest that these beliefs persevere because people are particularly good at causal reasoning. For example, people may seek out favorable/consistent information or discount new information that is contrary to their

belief. When causal reasoning is disrupted or reduced, for instance by counting backwards from 200 by 3s (Fleming & Arrowood, 1979) or by thinking about alternative causes (Anderson, 1982), so is belief perseverance. However, there does not appear to be any evidence to date that people will spontaneously disrupt causal reasoning on their own.

Cognitive Sense-Making Model of Hindsight Bias: A Case for Expectancy

Processing

In contrast to the motivational model of hindsight bias that takes into account defensive processing, the cognitive sense-making model takes into account outcome expectancy. Pezzo (2003) showed that, under certain conditions, unexpected outcomes may not produce much or any hindsight bias, regardless of whether or not they were negative or upsetting. In particular, he found that the degree to which a person could *make sense* of the outcome was highly predictive of the size of the bias it produced. In this model, only unexpected outcomes that one can make sense of produce hindsight bias. Expected outcomes do not require sense-making, and thus do not produce any bias, and unexpected outcomes that one cannot make sense of also produce little or no hindsight bias.

For example, Pezzo (2003) asked participants who scored in the upper and lower range on an academic self-esteem measure to complete a cognitive abilities task and were then either given false feedback (e.g., either positive or negative) or no feedback at all (i.e., control group). Participants were asked to list their thoughts about the feedback they received and then were asked to indicate what percentile they thought they would fall into. Results showed that there was no hindsight bias when the participant received

information that was congruent or expected but the bias was found for those participants who received incongruent feedback.

Motivational Sense-making Model of Hindsight Bias: Composite Model

It is important to understand that both motivational and cognitive processes can be at play in producing (or reducing) hindsight bias. For example, although Pezzo and Beckstead (2008) found evidence for defensive processing (supporting the motivational model), they also reported that whether or not an outcome confirmed one's expectations accounted for more variance in hindsight bias than whether or not it was upsetting. To address this, Pezzo and Pezzo (2007) modified the cognitive sense-making model to include motivational factors. The model still presumes that sense-making is necessary for hindsight bias to occur but allows that defensive motives may produce an extended search for causes that don't implicate oneself for a negative outcome. This would explain the occasional reports of "defensive pessimism" in which people appear to show greater hindsight for upsetting events (Tykocinski, 2001). If no external (i.e., situational) reasons can be found for an outcome, the model suggests that people may be motivated to prematurely end the sense-making process without searching for self-implicating causes – resulting in little or no bias. Finally, the model allows for the relatively small possibility that when undeniable internal reasons do exist (i.e., the person is culpable) people may actually experience hindsight bias, but in an effort to save face, they *respond* as though they did not. Such a response is more likely to occur if the bias is measured by asking people how "foreseeable" the response is than by the more traditional method of judging the likelihood of the outcome used in this study (Blank & Peters, 2010).

Purpose of Study/Expected Findings

The aim of this research was to assess the influence of potentially polarized and strongly held beliefs regarding the use of unconventional medical treatments on hindsight bias. Specifically, the influence of attitudes towards the use of marijuana in the treatment of a child with developmental disabilities was assessed. Although still illegal in the state of Florida, an amendment nearly passed in 2014 legalizing the use of medical marijuana as prescribed by a physician for patients with chronic illnesses (Florida Department of State Division of Elections, 2014). Results from the vote showed that close to 58% of voters were in favor of the amendment while 42% were not, indicating that there is not a major disparity between those that are for and against the use of medical marijuana. The expectation is that a strong polarized opinion on the use of this medical treatment (either pro or against) will mitigate the effects of a positive outcome but exacerbate the effects of a negative outcome.

Pezzo's (2003) cognitive sense-making model of hindsight bias would predict that an expected outcome would produce no hindsight bias because the sense-making process would not have been active. An unexpected outcome will produce hindsight bias as long as the person is able to make sense of the outcome. If it is unexpected but the person cannot make sense of the outcome, there will be reduced or no hindsight bias. In contrast, the pure motivational model (Louie, 1999; Mark & Mellor, 1991) predicts that only favorable outcomes or outcomes that are consistent with one's beliefs will produce hindsight bias. Whereas the cognitive sense-making model predicts hindsight bias for an unexpected outcome, the pure motivational model would predict no bias, at least assuming that an unexpected outcome is also unfavorable, and/or threatening to one's

strongly held beliefs. Additionally, the motivated sense-making model (Pezzo & Pezzo, 2007) was used to explain any findings that may not be explained in the first two models. This model was not tested specifically because it is based on a search for external and internal reasons for the outcome leading to either successful or unsuccessful sense-making. The scenario being utilized was not personally relevant to the participants, therefore a search for internal reasons that could have caused the outcome would be impossible. Yet, if a finding did not fit with either the cognitive sense-making model or the motivational model, this may suggest that a more compositional model, such as the motivated sense-making model, may be necessary to explaining hindsight bias results for moral decisions. See Tables 1.a (and Figure 1) and 1.b for predictions based on the cognitive sense-making and the motivational model, respectively.

Table 1.a Cognitive Sense-Making Model of Hindsight Bias Predictions

Symptoms after Treatment		
	Worsen	Improve
Pro-Drug	Unexpected → Bias*	Expected → No Bias
Anti-Drug	Expected → No Bias	Unexpected → Bias*

Note. *See Figure 1 below for influence of the sense-making process on the exhibition of hindsight bias.

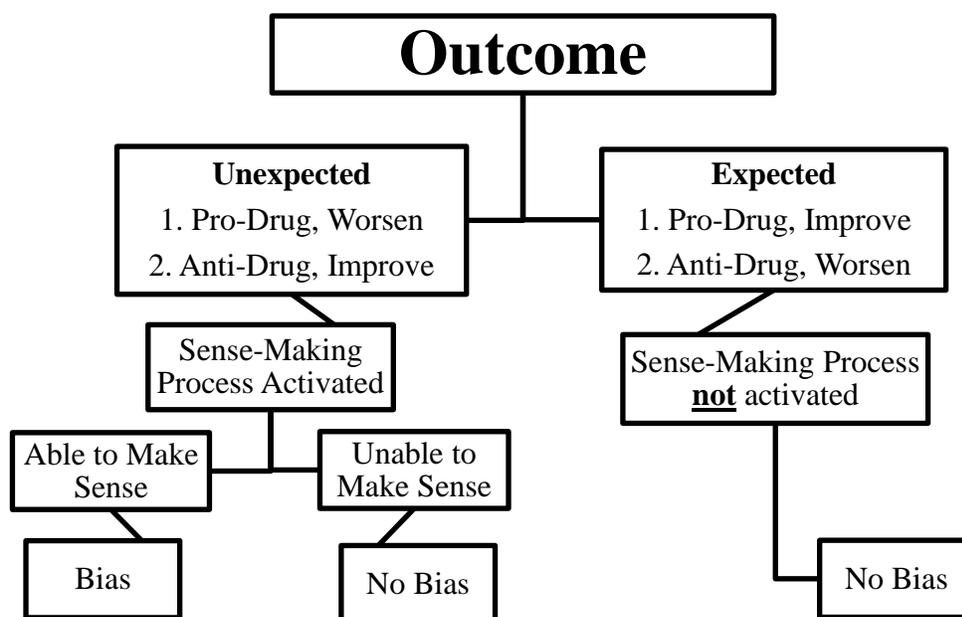


Figure 1. Hindsight Bias Predictions Based on the Cognitive Sense-Making Model.

