

RUNNING HEAD: Predicting the Direction of Affective Forecasting Errors

Impact Bias or Underestimation?

Outcome Specifications Predict the Direction of Affective Forecasting Errors

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## ABSTRACT

Affective forecasts are used to anticipate the hedonic impact of future events and decide which events to pursue or avoid. We propose that because affective forecasters are more sensitive to outcome specifications of events than experiencers, the outcome specification values of an event, such as its duration, magnitude, probability, and psychological distance, can be used to predict the direction of affective forecasting errors: whether affective forecasters will overestimate or underestimate its hedonic impact. When specifications are positively correlated with the hedonic impact of an event, forecasters will overestimate the extent to which *high* specification values will intensify and *low* specification values will discount its impact. When outcome specifications are negatively correlated with its hedonic impact, forecasters will overestimate the extent to which *low* specification values will intensify and *high* specification values will discount its impact. These affective forecasting errors compound additively when multiple specifications are aligned in their impact: In Experiment 1, affective forecasters underestimated the hedonic impact of winning a smaller prize that they expected to win, and they overestimated the hedonic impact of winning a larger prize that they did not expect to win. In Experiment 2, affective forecasters underestimated the hedonic impact of a short unpleasant video about a temporally distant event, and they overestimated the hedonic impact of a long unpleasant video about a temporally near event. Experiments 3A and 3B showed that differences in the affect-richness of forecasted and experienced event underlie these differences in sensitivity to outcome specifications, the impact bias, and its reversal.

*Keywords:* Affective Forecasting, Impact Bias, Scope Sensitivity, Affect, Attention

People rely on affective forecasts to anticipate the emotional impact of future events. Consequently, affective forecasts have an integral role in decisions, from everyday choices about what to eat for lunch to consequential personal, medical, and legal decisions (e.g., Blumenthal, 2004; Ditto, Hawkins, & Pizarro, 2005; Eastwick, Finkel, Krishnamurti, & Loewenstein, 2008; Halpern & Arnold, 2008; Lau, Morewedge, & Cikara, 2016; Marroquín, Nolen-Hoeksema, & Miranda, 2013; Mellers & McGraw, 2001; Miloyan & Suddendorf, 2015; Riis et al., 2005; Woodzicka & LaFrance, 2001). Early affective forecasting research demonstrated a widespread *impact bias*, a systematic tendency for forecasters to overestimate the hedonic impact of future events (e.g., Eastwick et al., 2007; Gilbert, Morewedge, Risen, & Wilson, 2004; Gilbert, Pinel, Wilson, Blumberg, & Wheatley, 1998; Morewedge, Gilbert, Keysar, Berkovits, & Wilson, 2007; Sieff, Dawes, & Loewenstein, 1999; Wilson, Wheatley, Meyers, Gilbert, & Axsom, 2000; for comprehensive reviews, see Gilbert & Wilson, 2007; Wilson & Gilbert, 2003; 2005; 2013).

More recent research suggests that the impact bias may be less pervasive than previously suggested. Some researchers have recently argued that affective forecasters are reasonably calibrated in their ability to predict the hedonic impact of future events (Mathieu & Gosling, 2012). Others have attributed an entire class of research demonstrating the impact bias to procedural artifacts that confound comparisons between affective forecasts and experimenter reports (Levine, Lench, Kaplan, & Safer, 2012; 2013). Most important, in a considerable number of cases, a reversal of the impact bias has been demonstrated. Many instances have been recently catalogued in which forecasters *underestimate* the hedonic impact of future events (e.g., Andrade & VanBoven, 2010; Bosson, Pinel, & Vandello, 2010; Buechel, Zhang, Morewedge, & Vosgerau, 2014; Dunn, Biesanz, Human, & Finn, 2007; Ebert & Meyvis, 2014; Epley & Schroeder, 2014; Gilbert, Lieberman, Morewedge, & Wilson, 2004; Lench, Safer, & Levine,

2011; Nordgren, Banas, & McDonald, 2011).

We propose a theory that can elucidate these seemingly incongruous findings by identifying features of forecasted events that can be used to predict the direction of forecasting errors. We suggest that whether forecasters overestimate, underestimate, or accurately estimate the hedonic impact of future events is in large part a function of the values of the outcome specifications associated with the forecasted event, such as whether the event is consequential or trivial, long or short in duration, high or low in magnitude or probability, or near or far in psychological distance. We first provide an overview of demonstrations of the impact bias and its reversal. We then articulate our theory illuminating when and why outcome specification values can produce both kinds of affective forecasting errors.

### **The Scope of Forecasting Errors: An Ongoing Debate**

Early research in affective forecasting found that affective forecasters are generally accurate when predicting whether an event will be pleasant or unpleasant, but often err in their predictions of how pleasant or unpleasant the event will be (e.g., Arntz, 1996; Loewenstein & Schkade, 1998; Rachman & Arntz, 1991). This research documented an *impact bias*, a systematic tendency for forecasters to overestimate the intensity (i.e., intensity bias) and the duration<sup>1</sup> (i.e., durability bias) of hedonic reactions to future events (for reviews, see Gilbert & Wilson, 2007; Wilson & Gilbert, 2003; 2005; 2013). Research uncovering the cognitive and motivational processes underlying the impact bias documented its existence in a variety of domains, including hedonic responses to seropositive HIV tests (Sieff et al., 1999), being denied tenure (Gilbert et al., 1998), winning money (Morewedge et al., 2007), the dissolution of a

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<sup>1</sup> While the impact bias describes a misprediction of initial intensity (intensity bias) and duration (durability bias), the present research focuses on the intensity bias.

romantic relationship (Eastwick et al., 2007; Gilbert et al., 1998), narrowly missing a train (Gilbert, Morewedge et al., 2004), the outcome of political elections (Gilbert et al., 1998; Lau et al., 2016), living in California (Schkade & Kahneman, 1998), and a favorite team winning or losing a sporting event (Lau et al., 2016; Wilson et al., 2000).

More recent findings have challenged the significance and validity of the impact bias, sparking an ongoing debate in this line of inquiry (e.g., Levine et al., 2012; 2013; Mathieu & Gosling, 2012; Wilson & Gilbert, 2013). Recent direct challenges to the impact bias include suggestions that (a) its size depends on the metric by which affective forecasters are evaluated, and (b) that many previous demonstrations of the impact bias were invalid demonstrations due to a procedural artifact. In a meta-analysis of affective forecasting studies, Mathieu and Gosling (2012) argued that when accuracy is computed in an absolute sense, affective forecasters do have difficulty predicting the absolute intensity of their hedonic response events, but “when accuracy is computed in a relative sense, people are reasonably good at predicting how they will feel” (p. 162). In other words, forecasters are inaccurate when predicting exactly how good or bad positive and negative events will make them feel, but they accurately predict which positive events will make them feel better and which negative events will make them feel worse.

Challenging the conceptual and empirical validity of many demonstrations of the impact bias, Levine and colleagues (2012; 2013) argued that procedural artifacts - rather than psychological biases - were responsible for many demonstrations of the intensity bias: “[our] results indicate that people can predict the intensity of their feelings about events with a high degree of accuracy, and that a procedural artifact contributes to people’s tendency to overestimate the intensity of their feelings in general” (Levine et al., 2012, p. 598). Levine and colleagues argued that affective forecasters and experiencers differently interpret the questions

they are asked: Forecasters interpret the question as referring to their emotional response to the specified event, whereas experiencers interpret the question as referring to their feelings in general. They claim to find that when both forecasters and experiencers are asked specifically about how the event will or does make them feel, the intensity bias is eliminated (Levine et al. 2012; 2013; for a response to these criticisms see Wilson & Gilbert, 2013).

Most important, challenges to the prevalence of the impact bias have emerged from a growing number of cases in which forecasters systematically *underestimate* the hedonic impact of future events. For instance, women underestimate the anger and disgust induced by benevolent sexism (Bosson et al., 2010). Both men and women underestimate the emotional benefits of positive interactions with strangers (Dunn et al., 2007; Epley & Schroeder, 2014), the distress of being mildly insulted (Gilbert, Lieberman et al. 2004), and the pain induced by being socially excluded by strangers (Nordgren et al., 2011). People underestimate the pleasure they will derive from prizes they expect to win (Buechel et al., 2014) and the pleasure and pain derived from learning the outcome of a gamble that they had already decided to forego (Andrade & VanBoven, 2010). In addition, people underestimate the extent to which seemingly trivial contextual considerations of outcomes, such as the precise location of a prize, will impact their response to that outcome (Levine et al., 2011). Lastly, people underestimate the extent to which they will be affected by fictional, temporally distant, and hypothetical events such as reading a fictional or old news story about a girl dying (Ebert & Meyvis, 2014).