Table 1.b Motivational Model of Hindsight Bias Predictions

Symptoms after Treatment		
	Worsen	Improve
Pro-Drug	Unfavorable → No Bias	Favorable → Bias
Anti-Drug	Favorable → Bias	Unfavorable → No Bias

Methods

Participants

Two hundred thirty-seven undergraduate psychology students from the University of South Florida St. Petersburg participated in an anonymous online survey and received extra credit in their psychology courses for participation. Participants were recruited through SONA, an online experiment management system. Thirty-five participants were removed due to incorrect responses to one or more manipulation check items in the survey (e.g., choose the outcome of the scenario, choose the correct diagnosis of the child in the vignette, etc.) or for failure to complete the survey, leaving a total of 202 participants.

Participants were predominantly female (88.1%) and white (64.9%). When asked about their marijuana use, approximately 34% of participants indicated that they have never used marijuana. For those who indicated they had used marijuana, usage varied from once or twice (29.7%), occasional (25.7%), or regular use (10.4%). Approximately 55% of participants support the legalization of recreational marijuana use. Additionally, most were also in favor of the legalization of medical marijuana for children and adults under supervision, 69.3 and 87.6%, respectively. See Table 2 for additional demographic information.

Table 2 Demographic Characteristics

Characteristics	n	%
Gender		
Female	178	88.1
Male	24	11.9
Ethnicity		
American Indian/Alaskan	2	1.0
Hawaiian Native or other Pacific Islander	1	0.5
Black	15	7.4
Asian American	13	6.4
Hispanic	21	10.4
White	131	64.9
Other	14	6.9
I wish not to answer	5	2.5
Personal Use of Marijuana		
Never	69	34.2
Once or twice	60	29.7
Occasionally	52	25.7
Regularly	21	10.4

Note. n = 202

Procedures

In recent years, the use of medical marijuana to treat different medical conditions, ranging from seizure disorders to nausea after chemotherapy to anxiety disorders, has increased. According to the National Conference of State Legislature (March, 2015) webpage, a total of 23 states currently have legalized medical marijuana statutes. One particular use for medical marijuana is to treat children suffering from Autism Spectrum Disorder (ASD) who are also exhibiting self-injurious behavior. Although there are no recently published empirical studies examining the use of this medical treatment to date, there is anecdotal evidence supporting the use of this treatment that participants may have been exposed (e.g., reports in the newspaper or on television) to prior to participating in the study.

All participants read a vignette (Appendix A) describing “Josh,” a 7-year-old child diagnosed with ASD, who had recently developed self-injurious behaviors. Due to the lack of empirical evidence regarding the use of medical marijuana, the vignette included both supporting anecdotal information and reasons against the use of the medical treatment (e.g., no empirical evidence, still illegal at the federal level). After a discussion with their son’s physician about the benefits and risks of medical marijuana, the vignette ends with the parents ultimately deciding to start their son on the unconventional treatment. Participants were randomly assigned to one of three “three month assessment update” outcome conditions -- positive, negative, no outcome/control (Appendix B) -- from Josh’s physician. Participants who were randomly assigned to either the positive or negative outcome condition received the update of the child after three months of using the medical marijuana treatment (see Appendix B). Those

participants in the “No Outcome” or control condition were given no update on the child’s condition. Finally, participants completed an additional questionnaire discussed in the materials section below.

Hindsight Bias Scores. A hindsight bias score was calculated for each participant receiving an outcome. For participants in the positive outcome condition, this score was calculated by subtracting the mean likelihood rating (on a scale from 0-100) for the relevant control condition from each individual’s likelihood rating. For participants in the negative outcome condition, the score was calculated the same way and then multiplied by -1. This was done so that a positive score always indicated hindsight bias, and a negative score indicated reverse hindsight bias regardless of the outcome.

$$\text{Hindsight Bias} = \text{Individual Likelihood} - \text{Mean of Relevant Control Condition}$$

It is important to note that the mean of the relevant control condition was used to calculate hindsight bias scores. That is, those with a pro-drug attitude in either the positive or negative outcome condition were compared only to those with a pro-drug attitude in the control condition.

Materials

The Drug-Related Knowledge, Attitudes, and Beliefs Scale (DRKAB) (Bryan, 2000) was modified for the current study and administered to the participants prior to reading the vignette in order to assess participants’ attitudes towards the use of marijuana. The original scale assessed knowledge, attitudes, and beliefs of drug abuse/abuser as well as direct questions about numerous illicit drugs including marijuana, cocaine, heroin, ecstasy, and others. Items that were included for this study assessed overall attitudes and beliefs of drug abuse/abuser in general (e.g., “All illegal drugs are equally harmful to

your health,” “Our society is too tolerant towards drug users,” etc.) and specific items concerning the use of marijuana (e.g., “The use of cannabis should not be against the law,” “Occasional use of cannabis is not really dangerous,” etc.). The word “cannabis” was replaced with the more commonly used word “marijuana” in order to make it less technical and more understandable for all participants. All items utilized a 7-point rating scale ranging from *Disagree Strongly* to *Agree Strongly*. For a complete list of scale items, refer to Appendix C. Additionally, questions regarding the participants’ personal use of marijuana, their knowledge of others around them using marijuana, and their attitudes towards legalizing the use medical and recreational marijuana were asked along with other demographic questions. For a complete list of demographic items, refer to Appendix D.

After reading the vignette and receiving one of the three possible outcomes, participants completed the Follow-Up Questionnaire. Participants were asked to rate the likelihood that the drug treatment would be successful on a scale of 0-100 percent. If participants were in either the positive or negative outcome group, they were explicitly instructed to disregard the outcome information they received. Additionally, if participants were in the positive/negative outcome condition group, they responded to items that assessed how surprising the outcome was or how much sense the outcome made on a 6-point rating scale ranging from *Not At All* to *Completely*. All participants rated how risky the treatment was how severe the child’s condition was, and how confident they would have to be in the drug’s effectiveness before giving it to their own child. Participants were also asked whether the physician met “standard of care” (i.e., defined as “the caution that a reasonable person in similar circumstances would exercise

in providing care to a patient”) and to provide reasons for their judgment. For a complete list of scale items, please refer to Appendix E.

Results

Basic Hindsight Bias Effects

Participants were categorized as either Pro-drug or Anti-drug based on their response to the following item from the DRKAB Scale: “All illegal drugs are equally harmful to your health” (see Figure 1). This question was used alone rather than using a combined score across all of the DRKAB items due to this item having the largest amount of polarity. This made it much simpler to create the two categories of participants. Three participants were excluded from the analyses because they indicated they neither approved nor disapproved of the statement and therefore could not be categorized as either “pro” or “anti” drug. This left 127 participants in the “Pro-Drug” attitude group and 72 participants in the “Anti-Drug” attitude group.