Like demonstrations of the impact bias, these demonstrations of its reverse establish systematic and replicable biases in affective forecasting. They suggest, however, that the direction of affective forecasting errors is less uniform than indicated by initial research in this area. And while different individual theories have been proposed to explain each of these

systematic reversals (e.g., Buechel et al., 2014; Ebert & Meyvis, 2014; Gilbert, Lieberman, et al. 2004), no theory to date has offered a comprehensive account explaining when and why affective forecasters exhibit both the impact bias and its reversal across such a variety of domains.

### **Outcome Specifications and Hedonic Impact in Prospect and Experience**

We propose that values of the focal outcome specifications associated with an event predict when forecasters will exhibit an impact bias and when they will exhibit the opposite forecasting error, that is, when they will underestimate the intensity of their emotional responses to a future event.

Events are associated with “outcome specifications.” Events vary on dimensions such as scope (e.g., magnitude, length, significance), likelihood (e.g., probability, expectedness), and psychological distance (e.g., abstractness, temporal distance, spatial distance, social distance, veracity; Morewedge & Hershfield, 2015; Trope & Liberman, 2010). A surgical procedure, for instance, may have a small or large impact on one’s health, be short or long, have a small or large likelihood of success, and may loom in the near or distant future. These outcome specification values can influence the hedonic impact of events (Mellers, 2000; Mellers, Schwartz, Ho, & Ritov, 1997; Morewedge, 2015). They are sometimes positively correlated with the hedonic impact of an event; presumably, winning more money is better than winning less money, and having a longer commute is usually worse than having a shorter commute (Mellers et al., 1997; Morewedge, Kassam, Hsee, & Caruso, 2009). Outcome specifications can also be negatively correlated with the hedonic impact of an event; presumably, winning \$100 feels better if one had a 1% chance of winning than a 99% chance, and receiving \$100 today is more

exciting than receiving \$100 a year from today (Brandstaetter, Kuehberger, & Schneider, 2002; Ebert & Meyvis, 2014; Mellers et al., 1997).

Critically, outcome specification values appear to impact affective forecasts more than the corresponding experiences<sup>2</sup>. Forecasters are more sensitive than are experiencers to magnitude specifications, including the size of their income (Aknin, Norton, & Dunn, 2009), the number of victims who die in a disaster (Dunn & Ashton-James, 2008), and the comparative value of a prize (Morewedge, Gilbert, Myrseth, Kassam, & Wilson, 2010). Similarly, they are more sensitive to the probability specifications of gains and losses (Buechel et al., 2014) and to the psychological distance of an event, such as whether it is real or fictional (Ebert & Meyvis, 2014).

One major source for this difference in sensitivity to outcome specifications is that experiences are more affect-rich than the simulations upon which affective forecasts rely. Affective forecasts are based on imagined or simulated reactions toward future events (Gilbert & Wilson, 2007; Morewedge & Hershfield, 2015) that are typically less vivid, intense, and emotional than the corresponding experience of that event (Buechel et al., 2014; Dunn & Ashton-James, 2008; Ebert & Meyvis, 2014; Morewedge et al., 2010). The visceral intensity of feeding, mating, and speaking, for example, is greater when engaging in those activities than when simulating them in advance (e.g., Loewenstein, 1996; Nordgren, van der Pligt, van Harreveld, 2007; Van Boven, Loewenstein, Welch, & Dunning, 2012).

People are quick to orient to emotional stimuli (Bradley, 2009; Yiend, 2010), and emotionally intense stimuli capture attention away from other present stimuli and abstract

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<sup>2</sup> Probability and magnitude specifications have been shown to influence both predicted (Brandstaetter et al., 2002) and reported hedonic responses to outcomes (Mellers et al., 1997), but these demonstrations occurred in within-subject designs, which generally increase scope sensitivity (Hsee & Zhang, 2004; 2010). In demonstrations using between-subject designs, forecasters have been shown to be more sensitive to outcome specifications than experiencers (Buechel et al., 2014).

features (Eccleston & Crombez, 1999). As affect-rich stimuli usurp finite attentional resources, they reduce the attentional resources available to devote to and be sensitive to outcome specifications (Hsee & Rottenstreich, 2004; Morewedge et al., 2010; Rottenstreich & Hsee, 2001). Because hedonic experiences are more affect-rich than the corresponding simulations upon which forecasts are based, we suggest that experiences are more likely to usurp the attentional resources necessary to attend to and be impacted by outcome specifications. As a consequence, affective forecasters are more sensitive to outcome specifications than experiencers (Buechel et al., 2014). In other words, because prospective simulations are less affect-rich (i.e., less vivid, intense, and emotional), affective forecasters are more likely to attend to outcome specifications and therefore incorporate them into their predictions about how the outcome specifications will intensify or discount future affect (thus leading to an overweighting of outcome specifications in prospect as compared to experience reports).

Evidence most directly supporting our affective-attentional account comes from research examining the greater sensitivity of affective forecasters than experiencers to probability and psychological distance specifications, sometimes leading to underestimation of hedonic response (Ebert & Meyvis, 2014, see also Buechel et al., 2014) and sometimes leading to seeming overestimation of hedonic responses (Buechel et al., 2014). Buechel and colleagues (2014) found that affective forecasters are generally more sensitive to probability specifications than experiencers, but this difference is mitigated when the simulated event is affect-rich during forecasting. Forecasters were more sensitive to the probability of winning a cookie than experiencers when the simulated event was affect-poor (when the cookie was obscured by an opaque wrapper while forecasting). By contrast, forecasters were as insensitive to the probability

specifications of winning a cookie as experiencers when the simulated event was affect-rich (when the cookie lay uncovered on top of its wrapper while forecasting).

In line with our argument that attentional resources are required to attend to and be impacted by outcome specifications, diverting attentional resources via cognitive load diminishes the sensitivity of affective forecasters to probability specifications, and drawing attention to those probability specifications increases the sensitivity of experiencers to probability specifications (Buechel et al., 2014). Likewise, freeing up experiencers' attentional resources by inserting breaks into a movie or slowing the pace of consumption makes experiencers more sensitive to outcome specifications, including the psychological distance and comparative value of the event experienced, leading to more accurate forecasts (Ebert & Meyvis, 2014; Morewedge et al., 2010). With breaks inserted into a sad movie, for instance, experiencers felt worse when the movie was presumably based on a real event than on a fictional event. Without breaks, experiencers felt similarly bad whether the movie was based on a real or fictional event (Ebert & Meyvis, 2014).

### **Predicting the Direction of Forecasting Errors**

We propose that these differences in sensitivity to outcome specifications between forecasters and experiencers can be used to predict whether affective forecasters will *overestimate* or *underestimate* the hedonic impact of events. Specifically, the direction in which a focal outcome specification and its value modulate the hedonic impact of an event indicates which affective forecasting error is more likely. When the focal outcome specification is positively correlated with the hedonic impact of an event (e.g., scope, magnitude, duration), forecasters should overestimate the extent to which high specification values will intensify its

impact and low specification values will diminish its impact. As these specification values increase, forecasters should then be increasingly likely to overestimate the hedonic impact of events (i.e., exhibit an impact bias). As these specification values decrease, forecasters should be increasingly likely to underestimate the hedonic impact of events (i.e., exhibit its reversal). Forecasters should be more likely to overestimate than underestimate how happy they would be if they won a large amount of money, for example, and should be more likely to underestimate than overestimate how happy they would be if they won a small amount of money.

Conversely, when the focal outcome specification is negatively correlated with the hedonic impact of an event (e.g., psychological distance, expectedness), forecasters should overestimate the extent to which low specification values will intensify its impact and high specification values will diminish its impact. As these specification values decrease, forecasters should then be increasingly likely to overestimate the hedonic impact of events (i.e., exhibit the impact bias). As these specification values increase, forecasters should be increasingly likely to underestimate the hedonic impact of events (i.e., exhibit its reversal). Forecasters should be more likely to overestimate than underestimate how happy they would be if they won money that they would receive in the near future, for example, and should be more likely to underestimate than overestimate how happy they would be if they won money that they would receive in the distant future.

This theory also allows us to systematically predict affective forecasting errors when there is more than one focal outcome specification. More often than not, events vary on multiple outcome specifications that can influence their hedonic impact. Gambles usually explicitly specify an amount of money to be won and the likelihood of winning it, making both magnitude and probability focal outcome specifications (Mellers et al., 1997). Similarly, tenure at an

institution can matter more or less, can be nearer or farther in the future, and can be more or less assured, thereby varying in magnitude, psychological distance, and probability. Stories can be long or short, and the events they describe can be real or fictional, therefore varying in duration and psychological distance.

When events vary on multiple outcome specifications, we hypothesize that their combined effects on forecasting errors will be additive. Because affective forecasters are generally more sensitive to outcome specifications than experiencers, these additive effects should amplify forecasting errors when the levels of focal specifications are aligned in their modulation of hedonic impact, leading to systematic and predictable affective forecasting errors. Forecasters should be particularly likely to overestimate the hedonic impact of an event with high magnitude and low probability (or long duration and low psychological distance), for example, and particularly likely to underestimate the hedonic impact of an event with low magnitude and high probability (or short duration and high psychological distance).