A 3 X 2 factorial ANOVA was conducted with outcome condition (negative, no outcome, positive) and attitude (anti-drug, pro-drug) as the between-subjects factors for participant ratings on the likelihood that the treatment would be successful. The range for this item was 100, with a minimum rating of 0 and a maximum of 100. The average rating was 66.56 ($SD = 21.31$), skewness was -1.01, and kurtosis was .93. There was a significant main effect of condition, (Positive - $M = 73.30$, $SD = 18.24$, Control - $M = 66.24$, $SD = 14.72$, Negative - $M = 61.56$, $SD = 25.86$), $F(2, 193) = 7.15$, $p = .001$, $\eta^2_p = .07$, but not of attitude, (Pro-Drug ($M = 68.89$, $SD = 18.74$), Anti-Drug ($M = 73.32$, $SD = 24.96$), $F(1, 193) = 2.65$, $p = .11$, $\eta^2_p = .01$). There was a strong tendency towards

statistical significance for the interaction of outcome condition by attitude, $F(2, 193) = 3.04$, $p = 0.050$, $\eta^2_p = .03$. Simple main effects analyses showed that the effect of outcome was significant only for the anti-drug participants, $F(2, 80) = 6.27$, $p = .003$, $\eta^2_p = .14$, but not for the pro-drug participants. Anti-drug participants in both conditions exhibited hindsight bias while pro-drug participants did not exhibit the bias in either condition. See Figure 3 for the likelihood of improvement interaction between outcome condition and drug attitude and Table 3 for descriptive statistics associated with the interaction.

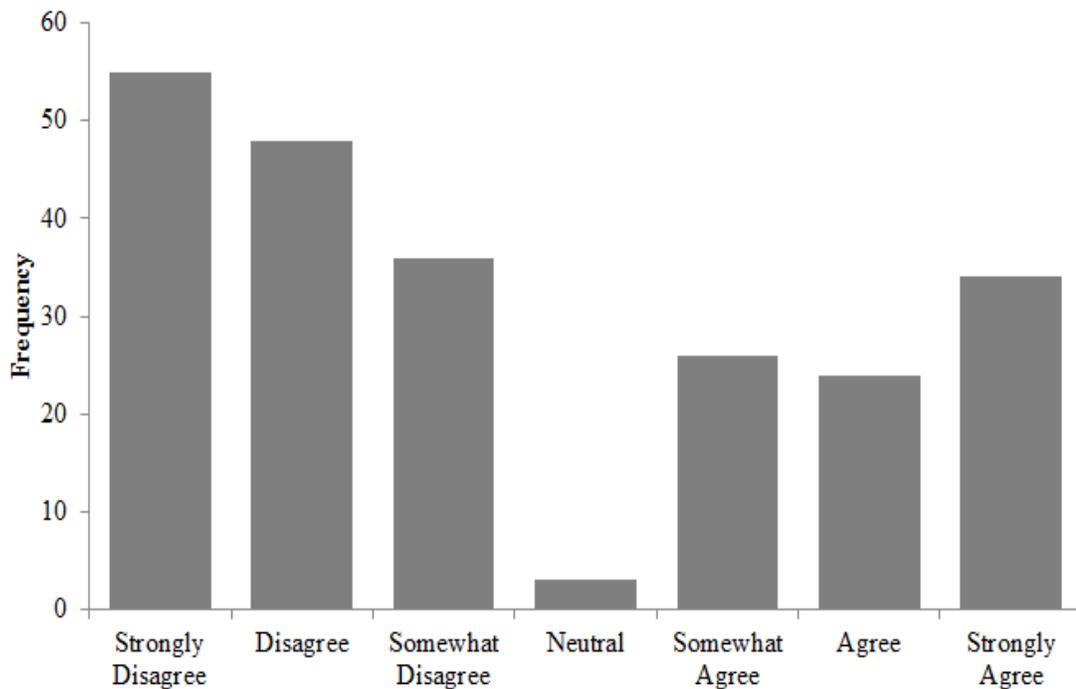


Figure 2. Attitude of Illegal Drugs Distribution ($n = 202$). Participants who disagreed with the statement “All illegal drugs are harmful to your health” were categorized as “Pro-Drug” participants ($n = 127$). Those who agreed with the statement were categorized as “Anti-Drug” participants ($n = 72$). Three participants were excluded from the analyses for responding to the item with “Neutral.”

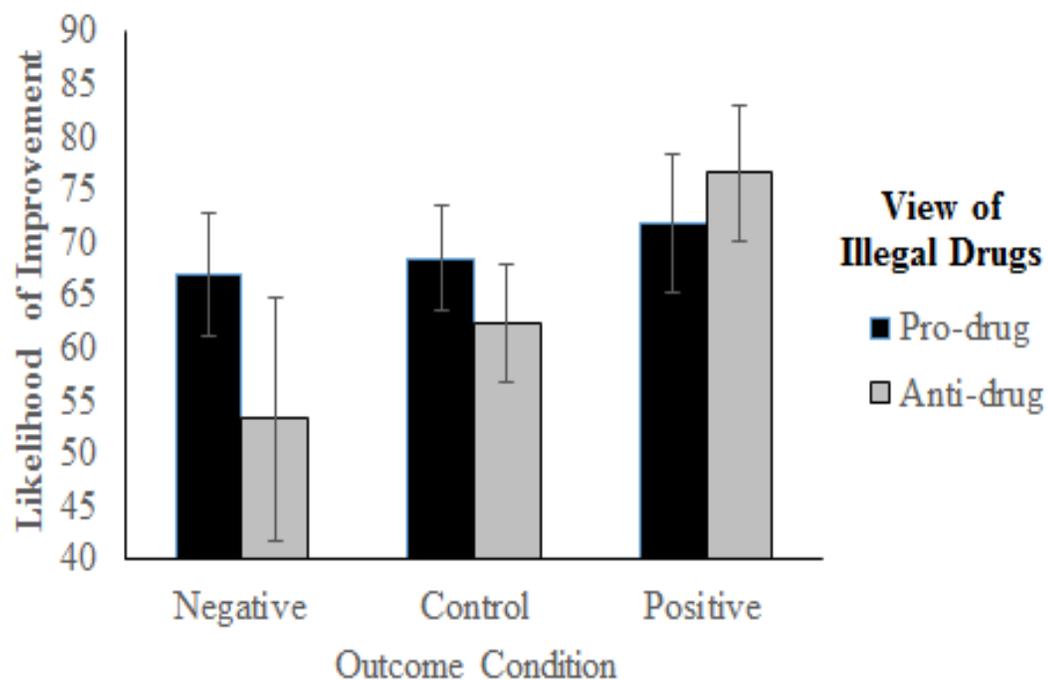


Figure 3. Interaction between Outcome and Drug Attitude for Likelihood Ratings ($n = 199$). Error bars represent 95% C.I.

Table 3. Likelihood of Improvement as a Function of Outcome and Drug Attitudes.

Outcome Condition	Pro-Drug			Anti-Drug		
	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>
Negative	66.9	20.1	48	53.3	31.5	31
Control	68.5	15.4	40	62.3	12.8	23
Positive	71.8	20.2	39	76.6	13.0	18

Note. $n = 199$

A different way to examine hindsight effects is to use a priori contrasts. Among anti-drug participants, those who received a positive outcome rated likelihood of improvement significantly higher than those in the control condition, $t(193) = 2.23$, $p = .03$, $d = 1.11$, while those receiving a negative outcome rated likelihood of improvement significantly lower than the control condition, $t(193) = 1.6$, $p = .11$, $d = .37$. Contrasts for pro-drug participants revealed no difference between the control condition and either the positive outcome condition, $t(193) = .71$, $p = .48$, $d = .18$, or the negative outcome condition, $t(193) = .37$, $p = .71$, $d = .09$.