The additive prediction of our theory also suggests that the propensity for focal outcome specifications to induce affective forecasting errors should be diminished when those specifications are misaligned in their modulation of hedonic impact. Due to their countervailing effects, forecasters should exhibit greater accuracy for high magnitude events that are also of high probability (or long in duration and far in distance), for instance, and low magnitude events that are of low probability (or short in duration and near in distance).

### **Overview of Experiments**

In strenuous interaction tests (Shadish, Cook, & Campbell, 2002), we first examine the ability of our theory to predict these reinforcing and mitigating effects. We examine our theory's

ability to predict the presence and direction of forecasting errors when we manipulate both the probability and magnitude of a positive event in Experiment 1 and when we manipulate both the psychological distance and the duration of a negative event in Experiment 2. We then test our theory that affect-richness underlies the different sensitivity of forecasters and experiencers to outcome specifications of an event. In Experiments 3A and 3B, we freeze on one level of each specification used in Experiment 2 and manipulate the affect-richness of the event for forecasters. We conceptually replicate the direction of forecasting errors in Experiment 2 when the forecasted event is affect-poor: overestimation in Experiment 3A and underestimation in Experiment 3B. More important, we show that when the forecasted event is as affect-rich as the experienced event, forecasters are no more sensitive than experiencers to duration and psychological distance.

### **Experiment 1: Probability and Magnitude**

We first tested the predictive validity of our theory by testing its ability to anticipate when forecasters would overestimate and underestimate a positive experience that varied with regard to its probability (adapted from Buechel et. al 2014) and magnitude. Participants forecasted or reported their happiness upon winning a small or large bag of chocolate, with the prior probability of winning set to 10% or 90%. We predicted that forecasters would be more sensitive to both magnitude and probability specifications than experiencers.

More important, as affective forecasting errors should be amplified when outcome specifications are aligned in their modulation of hedonic impact, we predicted that forecasters would overestimate how happy experiencers would be to win the large bag given a 10% probability of winning, and that they would underestimate how happy experiencers would be to

win the small bag given a 90% probability of winning. And as forecasting errors should be mitigated when outcome specifications have countervailing influences on hedonic impact, we predicted that forecasters would be more accurate when forecasting how happy experiencers would be to win the large bag given a 90% chance and the small bag given a 10% chance.

## Method

### *Participants and Design*

Three hundred and ninety undergraduate students and pedestrians (149 females;  $M_{\text{age}} = 24.56$  years,  $SD = 9.66$ ) received course credit or \$2 for participating<sup>3</sup>. Each was randomly assigned to one condition in a 2 (role: forecaster, experiencer) x 2 (magnitude: small, large) x 2 (probability of winning: 10%, 90%) between-subjects design.

### *Procedure*

Each participant was seated in a private cubicle with a double-sided paper-and-pencil survey and a prize. In the small magnitude condition, the prize in the cubicle was one .5oz packet of M&M's. In the large magnitude condition, the prize in the cubicle was a bag (~11oz) containing twenty-one .5oz packets of M&M's. All participants then played a game of chance. Participants were told that they would win the prize if they drew a ball marked with an "X" from an opaque bag containing 10 balls. Participants in the 10% probability of winning condition were told that 1 of the 10 balls was marked with an "X." Participants in the 90% probability of winning condition were told that 9 of the 10 balls were marked with an "X." We actually marked

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<sup>3</sup>We planned to collect ~ 50 participants per cell for each of our experiments (except for Experiment 3B, see page 29). Target sample sizes for Experiments 1, 2 and 3A were based on published studies comparing the sensitivity of (affect-poor) forecasters with the sensitivity of experiencers and affect-rich forecasters (e.g., Buechel et al., 2014), which were reliably successful with a sample size of  $\leq 50$  participants per condition, with a mean effect size of  $\eta_p^2 = .05$  (i.e., a medium effect size). Variations in cell sizes are due to online completion rates and lab session attendance.

7 balls with an “X” so that the majority (but not all) of the participants drew a winning ball to minimize suspicion that the game was rigged.

Forecasters first predicted how happy they would be if they drew a ball with an “X” and won the prize on a 13-point scale with endpoints,  $1 = \textit{Very Unhappy}$  and  $13 = \textit{Very Happy}$ . They then drew a ball and won the prize if they drew a ball with an “X.” They did not win the prize if they drew an unmarked ball.

Experiencers first drew a ball and won the prize if they drew a ball with an “X.” They did not win the prize if they drew an unmarked ball. They then reported how they felt on the same scale used by forecasters.

As manipulation checks, all participants then assessed their subjective likelihood of winning on a 13-point scale with endpoints,  $1 = \textit{Extremely Low}$  and  $13 = \textit{Extremely High}$ , and the subjective size of the prize on a 13-point scale with endpoints,  $1 = \textit{Extremely Small}$  and  $13 = \textit{Extremely Large}$ . As an attention/comprehension check, we asked participants at the end of the survey to recall the stated probability of winning the prize in an open-response format.

## Results

### *Exclusions*

Only participants who correctly recalled their probability of winning were included in subsequent analyses. An additional 57 experiencers who did not win the prize were excluded from the analyses, leaving a final sample of 272 participants. Exclusion criteria were determined in advance and did not differ by condition,  $\chi^2(1, N = 390) < 2.55, ps > .13$ . There were no other exclusions. Differences in degrees of freedom reflect missing values for the reported variable.

### *Manipulation Checks*

Our manipulations of outcome specifications were successful. A 2 (role: forecaster, experiencer) x 2 (magnitude: small, large) x 2 (probability of winning: 10%, 90%) between-subjects ANOVA revealed that the subjective likelihood of winning was lower in the 10% conditions ( $M = 4.22$ ,  $SD = 2.27$ ) than in the 90% conditions ( $M = 10.81$ ,  $SD = 7.41$ ),  $F(1, 253) = 77.30$ ,  $p < .001$ ,  $\eta_p^2 = .23$ . No other effects or interactions were significant, all  $F$ s  $< 2.98$ ,  $ps > .09$ .

A 2 (role: forecaster, experiencer) x 2 (magnitude: small, large) x 2 (probability of winning: 10%, 90%) between-subjects ANOVA revealed that the subjective magnitude of the large prize was greater ( $M = 8.73$ ,  $SD = 2.77$ ) than the small prize ( $M = 5.09$ ,  $SD = 2.47$ ),  $F(1, 253) = 111.79$ ,  $p < .001$ ,  $\eta_p^2 = .31$ . No other main effects or interactions were significant, all  $F$ s  $< 3.11$ ,  $ps > .08$ .

#### *Forecasted and Experienced Emotional Impact*

Happiness ratings were submitted to a 2 (role: forecaster, experiencer) x 2 (magnitude: small, large) x 2 (probability of winning: 10%, 90%) between-subjects ANOVA. The analysis revealed a main effect of probability,  $F(1, 262) = 6.92$ ,  $p = .01$ ,  $\eta_p^2 = .03$ . More important, the analysis revealed the two predicted significant two-way interactions between role and outcome specifications (see Figure 1): A Role x Probability interaction indicated that forecasters were more sensitive to probability specifications than were experiencers,  $F(1, 262) = 7.87$ ,  $p = .005$ ,  $\eta_p^2 = .03$ . A Role x Magnitude interaction indicated that forecasters were more sensitive to magnitude specifications than were experiencers,  $F(1, 262) = 4.02$ ,  $p = .04$ ,  $\eta_p^2 = .02$ . All unreported effects:  $F$ s  $< 1.80$ ,  $ps > .18$ . The three-way interaction was not significant ( $F < 1$ ), suggesting additive effects of outcome specifications among affective forecasters (i.e., both

specifications influenced forecasts, but their effects were not multiplicative; see General Discussion).

As predicted, additive differences in sensitivity to outcome specifications between forecasters and experiencers produced two qualitatively different forecasting errors when they were aligned in their modulation of the hedonic impact of the event: Simple effect tests revealed that in the large-magnitude/10% chance of winning conditions, forecasters *overestimated* their happiness about winning the prize ( $M = 10.53$ ,  $SD = 1.65$ ) compared to experiencers ( $M = 9.04$ ,  $SD = 2.61$ ),  $F(1, 262) = 9.18$ ,  $p = .003$ ,  $\eta_p^2 = .03$ . Conversely, in the small-magnitude/90% chance of winning conditions, forecasters *underestimated* their happiness about winning the prize ( $M = 8.38$ ,  $SD = 1.63$ ) compared to experiencers ( $M = 9.25$ ,  $SD = 1.58$ ),  $F(1, 262) = 4.03$ ,  $p = .04$ ,  $\eta_p^2 = .02$ .

Forecasts were more accurate when the effects of outcome specifications were countervailing. Affective forecasts and experiencers' reports did not differ for the small-magnitude/10% chance of winning conditions or the large-magnitude/90% chance of winning conditions,  $F_s < 1$ .

### Discussion

Affective forecasters were more sensitive than experiencers to outcome specifications. Forecasters exhibited greater sensitivity to the probability and the magnitude of a positive event when predicting its hedonic impact than did experiencers when reporting its hedonic impact. These analyses conceptual replicate differences between forecasters and experiencers in their sensitivity to probability (Buechel et al., 2014) and demonstrate the generalization of this difference in specification sensitivity to another outcome specification (i.e., magnitude) in the same experiment.

More important, the results demonstrate how different sensitivity to probability and magnitude specifications can jointly produce both underestimation and overestimation in affective forecasts. When these two outcome specifications were aligned in their modulation of hedonic impact, their additive effects produced the two qualitatively different forecasting errors predicted by our theory: Forecasters overestimated how happy experiencers would feel about winning a large prize given a low probability of winning and underestimated how happy experiencers would feel about winning a small prize given a high probability of winning. When the two outcome specifications were misaligned in their modulation of hedonic impact, the effects on forecasters were countervailing and the affective forecasts were more accurate. Forecasters accurately predicted how happy experiencers would feel about winning a large prize given a high probability and about winning a small prize given a low probability.

### **Experiment 2: Duration and Psychological Distance**

We next tested the predictive validity of our theory by testing its ability to anticipate when affective forecasters would overestimate and underestimate a negative experience that varied with regard to its psychological distance (inspired by Ebert & Meyvis, 2014) and duration. Participants forecasted or reported how bad they would or did feel immediately after watching either a ten-second or a three-minute long video of a puppy trapped in a sewer, an event that supposedly had been filmed either two days or eight years before. We predicted that forecasters would be more sensitive than experiencers to both duration and psychological distance specifications.

More important, as affective forecasting errors should be amplified when outcome specifications are aligned in their modulation of hedonic impact, we predicted that forecasters

would overestimate how bad experiencers would feel after watching the longer video of a more recent event and underestimate how bad experiencers would feel after watching the shorter video of a more distant event. And as forecasting errors should be mitigated when outcome specifications have countervailing influences on hedonic impact, we predicted that forecasters would be more accurate when forecasting how bad experiencers would feel after watching the shorter, more recent video and the longer, more distant video.

## Method

### *Participants and Design*

Four hundred and sixty-nine Mturk workers (222 females;  $M_{\text{age}} = 34.07$  years,  $SD = 11.53$ ) received 40¢ for participating. Each was randomly assigned to one condition in a 2 (role: forecaster, experiencer) x 2 (duration: short, long) x 2 (psychological distance: near, distant) between-subjects design.

### *Procedure*

Participants first saw a thumbnail with an image of a puppy trapped in a sewer, a preview of the video they would watch during the experiment. To manipulate event duration, participants were told that the video was either ten seconds long (short duration condition) or three minutes long (long duration condition). To manipulate the psychological distance of the event, participants were told the event had been filmed either two days before (near condition) or eight years before (distant condition). The video was selected such that the frame in the thumbnail and video contained the same subject, action, and background (i.e., a puppy, walking, in a sewer pipe), see also Discussion of Experiment 3A and 3B.

Forecasters first predicted how sad, distressed, and absorbed they would be after watching the video on 9-point scales with the endpoints,  $1 = \textit{Not at All}$  and  $9 = \textit{Very Much}$

(adapted from Ebert & Meyvis, 2014). They then watched the video. Experiencers first watched the video and then reported their current feelings on the same scales.

As manipulation checks, participants then assessed the subjective duration of the video, the subjective temporal distance of the event, and the believability of the video on 7-point scales with endpoints,  $1 = \textit{Very Short}$  and  $7 = \textit{Very Long}$ ,  $1 = \textit{Very Close}$  and  $7 = \textit{Very Far}$ , and  $1 = \textit{Not at All}$  and  $7 = \textit{Very}$ , respectively. Finally, we administered an attention check (Oppenheimer, Meyvis, & Davidenko, 2009).

## Results

### *Exclusions*

Only participants who passed the attention check were included in the subsequent analyses. This exclusion criterion was determined in advance. In addition, we excluded participants without a novel IP address after noticing several duplications of the same IP address, leaving a final sample of 403 participants. Exclusions did not differ by conditions,  $\chi^2$ s (1,  $N = 469$ )  $< 1.60$ ,  $ps > .20$ . There were no other exclusions. Differences in degrees of freedom reflect missing values for the reported variable.

### *Manipulation Checks*

Our manipulations of outcome specifications were successful. A 2 (role: forecaster, experiencer) x 2 (duration: short, long) x 2 (psychological distance: near, distant) between-subjects ANOVA revealed that the subjective duration of the ten-second video was shorter ( $M = 1.49$ ,  $SD = 1.39$ ) than that of the three-minute video ( $M = 4.29$ ,  $SD = 2.04$ ),  $F(1, 385) = 195.24$ ,  $p < .001$ ,  $\eta_p^2 = .33$ . No other effects or interactions were significant,  $F$ s  $< 1$ .

A 2 (role: forecaster, experiencer) x 2 (duration: short, long) x 2 (psychological distance: near, distant) between-subjects ANOVA revealed that the event was psychologically closer when

it had presumably occurred two days before ( $M = 3.16$ ,  $SD = 2.19$ ) than eight years before ( $M = 4.14$ ,  $SD = 2.72$ ),  $F(1, 384) = 15.00$ ,  $p < .001$ ,  $\eta_p^2 = .04$ . No other effects or interactions were significant  $F_s < 1.90$ ,  $p_s > .17$ .

Our manipulations did not affect the believability of the videos. A 2 (role: forecaster, experiencer) x 2 (duration: short, long) x 2 (psychological distance: near, distant) between-subjects ANOVA revealed that all versions of the video were perceived to be similarly believable, all  $F_s < 1.80$ ,  $p_s > .18$ .

#### *Forecasted and Experienced Emotional Impact*

The three measures of emotional impact were highly correlated ( $\alpha = .75$ ) and aggregated into an index of negative affect (as in Ebert & Meyvis, 2014). This index was submitted to a 2 (role: forecaster, experiencer) x 2 (duration: short, long) x 2 (psychological distance: near, distant) between-subjects ANOVA. The analysis revealed a main effect of role,  $F(1, 395) = 4.45$ ,  $p = .04$ ,  $\eta_p^2 = .01$ . More important, the analysis revealed the two predicted significant interactions between role and outcome specifications (see Figure 2): A Role x Duration interaction indicated that forecasters were more sensitive to duration specifications than were experiencers,  $F(1, 395) = 7.74$ ,  $p = .006$ ,  $\eta_p^2 = .02$ . A Role x Distance interaction indicated that forecasters were more sensitive to temporal distance specifications than were experiencers,  $F(1, 395) = 5.21$ ,  $p = .02$ ,  $\eta_p^2 = .01$ . All unreported effects:  $F_s < 2.76$ ,  $p_s > .09$ . Again, the three-way interaction was not significant ( $F < 1$ ), suggesting additive effects of outcome specifications among forecasters.

As predicted, additive differences in sensitivity to outcome specifications between forecasters and experiencers produced two qualitatively different forecasting errors when outcome specifications were aligned in their modulation of hedonic impact. Simple effect tests revealed that in the long/near video conditions, forecasters *overestimated* how bad they would

feel ( $M = 6.89$ ,  $SD = 1.68$ ) compared to experiencers ( $M = 5.75$ ,  $SD = 1.66$ ),  $F(1, 395) = 10.23$ ,  $p = .001$ ,  $\eta_p^2 = .03$ . In the short/distant video conditions, however, forecasters marginally *underestimated* how bad they would feel ( $M = 5.51$ ,  $SD = 1.58$ ) compared to experiencers ( $M = 6.13$ ,  $SD = 1.61$ ),  $F(1, 395) = 3.45$ ,  $p = .064$  ( $p = .032$ , with the more appropriate one-tailed test; Rosenthal & Rosnow, 1991),  $\eta_p^2 = .01$ .

Forecasts were more accurate when the effects of outcome specifications were countervailing. Forecasts and experiencers' reports did not differ in the short/near video conditions,  $F(1, 395) = 1.50$ ,  $p > .20$ , and forecasters only marginally overestimated negative affect in the long/distant video conditions,  $F(1, 395) = 3.03$ ,  $p = .08$ ,  $\eta_p^2 = .004$ .

### Discussion

Extending our findings to a negative domain with two different outcome specifications, forecasters were more sensitive than experiencers to the hedonic impact of the duration and psychological distance of a negative event. These results conceptually replicate the finding of greater sensitivity of forecasters than experiencers to psychological distance (Ebert & Meyvis, 2014) and demonstrate the generalization of this difference in sensitivity to another outcome specification (i.e., duration) in the same experiment.