Ratings Associated with Cognitive Sense-Making Model

Surprise Ratings. A 2 X 2 factorial ANOVA was conducted with outcome condition (negative, positive) and attitude (anti-drug, pro-drug) as the between-subjects factors for participant ratings of outcome surprisingness. The range for this item was 5, with a minimum rating of 1 and a maximum of 6. The average rating was 3.10 ($SD = 1.61$), skewness was .29, and kurtosis was -1.18. There was not a significant main effect of drug attitude on surprise ratings, (Pro-Drug - $M = 3.22$, $SD = 1.60$, Anti-Drug - $M = 2.92$, $SD = 1.63$), $F(1, 132) = 2.18$, $p = .14$, $d = .19$. Participants receiving a negative outcome were more surprised ($M = 3.9$, $SD = 1.5$) than those receiving a positive outcome ($M = 2.1$, $SD = 1.2$), $F(1, 132) = 48.38$, $p < .001$, $d = 1.4$. A marginally significant interaction of outcome condition by attitude, however, indicated that both pro- and anti-drug participants rated the positive as less surprising than the negative outcome but that pro-drug participants rated the negative outcome as more surprising than the anti-drug participants, $F(1, 132) = .20$, $p = .088$, $\eta^2_p = .02$. See Figure 4 for the surprise ratings interaction between outcome condition and drug attitude.

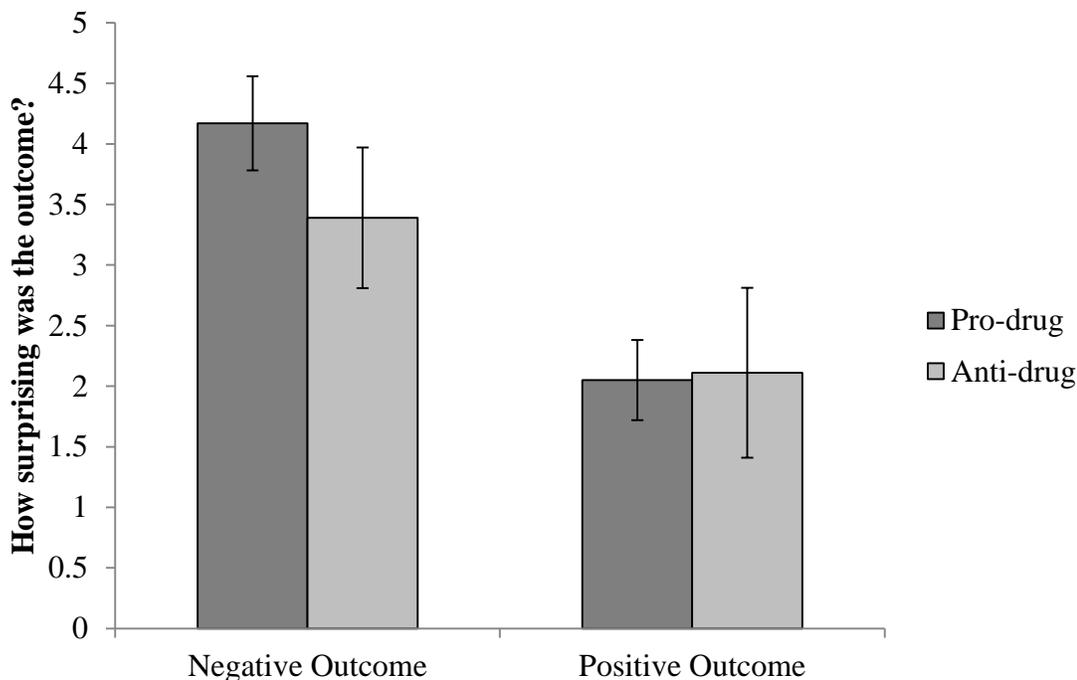


Figure 4. Interaction between Outcome and Drug Attitude for Surprise Ratings ($n = 136$). Error bars represent 95% C.I.

Pezzo's (2003) sense-making model states that surprise ratings should be negatively correlated with hindsight bias scores. Consistent with this model, overall, as a person's rating of how surprised they were at the outcome increased, the less they exhibited the bias, $r(135) = -.63, p < .001$. Follow up within-cell correlations based on outcome condition (positive, negative) and drug attitude (anti-drug, pro-drug) were used to examine whether there were differences in the relationship based on these groups. If pro-drug participants received a negative outcome, they exhibited more hindsight bias when they were less surprised by the outcome, $r(52) = -.65, p < .001$. Similarly, but with a stronger relationship, anti-drug participants who received a negative outcome also exhibited more of the bias when they were less surprised by the outcome, $r(32) = -.72, p < .001$. When pro-drug participants received a positive outcome, they showed a larger

hindsight bias when they were less surprised at the outcome, $r(39) = -.58, p < .001$. When anti-drug participants received a positive outcome, they showed a larger hindsight bias when they were less surprised, $r(18) = -.50, p = .03$.

Sense-Making Ratings. A 2 X 2 factorial ANOVA was conducted with outcome condition (negative, positive) and attitude (anti-drug, pro-drug) as the between-subjects factors for participant ratings of how much sense the outcome made. The range for this item was 5, with a minimum rating of 1 and a maximum of 6. The average rating was 3.65 ($SD = 1.53$), skewness was .04, and kurtosis was -1.18. Participants receiving a positive outcome were more able to make more sense of the outcome ($M = 4.5, SD = 1.4$) than those who received a negative outcome ($M = 3.1, SD = 1.4$), $F(1, 132) = 29.83, p < .001, d = 1.0$. There was no effect of attitude, (Pro-Drug - $M = 3.59, SD = 1.45$), Anti-Drug - $M = 3.76, SD = 1.64$), $F(1, 132) = .97, p = .33, d = .11$, nor a significant outcome condition by attitude interaction $F(1, 132) = .53, p = .47, \eta^2_p = .004$. See Figure 5 for the sense-making ratings interaction between outcome condition and drug attitude.

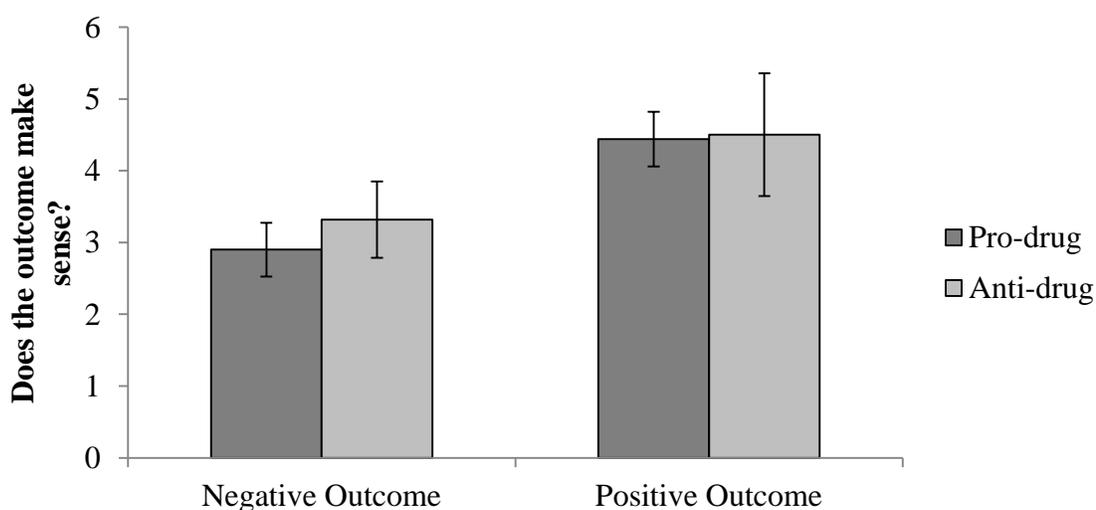


Figure 5. Interaction between Outcome and Drug Attitude for Sense Ratings ($n = 136$). Error bars represent 95% C.I.