More important, the results demonstrate how different sensitivity to psychological distance and duration specifications can jointly produce both underestimation and overestimation in affective forecasts. When the two outcome specifications were aligned in their modulation of hedonic impact, their additive effects produced the two qualitatively different forecasting errors we had predicted: Forecasters overestimated how bad experiencers would feel after watching a long, temporally near video of a puppy trapped in a sewer and underestimated how bad experiencers would feel after watching a short, temporally distant video of a puppy trapped in a

sewer. When the two outcome specifications were misaligned in their modulation of hedonic impact, the effects on forecasters were countervailing, and the resulting affective forecasts were more accurate. Forecasters more accurately predicted how bad experiencers would feel after watching a short, temporally near video or a long, temporally distant video.

### **Experiments 3A and 3B: Differences in Affective State and Forecasting Errors**

Our theory proposes that differences in affect-richness of forecasted and experienced events underlie the errors in affective forecasting observed in the previous studies. If our theory is correct, these forecasting errors should be mitigated when forecasted and experienced events are similarly affect-rich. In Experiments 3A and 3B, we directly tested this prediction. We examined whether increasing the affect-richness of forecasted events would eliminate the differences in specification sensitivity of forecasters and experiencers found in the paradigm used in Experiment 2. In both experiments, forecasters predicted how bad they would feel after watching one version of the video of the trapped puppy used in Experiment 2. Experiencers reported how bad they felt after watching the same version of that video.

In Experiment 3A, we manipulated the duration of the psychologically near version of the video and the affect-richness of the event forecasted. In Experiment 3B, we manipulated the psychological distance of the short version of the video and the affect-richness of the event forecasted. A time delay manipulation was used to manipulate the affect-richness of the forecasted events in both experiments. All participants first watched the video assigned to their condition. Experiencers reported how they felt, as in previous experiments. In two forecaster conditions, forecasters predicted how they would feel if they watched the same video again one

week later<sup>4</sup>. These two forecaster conditions differed in a critical way: Forecasters in an affect-rich condition made their forecasts immediately after watching the video while the forecasted event was as affect-rich as the event was for experiencers. Forecasters in an affect-poor condition made their forecasts after a 3-minute delay when the forecasted event was less affect-rich than the event was for experiencers. This delay design also addresses the potential for forecasting errors in the previous experiment to be due to the possibility that the video thumbnail - upon which forecasts were based - was unrepresentative of the video.

Our theory predicts that forecasters in the affect-rich condition should be less sensitive to outcome specifications than forecasters in the affect-poor condition. Thus, whereas affective forecasters in the affect-poor condition should predict feeling worse than experiencers report in the long duration conditions in Experiment 3A and predict feeling less bad than experiencers report in the psychological distant conditions in Experiment 3B (as did forecasters in Experiment 2), affective forecasters in the affect-rich condition should not differ from experiencers in the extremity of their predictions in Experiment 3A and Experiment 3B.

## Experiment 3A: Duration

### Method

#### *Participants and Design*

Three hundred and ninety-four Mturk workers (185 females;  $M_{\text{age}} = 36.39$  years,  $SD = 12.99$ ) received 40¢ for participating. Each was randomly assigned to one condition in a 3 (role: experiencer, affect-rich forecaster, affect-poor forecaster) x 2 (duration: short, long) between-subjects design.

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<sup>4</sup> This gap in time was included so that forecasters would not need to account for the influence of hedonic adaptation in their forecasts, which could occur if the video was watched twice in a row, right then.

### *Procedure*

All participants watched the video of a puppy trapped in a sewer that had supposedly occurred two days before, the same video used in the psychologically near conditions in Experiment 2. As in Experiment 2, the video duration was ten seconds in the short condition and three minutes in the long condition. Experiment 3A thus used the same stimuli and outcome specifications as in the near psychological distance conditions in Experiment 2.

Immediately after watching the video, experiencers reported how sad, distressed, and absorbed they were on the same scales as used in Experiment 2. Participants in both forecaster conditions predicted how sad, distressed, and absorbed they would feel if they watched the same video again one week later on the same scales as experiencers. Forecasters in the affect-rich condition made their forecast immediately after watching the video while the event was still affectively intense. Forecasters in the affect-poor condition made their forecast after watching a neutral 3-minute video of the planet Earth as viewed from space, which has been demonstrated to reduce the intensity of previous affective experiences (Buechel et al., 2014).

As a manipulation check, participants then assessed the video's subjective duration on a 7-point scale with endpoints,  $1 = \textit{Very Short}$  and  $7 = \textit{Very Long}$ . Finally, we administered an attention check (Oppenheimer et al., 2009) and asked participants whether they were able to play the videos. We included this question because some participants in Experiment 2 reported having difficulties playing the video.

## Results

### *Exclusions*

Only the 361 participants who had a novel IP address, who passed the attention check, and who were able to play the videos were included in the subsequent analyses. These exclusion criteria were determined in advance, and exclusions did not differ by conditions,  $\chi^2$ s (1,  $N = 394$ )  $< 1.60$ ,  $ps > .90$ . There were no other exclusions. Differences in degrees of freedom reflect missing values for the reported variable.

### *Manipulation Check*

Our manipulation of outcome specifications was successful. A 3 (role: experiencer, affect-rich forecaster, affect-poor forecaster) x 2 (duration: short, long) between-subjects ANOVA revealed that the subjective duration of the ten-second video was shorter ( $M = 3.92$ ,  $SD = 1.53$ ) than the three-minute video ( $M = 6.57$ ,  $SD = .83$ ),  $F(1, 353) = 419.26$ ,  $p < .001$ ,  $\eta_p^2 = .54$ . No other main effects or interactions were significant, all  $F$ s  $< 1.90$ ,  $ps > .14$ .

### *Forecasted and Experienced Emotional Impact*

The three measures of emotional impact were highly correlated ( $\alpha = .86$ ) and aggregated into an index of negative affect, as in Experiment 2. This index was submitted to a 3 (role: experiencer, affect-rich forecaster, affect-poor forecaster) x 2 (duration: short, long) between-subjects ANOVA. The analysis revealed a significant main effect of role,  $F(1, 355) = 4.48$ ,  $p = .01$ ,  $\eta_p^2 = .03$ . More important, it revealed a significant Role x Duration interaction (see Figure 3),  $F(2, 355) = 3.42$ ,  $p = .03$ ,  $\eta_p^2 = .02$ . Unreported effect,  $F < 1$ .

We first decomposed the interaction to examine whether participants in each of the three role conditions exhibited sensitivity to duration specifications. In line with our argument that affect-richness underlies the difference in sensitivity to outcome specifications between forecasts and experiencer reports, only forecasters in the affect-poor condition showed significant sensitivity to video duration. Forecasters in the affect-poor condition predicted that they would

feel worse when the video was long ( $M = 7.04$ ,  $SD = 1.91$ ) than when it was short ( $M = 5.98$ ,  $SD = 2.44$ ),  $F(1, 355) = 6.90$ ,  $p = .01$ ,  $\eta^2 = .02$ . By contrast, experiencers reported feeling similarly bad, whether the video was long ( $M = 5.44$ ,  $SD = 2.37$ ) or short ( $M = 5.84$ ,  $SD = 2.27$ ),  $F < 1$ , and forecasters in the affect-rich condition predicted that they would feel similarly bad regardless of whether the video they watched was long ( $M = 6.03$ ,  $SD = 2.24$ ) or short ( $M = 6.05$ ,  $SD = 2.26$ ),  $F < 1$ .

To test specific predictions of our theory, we next decomposed the interaction by running custom contrasts comparing the sensitivity to psychological distance between pairs of the three role conditions. First, to examine whether the results replicated the pattern found in Experiment 2, we compared the predictions of affect-poor forecasters and the reports of experiencers in contrasts testing the 2 (role: experiencer, affect-poor forecaster) x 2 (duration: short, long) interaction. This analysis revealed that, as in Experiment 2, there was a significant Role x Duration interaction indicating that affect-poor forecasters were more sensitive to outcome specifications than experiencers,  $F(1, 355) = 6.22$ ,  $p = .01$ ,  $\eta_p^2 = .02$ . Mirroring the pattern of forecasting errors found in Experiment 2, affect-poor forecasters predicted they would feel worse compared to experiencers if they watched a long video about a psychologically near event (i.e., akin to overestimation),  $F(1, 355) = 15.47$ ,  $p < .001$ ,  $\eta_p^2 = .04$ , but their predictions did not differ from experiencer reports if they watched a short video about a psychologically near event,  $F < 1$ .

To test our hypothesis that differences in sensitivity found in Experiment 2 would be eliminated when the event was affect-rich during forecasts, we compared the predictions of affect-rich forecasters and the reports of experiencers in contrasts testing the 2 (role: experiencer, affect-rich forecaster) x 2 (duration: short, long) interaction. The analysis revealed

no interaction,  $F < 1$ . Furthermore, no overestimation was observed; the predictions made by affect-rich forecasters did not differ from experiencer reports,  $F_s < 1.82$ ,  $p_s > .17$ .