Again, Pezzo's (2003) sense-making model states that sense ratings should be positively correlated with hindsight bias scores. Consistent with this model, overall, as a person's rating of how much sense the outcome made to them, the more they exhibited the bias, $r(135) = .30, p < .001$. Follow up within-cell correlations based on outcome condition (positive, negative) and drug attitude (anti-drug, pro-drug) was used to examine whether there were differences in the relationship based on these groups. There was not a significant relationship between sense-making and hindsight bias for either pro-drug participants, $r(52) = .15, p = .28$, or for anti-drug participants who received a negative outcome, $r(32) = .09, p = .61$. When pro-drug participants received a positive outcome, they showed a larger hindsight bias when they were able to make more sense out of the outcome, $r(39) = .74, p < .001$. When anti-drug participants received a positive outcome, however, there was no significant relationship, $r(18) = .20, p = .41$.

Outcome Manipulation Checks

Additional items were administered to examine how participants perceived the child's situation and the outcome. These items are considered manipulation checks to ensure that participants were reading the vignette thoroughly and to ensure that the positive and negative outcomes were successful manipulations. These included how confident they would need to be that the drug would improve the child's condition in order to administer that treatment to a child, how risky they rated the unconventional treatment, and how severe the participant rated the child's condition. A Pearson's correlation was run between hindsight bias scores, criterion, risk, and severity ratings. There was a marginally significant correlation between hindsight bias score and criterion

score, $r(135) = .14, p = .10$, meaning that the more confident the person needed to be about the effectiveness of the treatment before giving it to their own child, the more they exhibited the bias. There was no correlation between hindsight bias score and risk rating, $r(135) = .04, p = .68$. There was also no correlation between hindsight bias score and severity rating, $r(135) = -.05, p = .58$.

Criterion. A 3 X 2 factorial ANOVA was conducted with outcome condition (negative, control, positive) and attitude (anti-drug, pro-drug) as the between-subjects factors for participants' ratings of how confident they would have to be in the drug's effectiveness before giving it to their own child (criterion). The range for this item was 100, with a minimum rating of 0 and a maximum of 100. The average rating was 70.88 ($SD = 23.93$), skewness was $-.89$, and kurtosis was $.37$. There was not a significant main effect of outcome condition, (Positive - $M = 74.96, SD = 20.13$, Control - $M = 71.98, SD = 25.61$, Negative - $M = 67.47, SD = 24.81$), $F(1, 193) = 2.06, p = .13, \eta^2_p = .02$. There was a significant main effect of attitude, where anti-drug participants needed to be more confident ($M = 76.4, SD = 24.8$) in the drug's effectiveness than pro-drug participants ($M = 69.0, SD = 23.0$), $F(1, 193) = 6.46, p < .05, \eta^2_p = .03$. There was not a significant outcome condition by attitude interaction $F(2, 193) = .35, p = .71, \eta^2_p = .004$. See Figure 6 for the criterion ratings interaction between outcome condition and drug attitude.

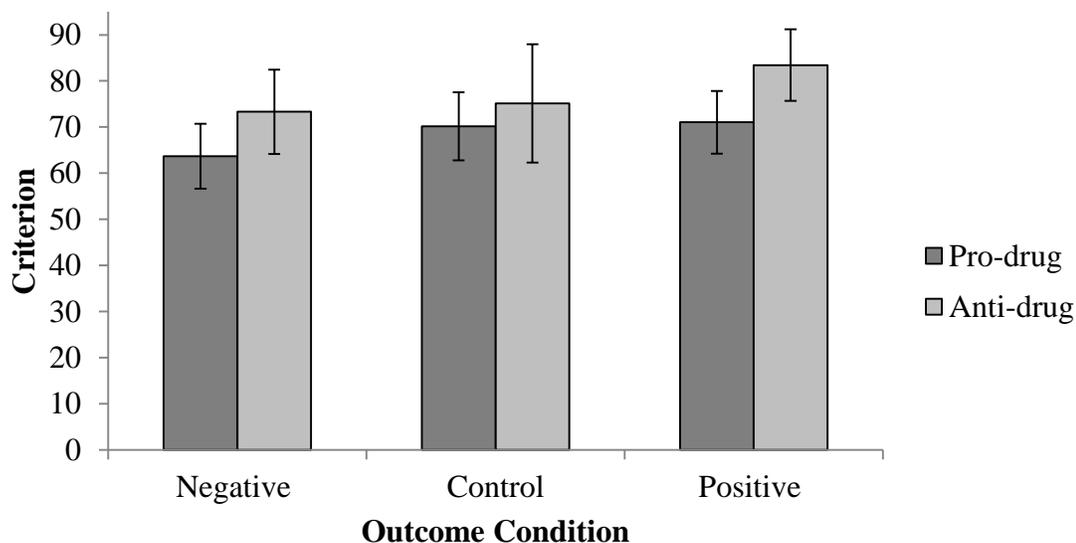


Figure 6. Interaction between Outcome and Drug Attitude for Criterion Ratings ($n = 199$). Error bars represent 95% C.I.

Ratings of Risk. A 3 X 2 factorial ANOVA was conducted with outcome condition (negative, control, positive) and attitude (anti-drug, pro-drug) as the between-subjects factors for participant ratings of risk. The range for this item was 5, with a minimum rating of 1 and a maximum of 6. The average rating was 3.39 ($SD = 1.53$), skewness was .07, and kurtosis was -1.01. There was not a significant main effect of outcome condition, (Positive - $M = 74.96$, $SD = 20.13$, Control - $M = 71.98$, $SD = 25.61$, Negative - $M = 67.47$, $SD = 24.81$), $F(1, 193) = .36$, $p = .70$, $\eta^2_p = .004$. However, there was a significant main effect of attitude, where anti-drug participants rated the treatment as riskier ($M = 4.0$, $SD = 1.6$) than pro-drug participants ($M = 3.1$, $SD = 1.4$), $F(1, 193) = 16.73$, $p < .001$, $\eta^2_p = .08$. There was not a significant outcome condition by attitude interaction $F(2, 193) = .97$, $p = .38$, $\eta^2_p = .01$. See Figure 7 for the risk ratings interaction between outcome condition and drug attitude.