To directly test our hypothesis that the affect-richness of the event during forecasts determines forecasters' sensitivity to outcome specifications, we compared the two forecaster conditions in contrasts corresponding to the 2 (role: affect-rich forecaster, affect-poor forecaster) x 2 (duration: short, long) interaction. The analysis revealed a marginally significant Role x Duration interaction,  $F(1, 355) = 3.54$ ,  $p = .06$ ,  $\eta_p^2 = .01$ , tentatively suggesting that the affect-richness manipulation decreased sensitivity to outcome specifications among forecasters. Affect-poor forecasters predicted they would feel worse compared to affect-rich forecasters if they watched a long video about a psychologically near event,  $F(1, 355) = 6.20$ ,  $p = .01$ ,  $\eta_p^2 = .02$ , but their predictions did not differ from affect-rich forecasters if they watched a short video about a psychologically near event,  $F < 1$ .

### Experiment 3B: Psychological Distance

#### Method

##### *Participants and Design*

Seven hundred and fifty-five Mturk workers (447 females;  $M_{age} = 36.36$  years,  $SD = 12.46$ ) received 40¢ for participating. Each participant was randomly assigned to one condition in a 3 (role: experiencer, affect-rich forecaster, affect-poor forecaster) x 2 (psychological distance: near, distant) between-subjects design. Following the recommendation of Simonsohn (2015), we increased our target sample size by 250% from 50 to 125 participants per cell because Experiment 3A appeared to lack sufficient power to test all predictions of our theory (i.e., the

Role x Duration interaction between affect-poor and affect-rich forecasting conditions was only marginally significant).

### *Procedure*

All participants watched a ten second video of a puppy trapped in a sewer, the same video used in the short duration conditions in Experiment 2. As in Experiment 2, in order to manipulate the psychological distance of the event, participants were either told that the video had been filmed two days before (near condition) or eight years before (distant condition). In Experiment 3B, we thus used the same stimuli and outcome specifications as in the short video conditions in Experiment 2.

The remainder of the experiment was identical to Experiment 3A, with the following exceptions: The delay in the affect-poor forecaster condition was a writing task in which participants wrote for 3 minutes about a time when they had purchased office products (e.g., what type of products they had purchased and where they had purchased those products, etc.). Second, in this experiment, the manipulation check for the outcome specification assessed subjective temporal distance to the event on a 7-point scale with endpoints, *1 = Very Close* and *7 = Very Far*.

## Results

### *Exclusions*

Only the 663 participants who had a novel IP address, who passed the attention check, and who were able to play the video were included in the subsequent analyses. These exclusion criteria were determined in advance, and exclusions did not differ by conditions,  $\chi^2$ s (1,  $N = 755$ )  $< 2.90$ ,  $ps > .25$ . There were no other exclusions. Differences in degrees of freedom reflect missing values for the reported variable.

*Manipulation Check*

Our manipulation of outcome specifications was successful. A 3 (role: experiencer, affect-rich forecaster, affect-poor forecaster) x 2 (psychological distance: near, distant) between-subjects ANOVA revealed that the event was psychologically closer when it had presumably occurred two days before ( $M = 2.75$ ,  $SD = 1.77$ ) than eight years before ( $M = 4.44$ ,  $SD = 2.05$ ),  $F(1, 655) = 124.28$ ,  $p < .001$ ,  $\eta_p^2 = .16$ . No other main effects or interactions were significant, all  $F_s < 2.30$ ,  $p_s > .10$ .

*Forecasted and Experienced Emotional Impact*

The three measures of emotional impact were highly correlated ( $\alpha = .84$ ) and aggregated into an index of negative affect, as in Experiments 2 and 3A. This index was submitted to a 3 (role: experiencer, affect-rich forecaster, affect-poor forecaster) x 2 (psychological distance: near, distant) between-subjects ANOVA, which revealed no main effects,  $F_s < 1.90$ ,  $p_s > .13$ , only the predicted Role x Psychological Distance interaction (see Figure 4),  $F(2, 657) = 4.98$ ,  $p = .007$ ,  $\eta_p^2 = .02$ .

We first decomposed the interaction by examining whether participants in each of the three role conditions exhibited sensitivity to psychological distance specifications. In line with our argument that affect-richness underlies the difference in sensitivity to outcome specifications between forecasts and experiencer reports, only forecasters in the affect-poor condition exhibited sensitivity to outcome specifications. Forecasters in the affect-poor condition predicted that they would be less bad when the event in the short video was psychologically distant ( $M = 5.66$ ,  $SD = 2.13$ ) than when it was psychologically near ( $M = 6.53$ ,  $SD = 2.14$ ),  $F(1, 657) = 13.15$ ,  $p < .001$ ,  $\eta_p^2 = .02$ . By contrast, experiencers reported feeling similarly bad, whether the event in the short video was psychologically distant ( $M = 6.42$ ,  $SD = 1.93$ ) or near ( $M = 6.15$ ,  $SD = 1.85$ ),  $F < 1$ ,

and forecasters in the affect-rich condition predicted that they would feel similarly bad regardless of whether the video they watched was psychologically distant ( $M = 6.40$ ,  $SD = 2.13$ ) or near ( $M = 6.46$ ,  $SD = 1.80$ ),  $F < 1$ .

To test specific predictions of our theory, we next decomposed the interaction by running custom contrasts comparing the sensitivity to psychological distance between pairs of the three role conditions. First, to examine whether the current results replicate the pattern found in Experiment 2, we ran contrasts testing the 2 (role: experiencer, affect-poor forecaster) x 2 (psychological distance: near, distant) interaction. Replicating Experiment 2, it revealed a significant Role x Psychological Distance interaction,  $F(1, 657) = 8.70$ ,  $p = .003$ ,  $\eta_p^2 = .01$ , indicating that affect-poor forecasters were more sensitive to outcome specifications than experiencers. Mirroring the pattern of forecasting errors found in Experiment 2, affect-poor forecasters predicted they would feel less bad compared to experiencers if they watched a short video about a psychologically distant event (i.e., akin to underestimation),  $F(1, 657) = 7.11$ ,  $p = .01$ ,  $\eta_p^2 = .01$ , whereas their predictions did not differ from experiencer reports if they watched a short video about a psychologically near event,  $F(1, 657) = 2.14$ ,  $p = .15$ .

To test our hypothesis that differences in sensitivity found in Experiment 2 would be eliminated when the event was affect-rich during forecasts, we ran contrasts testing the 2 (role: experiencer, affect-rich forecaster) x 2 (psychological distance: near, distant) interaction. The analysis revealed no Role x Psychological Distance interaction,  $F < 1$ . Furthermore, no underestimation was observed; the predictions made by affect-rich forecasters did not differ from experiencer reports,  $F_s(1, 657) < 1.35$ ,  $p > .24$ .

To directly test our hypothesis that the affect-richness of the event during forecasts determines forecasters' sensitivity to outcome specifications, we compared the two forecaster

conditions by testing contrasts corresponding to the 2 (role: affect-rich forecaster, affect-poor forecaster) x 2 (psychological distance: near, distant) interaction. It revealed a significant Role x Psychological Distance interaction,  $F(1, 657) = 5.13, p = .02, \eta_p^2 = .01$ , indicating that the affect-richness manipulation decreased sensitivity to outcome specifications among forecasters. Affect-poor forecasters predicted they would feel less bad compared to affect-rich forecasters if they watched a short video about a psychologically distant event,  $F(1, 657) = 8.93, p = .003, \eta_p^2 = .01$ , but their predictions did not differ from affect-rich forecasters if they watched a short video about a psychologically near event,  $F < 1$ .

### Discussion

Differences in the affect-richness of forecasted and experienced events appear to underlie the difference in sensitivity between forecasters and experiencers to outcome specifications, accounting for both kinds of forecasting errors. Forecasters in the affect-poor conditions made their forecasts only 3 minutes after watching the same video that experiencers watched, yet they were more sensitive to duration and psychological distance than were experiencers. Consequently, they made forecasts consistent with overestimation after watching the psychologically near, long video (Experiment 3A), and they made forecasts consistent with underestimation after watching the psychologically distant, short video (Experiment 3B). By contrast, affective forecasters in the affect-rich conditions, whose forecasts were made while the forecasted event was affect-rich, were as insensitive to outcome specifications as were experiencers. Consequently, they made forecasts consistent with experiencer reports. The results provide evidence that converges with previous work showing that increasing the affect-richness of forecasted events reduces forecasters' sensitivity to probability specifications (Buechel et al.,

2014), and that reducing the affect-richness of experienced events with a filler task increases experiencers' sensitivity to psychological distance specifications (Ebert & Meyvis, 2014).

In addition to conceptually replicating Experiment 2 in the affect-poor forecasting and experiencer conditions, the design and results of Experiments 3A and 3B rule out several alternative accounts. First, all forecasters and experiencers saw the same event before making their judgments. This suggests that the different sensitivity of forecasters and experiencers to outcome specifications cannot be attributed to forecasters and experiencers having different information highlighted or having access to different information during judgment (e.g., Nisbett, Zukier, & Lemley, 1981). As forecasts made after watching the video corresponded closely to forecasts made before watching the video in Experiment 2, the results also suggest that forecasting errors in Experiment 2 were not due to an insufficient understanding of the experience they were about to have. Second, forecasters in the affect-rich and affect-poor conditions answered the same question and made the same judgment about the same future event. Thus, differences between the two forecaster conditions cannot be attributed to differences in their interpretations of the question they were asked or differences in the kind of judgments they made (Grice, 1975; Levine et al., 2012; 2013).