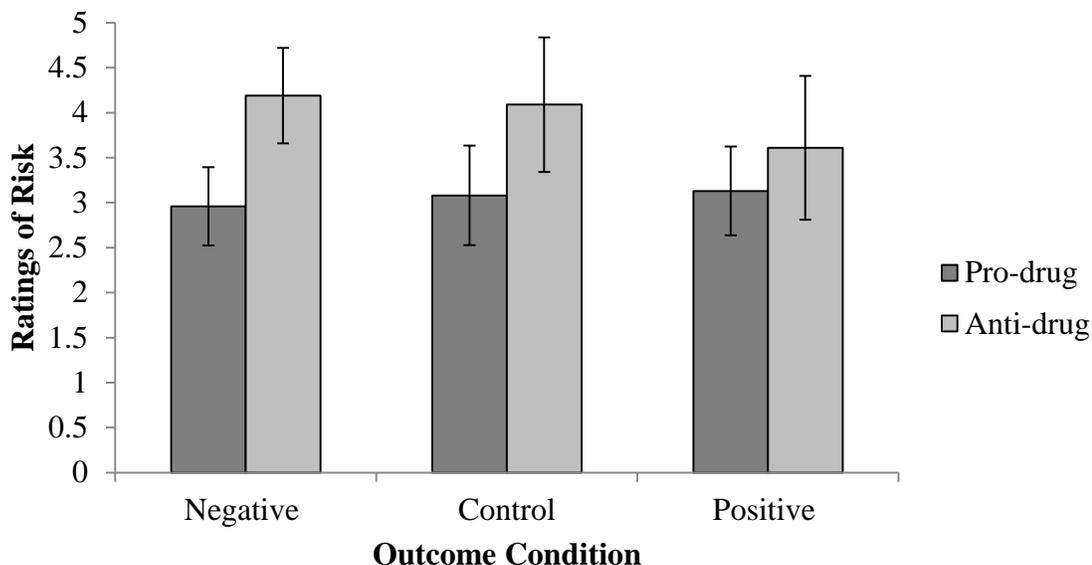


Figure 7. Interaction between Outcome and Drug Attitude for Ratings of Risk ($n = 199$). Error bars represent 95% C.I.

Condition Severity. A 3 X 2 factorial ANOVA was conducted with outcome condition (negative, control, positive) and attitude (anti-drug, pro-drug) as the between-subjects factors for participant ratings of severity. The range for this item was 5, with a minimum rating of 1 and a maximum of 6. The average rating was 4.91 ($SD = .92$), skewness was -1.00, and kurtosis was 1.68. There was not a significant main effect of outcome condition, (Positive - $M = 4.86$, $SD = 1.03$, Control - $M = 7.97$, $SD = .86$, Negative - $M = 4.90$, $SD = .89$), $F(2, 193) = .32$, $p = .72$, $\eta^2_p = .003$. There was not a significant main effect of attitude. (Pro-Drug - $M = 4.88$, $SD = .89$, Anti-Drug - $M = 4.96$, $SD = .97$), $F(1, 193) = .25$, $p = .62$, $\eta^2_p = .001$. There was not a significant outcome condition by attitude interaction, $F(2, 193) = .20$, $p = .82$, $\eta^2_p = .002$. See Figure 8 for the risk ratings interaction between outcome condition and drug attitude.

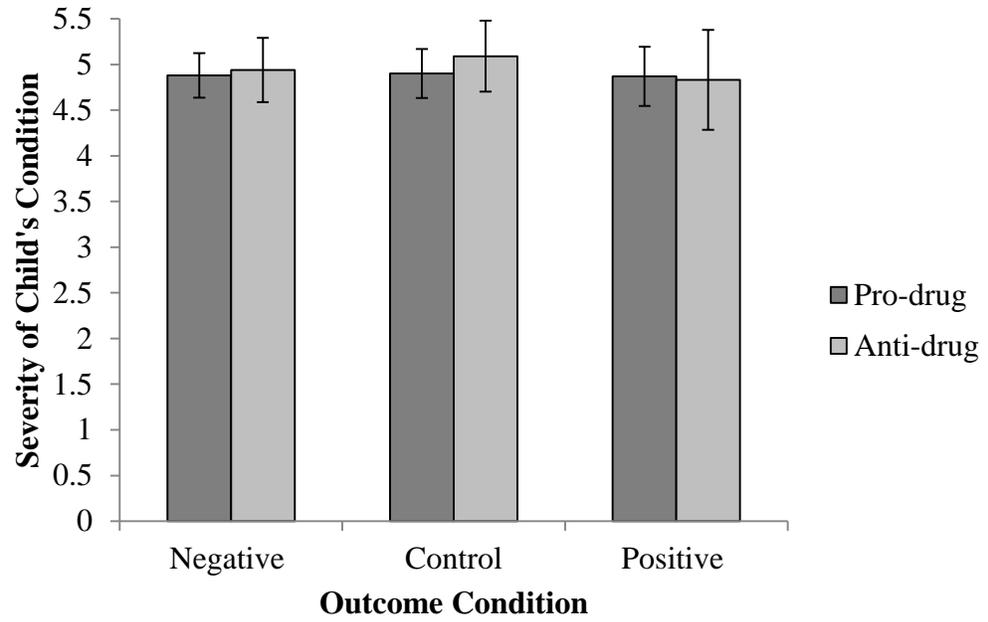


Figure 8. Interaction between Outcome and Drug Attitude for Condition Severity Ratings ($n = 199$). Error bars represent 95% C.I.

Discussion

According to Pezzo's (2003) cognitive sense-making model, participants who received an expected outcome (e.g., pro-drug participants who received a positive outcome) should exhibit no hindsight bias. Those who received an unexpected outcome (e.g., pro-drug participants who received a negative outcome) should exhibit hindsight bias, but only if they were able to effectively make sense of it. In contrast, the motivational model (Louie, 1999; Mark & Mellor, 1991) predicts that only favorable outcomes or outcomes that are consistent with one's beliefs will produce hindsight bias.

The control conditions in this study indicate that although those with a pro-drug view rated the likelihood of a positive outcome greater than those with a negative view, the difference was relatively small. More important, both the pro and anti-drug conditions expected a positive outcome (68% and 62%, respectively). Thus, the single item used from the Drug-Related Knowledge, Attitudes, and Beliefs Scale (DRKAB) (Bryan, 2000) does not appear to have been the best indicator of the participants' expectations for a positive outcome.

This is not to say that a positive outcome was viewed as inevitable by either group. Anti-drug participants still held a 38% expectation that a negative outcome would occur, and pro-drug participants held a 32% expectation. Thus, either outcome -- negative or positive -- should produce at least some surprise, and thus some hindsight bias. The cognitive model would, however, predict a larger bias for the negative outcome in both groups because it is more unexpected than a positive outcome. Finally, recall from Pezzo

(2003) that sense-making is necessary for hindsight bias to occur. If participants cannot make sense of an unexpected outcome, they still will not exhibit hindsight bias. With this in mind, let us consider each condition. First we consider conditions that are most *threatening* to participants.

Pro-Drug Attitude and Negative Outcome

These participants generally expected a positive outcome -- those in control condition rated the likelihood of the child's improvement to be about 68%. When presented instead with a negative outcome, these participants showed no bias at all ($d = .09, p = .71$). The motivational model predicted that participants would not exhibit any bias because the outcome is threatening to their belief. In contrast, the cognitive sense-making model predicted that a negative outcome, because it was relatively unexpected, would produce a hindsight bias. The lack of a bias in this condition would seem to be supportive of a defensive processing mechanism (Louie, 1999; Mark and Mellor, 1991). Recall, however, that a lack of hindsight bias can still be explained by the cognitive model if participants are unable to make sense of the outcome. Although sense-making ratings were lower for pro-drug participants than for anti-drug participants, the difference was quite small. Further, the within-cell correlation between individual hindsight bias scores and sense-making was not significant, indicating that the usual cognitive sense-making process may have been circumvented. Perhaps participants in this condition were so invested in the idea that marijuana is a beneficial medical treatment that they refused to make sense of the outcome.

One measure that could help address this is the length of time participants spent trying to make sense before they responded. If participants spent little or no time, this

would suggest participants refuse to even try to make sense of the outcome. If they took a relatively long time before responding this would instead suggest that sense-making was attempted, but failed. Unfortunately, reaction time was not recorded in this study.

Anti-Drug Attitude and Positive Outcome

For anti-drug participants, a positive outcome is clearly threatening and according to a motivational model should, produce no bias. But the outcome was also found to be at least somewhat unexpected. Recall, control participants rated a 62% likelihood of improvement and thus a 38% likelihood that the child would not improve. To the extent that the positive outcome was at least somewhat surprising initially, the cognitive model would predict at least a small hindsight bias for this condition. In fact, results indicated that participants exhibited the largest bias ($d = 1.11$) out of all conditions. One possibility is that the outcome that was provided was not the outcome that control participants were considering when they rated its likelihood. If the outcome was more dramatic than control participants were imagining, a large hindsight bias would be predicted by the cognitive model. Unexpectedly, the correlation between hindsight bias scores and sense-making ratings was not significant. This might have been caused, however, by a ceiling effect for this condition, as their sense-making ratings were the highest of any condition.

This large bias is not consistent with defensive processing mechanism of the motivational model because it is presumably threatening to participants' beliefs regarding the use of this medical treatment. The (surprising) fact that these participants were better able to make sense of the outcome than any other condition may indicate that they were also able to reduce the threat they felt from the outcome. Either that or participants were able to find a number of reasons for the positive outcome that still supported their belief

(Pezzo & Pezzo, 2007) or they changed their minds and decided that medical marijuana is, perhaps, not as bad as they thought. In either case, one would expect that a considerable amount of sense-making would occur, resulting in the large bias.

Pro-Drug Attitude and Positive Outcome

The remaining two conditions presented outcomes that were not threatening but expected and consistent with participants' beliefs. A positive outcome for these participants is completely consistent with their belief and so there is reason from a defensive processing perspective to exhibit hindsight bias based on the motivational model of hindsight bias. Based on this model, it was predicted that participants would exhibit hindsight bias because the outcome was consistent with their beliefs, making it more likely that they could have predicted the outcome. However, the non-occurrence of the bias does not support this model.

On the other hand, there is also not much reason to engage in sense-making either, even a slightly surprising outcome, if it is consistent with one's strongly held belief system. It is important to note that of the four outcomes, this is the least incongruent, and so the cognitive sense-making model would predict no hindsight bias in this condition. Results showed that participants did not show the bias, supporting the cognitive sense-making model's prediction. This result is further supported by the high sense-making and low surprise ratings by these participants. Unlike the other conditions, there was a very significant within-cell correlation between hindsight bias scores and sense-making, further supporting the notion that the outcome was expected and made sense to the participants. Participants were expecting the child to get better based on their pro-drug attitude/belief, so when they learned that the child's condition did improve, they

were not surprised. This, in turn, meant they did not have to search for information to explain the outcome -- the sense-making process was not activated – resulting in no bias. Because the outcome is also not threatening, there is no need to consider it further.

Anti-Drug Attitude and Negative Outcome

Finally, a negative outcome is consistent with participants' anti-drug belief and thus a bias should occur according to the defensive model. A bias is also consistent with the cognitive model to the extent that these participants expected a positive outcome. Indeed, this condition did produce a bias, albeit one with a relatively small effect size. Note however, that anti-drug participants had more difficulty making sense of this outcome than they did the positive outcome. Thus, the modest bias size is to be expected by cognitive model.

Conclusion

In review, predictions from the cognitive sense-making model were supported in two conditions: (1) when the bias occurred for anti-drug participants who received a positive outcome and (2) when no bias occurred for pro-drug participants who received a positive outcome. For the latter group of participants, the positive correlation between hindsight bias scores and sense-making support the cognitive sense-making model, which states that as long as the person is able to make sense of the outcome they will show more hindsight bias (Pezzo, 2003). The model also states that the more surprising the person finds the outcome to be, the smaller the bias will be, which is exactly what was exhibited by participants.

For pro-drug participants who received a negative outcome, the non-occurrence of the bias primarily supports the motivational model. If these participants were unable to

make sense of the outcome, however, then the lack of bias could still be explained by the cognitive sense-making model. Unfortunately, it cannot be definitely stated that participants were unable to make sense of the bias due to the non-significant within-cell correlation between sense-making and individual hindsight bias scores. Finally, both the motivational and the cognitive sense-making models are supported when the bias occurred for anti-drug participants who received a negative outcome.

Regardless of the outcome, anti-drug participants thought the treatment was riskier and that a “minimally competent doctor” needed to be more certain that the treatment would work before administering this treatment compared to pro-drug participants. Although it did not matter which condition participants were in, compared to pro-drug participants, anti-drug participants thought the treatment was riskier and thought that a “minimally competent doctor” needed to be more certain that the treatment would work before administering this treatment.

One limitation for this study is that the DRKAB scale item that was used to create the pro- and anti-drug groups was an all-encompassing statement (i.e., “All illegal drugs are equally harmful to your health”). Again, this item was used, as opposed to using a sum score across all DRKAB items because of the largest amount of polarity. Participants may have been thinking about more damaging drugs such as cocaine or heroin, and marijuana was not actively entertained. Another limitation is that specific pre- and post-attitude measures were not collected to assess whether participants’ views changed after reading the vignette. In the vignette, participants were given both pro and con arguments for using this type of treatment on the child, which may have provided the participant with new information they were not previously aware of. Attitude groups were created

by combining different levels of agreement/disagreement to the above DRKAB item; participants who only “*somewhat*” agreed with the statement were grouped together with participants who “*strongly*” agreed. Some participants who only slightly agreed/disagreed with the statement could have changed their minds after reading the scenario, which would directly affect all proceeding responses to questions and perhaps the magnitude of their bias.

In conclusion, there is no one model that accounts for the results in the present study. Future research should focus on determining the true mechanism behind how hindsight bias is affected by strongly held beliefs such as protected values or moral values. Although marijuana is a controversial topic, it is becoming decriminalized in states around the U.S. and medical marijuana is becoming more acceptable across the nation (National Conference of State Legislature, 2015). It would be interesting to examine how beliefs regarding other controversial topics such as gun control laws or the death penalty affect hindsight bias. These topics may have a stronger protected values (e.g., all life is valuable, therefore we should not have the death penalty), which may yield different results from this current study. Perhaps after learning more about the mechanism associated with these values, one of these models may become more supported or a new revised model of hindsight bias might be developed.

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Appendices

Appendix A: Study Vignette

Appendix B: Study Outcomes

Appendix C: Drug-Related Knowledge, Attitudes, and Beliefs Scale

Appendix D: Demographic Questionnaire

Appendix E: Follow-Up Questionnaire

Appendix A: Study Vignette

John and Sarah Smith have a seven-year-old son, Josh, who has been diagnosed with Autism Spectrum Disorder (ASD), which is a developmental disability that can cause significant social, communication and behavioral challenges. Josh has had this diagnosis for almost four years now and has encountered problems with both his communication skills and his behavior. Recently, Josh has started showing signs of self-injurious behavior to include slapping/punching himself, butting his head against the wall, and biting himself. This has led to numerous trips to the emergency room.

Josh's parents are very concerned about these new and dangerous behaviors and make an appointment with Josh's neuropsychiatrist, Dr. Henry Ellis, to discuss what treatment options are available to them. Once Dr. Ellis has examined Josh and reviews his charts and medical history, he tells John and Sarah that they have run out of new conventional medication options for Josh. He has been on all possible medications that can be prescribed for a child with ASD and none of them seem to have slowed the development of the self-injurious behaviors.

"We can keep Josh on the medication he is currently taking and see if they have any effect on these new behaviors. However, in my opinion, I don't think the medication will be able to help Josh any more than it already has" says Dr. Ellis.