### **General Discussion**

We find compelling evidence that our theory can predict when - and explain why - affective forecasters are more likely to overestimate or underestimate the hedonic impact of future events. Because affective forecasters are more sensitive to outcome specifications than are experiencers, the direction of affective forecasting errors is predicted by the direction in which

outcome specifications modulate the hedonic impact of events. When outcome specifications are positively correlated with the hedonic impact of an event, affective forecasters overestimate the extent to which high specification values will intensify and low specification values will discount its impact. When they are negatively correlated with the hedonic impact of an event, affective forecasters overestimate the extent to which low specification values will intensify and high specification values will discount its impact.

Consistent with our predictions, when two outcome specifications were aligned in their modulation of hedonic impact, their additive effect led to two predictable and qualitatively different forecasting errors: overestimation and underestimation of hedonic responses. Experiment 1 demonstrated that affective forecasters were more sensitive than experiencers to the magnitude and probability specifications of a positive event. As a result, forecasters overestimated how happy they would feel about winning a large prize they did not expect to win and underestimated how happy they would feel about winning a small prize that they expected to win. Experiment 2 showed that this pattern generalized to negative events and two different outcome specifications, duration and psychological distance. Forecasters overestimated how bad experiencers would feel after watching a long video of an unpleasant psychologically near event and underestimated how bad experiencers would feel after watching a short video of an unpleasant psychologically distant event. Outcome specifications led to weaker, less consistent forecasting errors when their effects were in opposition.

Note that, as our theorizing and our studies imply, we do not suggest that forecasting errors will be absent in all cases of opposing outcome specifications. One case in which opposing specifications are unlikely to have nullifying effects is when the level of one specification is less extreme than another specification. When the probability of winning a large prize is 52%, the

probability specification would probably not be high enough to counteract the influence of a large magnitude on overestimation. A second case in which opposing specifications are unlikely to have nullifying effects is when one outcome specification is more heavily weighted in prediction than in experience for integral or incidental reasons (e.g., Aknin et al., 2009; Kahneman, Krueger, Schkade, & Stone, 2006). When estimating how bad one would feel after a 1-hour or 12-hour medical procedure, for example, forecasters might naturally attend more to the duration of the procedure than to whether it is scheduled to take place in a week or a month.

In both the first and second case, the dampening effects of countervailing outcome specifications may not fully cancel out the impact of the other specification on affective forecasting errors. Indeed, we found directional forecasting errors in a few cases where outcome specifications had countervailing effects. In Experiment 2, we found that affective forecasters predicting how bad they would feel after watching the longer but psychologically distant video exhibited marginal overestimation, despite the countervailing effects of the two specifications. It is possible that the psychological distance manipulation was not sufficiently extreme to fully mitigate the intensifying effect of the video's duration, or that the duration of the video was weighted more heavily than the psychological distance of the event in affective forecasts.

Experiments 3A and 3B identify differences in the affect-richness of forecasted and experienced events as the underlying process responsible for both forecasting errors. Increasing the affect-richness of forecasted events in Experiments 3A and 3B eliminated both the cases of overestimation and underestimation exhibited by forecasters in Experiment 2. In addition to establishing process evidence for our theory, the design of these experiments also rules out alternative explanations for forecasting errors, including ones raised by recent critiques of existing demonstrations of the impact bias (Levine et al., 2012).

*Theoretical Contributions*

The present research makes important theoretical contributions. First, the research integrates what may appear to be contradictory findings in the affective forecasting literature. Early research in the affective forecasting literature suggested a widespread impact bias, in that people typically overestimate their emotional responses to future events. More recent research has yielded a number of counter-examples demonstrating that affective forecasting errors are in many cases absent or reversed. Many idiosyncratic theories have been offered to explain these reversals of the impact bias. However, each of these explanations is used to explain the case it demonstrates. Our theory is the first to provide a coherent theoretical account that can reconcile both cases of impact bias and its reversal and show that they can be due to the same underlying process, potentially resolving this ongoing debate in the affective forecasting literature. Our theory can be used to help predict when forecasters should exhibit an impact bias, when they should underestimate their emotional response to future events, and when affective forecasts should be accurate.

Second, we show that forecasters are more sensitive than experiencers to a variety of outcome specifications, which is a major cause of errors in affective forecasting. Although researchers have already established that forecasters are more sensitive to individual outcome specifications such as income earned, lives ended, extremity of sexism, comparative value, probability, and time (e.g., Aknin et al., 2009; Bosson et al., 2010; Buechel et al., 2014; Dunn & Ashton-James, 2008; Ebert & Meyvis, 2014; Morewedge et al., 2010), these previous demonstrations examined the effects of individual specifications and did not examine how multiple specifications influence affective forecasts and experiences. The present research is the

first to tie these existing findings together in a single, comprehensive theory that can predict the direction of forecasting errors.

Our findings suggest that people do attend to and incorporate multiple outcome specifications when they have the attentional resources to do so. However, the additive integration of multiple outcome specifications exhibited by affective forecasters appears to be less nuanced than some existing models would predict. Decision Affect Theory (Mellers et al., 1997) posits that scope and probability are integrated into hedonic judgment in a multiplicative manner, a pattern observed in experiments using within-subject designs<sup>5</sup>. The absence of three-way interactions in Experiments 1 and 2 suggests that the effects of outcome specifications among forecasters in our experiments were additive and not multiplicative. It is certainly possible that our experiments lacked the statistical power to detect a multiplicative effect. It is more likely, however, that our findings provide further evidence that competing views of people as totally insensitive to outcome specifications (e.g., Desvouses et al., 1992; Hsee & Zhang, 2004; 2010; Kahneman, 1986) and exquisitely sensitive to outcome specifications (e.g., Brandstaetter et al. 2002; Mellers et al., 1997) illustrate the gamut of their sensitivity to outcome specifications. This highlights that more research is needed to fully resolve how outcome specifications are integrated in prospect and experience for events varying on multiple dimensions, as most events do.

Third, we identify discrepancies in the affect-richness of the mental representation of events when forecasted and experienced as the underlying difference in sensitivity to outcome specifications that produce both types of forecasting errors. Mental simulations, upon which

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<sup>5</sup> Participants in Mellers et al.'s experiments reported their emotional response to 100 different outcomes with varying outcome specifications in a within-subject design. Participants in the present research only forecasted or reported their emotional response to one outcome with varying outcome specifications. This difference in procedure and stimuli used could explain differences in sensitivity and integration between both the forecasters and experiencers in our studies (Hsee & Zhang, 2004; 2010).

forecasts are based, tend to be less affect-rich than mental representations of the corresponding events as they are experienced (e.g., Buechel et al., 2014; Loewenstein, 1996; Nordgren et al., 2007; Van Boven et al., 2012). Consequently, affective forecasters typically have more resources available to attend to and therefore be impacted by outcome specifications. In line with this account, Experiments 3A and 3B revealed that increasing the affect-richness of a forecasted event decreased the sensitivity of forecasters to its outcome specifications. In addition to explaining why forecasters are generally more sensitive than experiencers to outcome specifications, our theory predicts when forecasters should be as (in)sensitive to outcome specifications as experiencers. Forecasters should be less sensitive to outcome specifications when the mental representation of the event they are forecasting is more affect-rich (e.g., when forecasting an affect-rich event or forecasting while in an aroused state) or when their attentional resources are taxed (e.g., while tired or under cognitive load). In these instances, forecasters should be as insensitive to outcome specifications as experiencers and make more accurate affective forecasts.

#### *Reconciliation of Previous Demonstrations*

Our theory is not only supported by the results of our experiments, it also can be used as a conceptual framework to reconcile and organize many previous cases in which forecasters exhibited the impact bias and its reversal (i.e., underestimation). In line with the predictions of our theory, the impact bias has previously been demonstrated for a variety of important, extreme, severe, and high-magnitude events, including receiving a positive HIV test (Sieff et al., 1999), being denied tenure (Gilbert et al., 1998), ending an intense romantic relationship (Eastwick et al., 2007), one's candidates winning fiercely partisan elections (Lau et al., 2016;), an important win or loss for fans of a college athletic team (Lau et al., 2016; Wilson et al., 2000), and being

subjected to hostile sexism (Bosson et al., 2010). Likewise, the impact bias has been demonstrated for a variety of surprising events, including narrowly missing a train (Gilbert, Morewedge et al., 2004) and winning an unexpected prize (Buechel et al., 2014). It has also been demonstrated for psychologically close events such as interacting with a close other (Dunn et al., 2007).