Seeing how distraught this information makes the parents, Dr. Ellis then tells them that there might be one unconventional treatment they can try. He explains there have been some cases where children in the same predicament as Josh have been given marijuana in liquid/pill form, and it seems to decrease the self-injurious behavior significantly. He explains that if they use a form of marijuana that produces a sedative effect without creating the stereotypical "high" feeling, this may calm Josh down during an episode where he begins to hurt himself.

Dr. Ellis goes on to say that even though there are some cases in which this unconventional treatment has worked, there are also some credible reasons why they should not try this treatment. It is still illegal at the federal level to use marijuana and there is no empirical research that evaluates the long-term neurological side effects of semi-regular marijuana use. This is a very big decision and Dr. Ellis warns them not to take this decision lightly. He suggests that John and Sarah go home, take some time to think about it, research it, and have a serious discussion. After that, if they would like to try giving Josh marijuana to treat his self-injurious behavior, then they should call the office.

After another two weeks and more episodes of Josh hurting himself, Sarah calls Dr. Ellis' office and tells him they would like to try the marijuana treatment. Dr. Ellis prescribes the marijuana for Josh, and requests his parents bring him back in one month to see how he is doing.

Appendix B: Study Outcomes

Positive Outcome One Month Follow Up:

At their one-month follow up, John and Sarah both describe how shocked they are at the improvement that Josh has made while using the marijuana treatment. They are thrilled to say that he has not suffered an episode where he has hit/punched/bit himself in close to three weeks. And, the few episodes that have occurred have been less extreme than before.

Negative Outcome One Month Follow Up:

At their one-month follow up, John and Sarah both describe how disappointed they are that this treatment, like the others, has not worked. And not only has it not worked, but Josh's self-injurious behaviors have increased. He is now having multiple episodes each day, and he is the most violent he has ever been. Josh's parents request that the marijuana treatment be stopped immediately.

Appendix C: Drug-Related Knowledge, Attitudes, and Beliefs Scale

In the following section you will find some statements / questions about drug use and drug users. These statements do not necessarily express our feelings. We are interested in finding out how you feel (i.e., your opinion) about these issues. There are no right or wrong answers to any of these statements; people have widely different views. Try not to rush through, nor to ponder too long over any question. Please choose your level of agreement for each statement using the scale below.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6	6

1. All illegal drugs are equally harmful to your health.
2. Our society is too tolerant towards people who use drugs.
- 4 I see people who are addicted to drugs more as criminals than as victims.
5. Most young people today try marijuana.
6. Alcohol abuse causes more problems in society than drug abuse.
7. Treatment should only be given to people addicted to drugs who intend to give up drugs for good.
8. I would tend to avoid someone who is addicted to drugs.
9. I would be nervous around someone who uses illegal drugs.
10. Money spent on the prevention of drug abuse is money well spent.
11. The use of marijuana should not be against the law.
12. People who are addicted to drugs are not given a fair chance to get along in society.
13. Occasional use of marijuana is not really dangerous.
14. People who end up with a drug problem have only themselves to blame.
15. Drugs are not really a problem in this country.
16. Treatment should be available to all people who are addicted to drugs.
17. People who are addicted to drugs really scare me.
18. Tougher sentences for people who abuse drugs is the answer to the drug problem in this country.
19. Most people are concerned about the drug problem in the United States.
20. Many people who are addicted to drugs exaggerate their troubles to get sympathy.
21. It is normal that young people will try drugs at least once.
22. The drug problem in the United States is out of control.
23. Almost all people who are addicted to drugs addicts are dangerous.
24. Drug education in schools should start at the primary level.
25. Drug related crime is a major problem in the United States today.
26. Reports about the extent of drug use among young people are exaggerated by the media.

27. People who are addicted to drugs who are charged with petty offenses should be given a choice between treatment and time in prison.
28. It would bother me to live near a person who is addicted to drugs.
29. Regular use of marijuana is just as dangerous to your health as regular use of heroin.
30. The availability of illegal drugs poses a great threat to young people.

Appendix D: Demographic Questionnaire

- 1. What is your age?**
- 2. Gender**
 - a. Male
 - b. Female
 - c. I wish not to answer
- 3. What is your ethnicity?**
 - a. American Indian/Alaskan
 - b. Hawaiian Native or other Pacific Islander
 - c. Black
 - d. Asian American
 - e. Hispanic
 - f. White
 - g. Other (Please Identify) _____
 - h. I wish not answer
- 4. What is your religious preference?**
 - a. Agnostic
 - b. Atheist
 - c. Buddhism
 - d. Christianity
 - e. Islam
 - f. Judaism
 - g. Other (Please Identify) _____
 - h. I wish not to answer
- 5. Have you ever used marijuana?**
 - a. I've never tried marijuana
 - b. I've tried it but only once or twice
 - c. I use it on occasion
 - d. I use it regularly
- 6. Do you personally know anyone that is currently using marijuana?**
 - a. Yes
 - b. No
- 7. Do you favor legalizing marijuana for recreational use?**
 - a. Yes
 - b. No
- 8. Do you favor laws legalizing the use of medical marijuana for adults under medical supervision?**
 - a. Yes
 - b. No
- 9. Do you favor laws legalizing the use of medical marijuana for children under medical supervision?**
 - a. Yes
 - b. No

Appendix E: Follow-Up Questionnaire

Given To All Outcome Conditions:

1. Consider Josh's condition before the marijuana treatment began. Please indicate how severe you perceived his condition to be.

1	2	3	4	5	6
Not severe at all					Extremely
severe					

2. Please choose Josh's diagnosis

- a) Autism Spectrum Disorder (ASD)
- b) Epilepsy
- c) Attention Deficit Hyperactive Disorder (ADHD)

3. Please choose the correct outcome of Josh's treatment.

- a) Josh's self-injurious behavior increased after receiving the marijuana treatment.
- b) Josh's self-injurious behavior decreased after receiving the marijuana treatment.
- c) There was no change in Josh's self-injurious behavior after receiving the marijuana treatment.
- d) I don't know the outcome of the treatment.

4. Given what you know about this case, how likely is it that the use of marijuana will decrease Josh's self-injurious behavior? (*Wording slightly changed in positive/negative condition; see below*).

0%-----100%

5. How risky do you think it was for Dr. Ellis to suggest the use of liquid marijuana to treat Josh's self-injurious behavior?

1	2	3	4	5	6
Not risky at all					Completely
risky					

6. Standard of care is typically defined as "that which a minimally competent physician in the same field would do under similar circumstances". Do you think that Dr. Ellis met the standard of care while treating Josh?

- a. If “YES” → You just indicated that you believe Dr. Ellis DID meet the standard of care. Please list all of the reasons you considered when making this determination.
- b. If “NO” → You just indicated that you believe Dr. Ellis did NOT meet the standard of care. Please list all of the reasons you considered when making this determination.

7. When thinking about the success of the drug, how sure should a minimally competent physician be before prescribing marijuana to a child?

0%-----100%

Additional Items Given In Positive/Negative Outcome Condition:

1. If you did not have knowledge of the outcome, how likely would you have thought it that the treatment would work? (*Wording slightly changed in the no outcome condition; see above*)

0%-----100%

2. To what extent were you surprised by the outcome?

1	2	3	4	5	6
Not at all					Completely

3. To what extent does it make sense to you that the use of marijuana decreased/increased Josh’s self-injurious behavior?

1	2	3	4	5	6
Not at all					Completely