By contrast, cases in which forecasters have underestimated the hedonic impact of future events, as our theory predicts, have been demonstrated across a variety of mild, less severe, low-magnitude events, including mild (“benevolent”) sexism (Bosson et al., 2010) and winning small prizes (Buechel et al., 2014). It has been observed for likely events such as highly probable or sure bets (Andrade & VanBoven, 2010; Buechel et al., 2014) and psychologically distant events such as positive and negative interactions with distant others (Dunn et al., 2007; Epley & Schroeder, 2014; Gilbert, Lieberman et al., 2004; Nordgren et al., 2011) as well as fictional, temporally distant, and hypothetical events (Ebert & Meyvis, 2014; Lench et al., 2011).

Our theory thus not only provides a guide for predicting affective forecasting errors, it also provides a lens through which to consider the timeline of research on errors in affective forecasting. Documentation of affective forecasting errors began with an initial focus on the surprising degree to which people are less affected by major life events than they anticipate. Since those cases have become commonplace, the focus has shifted to the surprising joy and pain produced by events that seem relatively inconsequential.

#### *Relationship to Previous Sources of Affective Forecasting Error*

Different sensitivity to outcome specifications between forecasters and experiencers is not the only cause of affective forecasting errors. Several other major sources of forecasting errors have been identified. Affective forecasters overlook their ability to rationalize and cope

with negative outcomes over time (i.e., *immune neglect*; Gilbert et al., 1998; Gilbert, Lieberman et al., 2004), leading to a durability bias whereby people overestimate the duration of hedonic reactions to future events. Forecasters focus too much on the hedonic impact of the event in question, neglecting to consider the hedonic impact of other future events that will be simultaneously experienced (i.e., *focalism*; Schkade & Kahneman, 1998; Wilson et al., 2000). Errors can also arise from forecasters relying on highly available but unrepresentative instances of past events (Meyvis, Ratner, & Levav, 2010; Morewedge et al., 2005), from forecasters making predictions in joint versus separate evaluation modes (Hsee & Zhang, 2004), and from forecasters strategically motivating themselves to produce or avoid a forecasted event (Morewedge & Buechel, 2013).

We believe that the paradigms used to examine forecasting errors in our experiments minimize concerns raised about previous demonstrations of the impact bias (Levine et al., 2012) and minimize these other causes of the impact bias, thereby demonstrating differences in sensitivity to outcome specifications as an independent and orthogonal source of forecasting errors. Experiencers in our studies made their reports immediately upon learning an outcome and did not have as much time to adapt to or rationalize events as did experiencers in other affective forecasting studies (*immune neglect*; e.g., Gilbert, Lieberman et al., 2004). Given the timing and the phrasing of our questions, the focus of both affective forecasters and experiencers was on the outcome. In Experiment 1 and 2, there were no intervening experiences between the forecasted and reported experience that could have diluted the influence of the focal event on hedonic evaluations or changed their interpretation of what they should report (Levine et al., 2012; Schkade & Kahneman, 1998; Wilson et al., 2000). Lastly, forecasts and experiences were made in a single evaluation mode, and forecasting errors were observed when forecasters and

experiencers had the same recent and representative memory to rely upon when making their judgments (Experiments 3A and 3B).

That said, these other processes certainly can contribute to biases in affective forecasting and thus may provide important boundary conditions for our theory and observations. For example, overestimation may be more likely for cases in which forecasters are particularly susceptible to immune neglect, as when making predictions about the long-term impact of hedonic events (because people ignore how quickly they will adapt to negative outcomes; Gilbert et al., 1998).

### *Caveats*

Like most psychological theories such as prospect theory (Kahneman & Tversky, 1979) and construal level theory (Trope & Liberman, 2010), the predictions of our theory are relative rather than absolute. Our theory predicts when forecasters are generally more likely to exhibit overestimation or underestimation, but it does not predict which precise levels of each outcome specification (e.g., \$1, 23%, or 7 days) will produce overestimation or underestimation.

One factor hindering such absolute predictions is that the perceptions of values of outcome specifications are relatively imprecise and malleable (e.g., Buechel & Morewedge, 2015; Morewedge, 2015; Stevens, 1975; Volkman 1951). The perceived value of most specific outcome specifications is relative, being influenced by the comparison standards salient at the time of judgment (e.g., Helson, 1948; Kahneman & Miller, 1986). For instance, a house is large or small by comparison to neighboring houses. A large wage in one country may be trivial in another. A commute is only long or short by comparison to other commutes (Morewedge et al.,

2009). Whether seven days is close or distant may depend on whether seven days is compared to a second or a year.

Another factor bounding the predictive accuracy of our theory is variance due to unspecified or unknown outcome specifications associated with a focal event. Even if the level of one or more focal outcome specification is precisely and explicitly specified, events may vary on other outcome specifications that are unspecified or uncertain. A professor might know the precise amount of money entailed if she received a grant, award, or promotion, but have no idea of how likely she is to receive it. A patient might know the odds of surviving a surgery, but be uncertain about its palliative effects on the pain that he feels.

That being said, while our theory cannot make a priori predictions about absolute and uncertain specification values, our theory *can* make predictions about the direction in which forecasts are *likely* to err. All else being equal, greater, longer, closer, and unlikelier events are more likely to beget overestimation than smaller, shorter, more distant, and more likely events. Thus, while our theory may not a priori be able to predict whether people would overestimate how happy they would be if they won \$20, our theory would predict that they would be more likely to overestimate how happy they would be if they won \$1000 than \$20, and that they would be less likely to underestimate how happy they would be if they won \$20 than \$1.

Furthermore, the precision of our theory in its predictions about the direction and the magnitude of forecasting errors should increase in accuracy as an increasing number of outcome specifications align in their modulation of hedonic impact (as in Experiments 1 and 2). While our theory may not a priori be able to predict whether forecasters would overestimate how happy experiencers would be winning \$20, our theory should more accurately predict that they would likely overestimate experiencers' response to winning \$20 with a 1% chance of winning. And its

prediction that forecasters would overestimate the impact of winning \$20 given a 1% chance should increase in its accuracy if that outcome occurred in the near (vs. distant) future.

### *Conclusion*

Deciding in the present and planning for the future requires people to not only accurately predict which experiences will make them feel better and worse, but also assess how good and how bad those experiences will make them feel (e.g., Charpentier, De Neve, Li, Roiser, & Sharot, 2016; Mellers & McGraw, 2001; Morewedge, 2015; Morewedge & Hershfield, 2015). Our theory and findings reconcile the seemingly incongruous cases of impact bias in affective forecasting and cases in which its opposite has been demonstrated. Moreover, it elucidates when, why, and in what directions forecasters will err in their predictions: Overestimation (i.e., impact bias) is more likely to occur for events that are large, unlikely, psychologically near, and/or long in duration (e.g., Aknin et al., 2009; Dunn & Ashton-James, 2008; Gilbert & Wilson, 2007; Lau et al., 2016), whereas underestimation is more likely to occur for events that are small, likely, psychologically distant, and/or short in duration (e.g., Andrade & Van Boven, 2010; Bosson et al., 2010; Ebert & Meyvis, 2014; Gilbert, Morewedge et al., 2004; Gilbert, Lieberman, et al., 2004).

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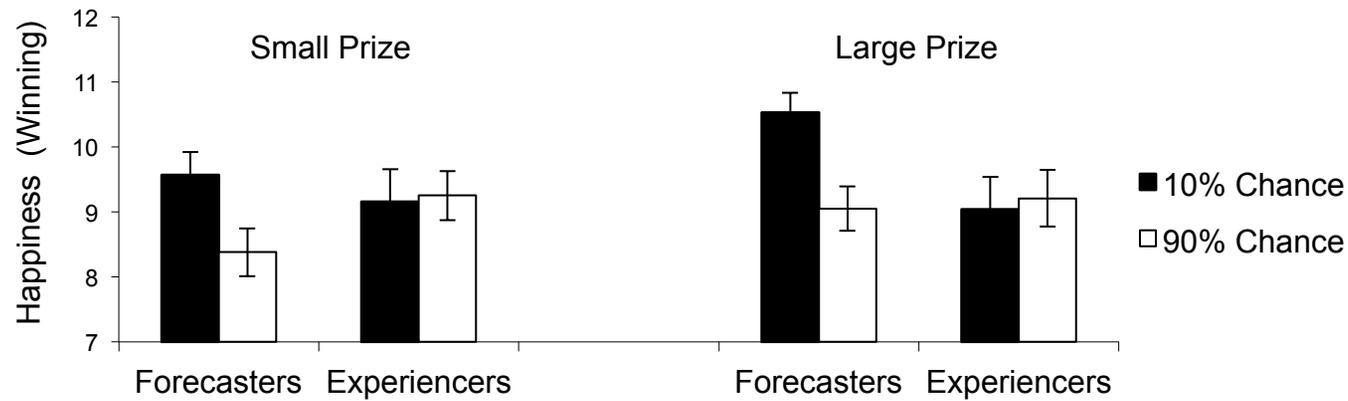
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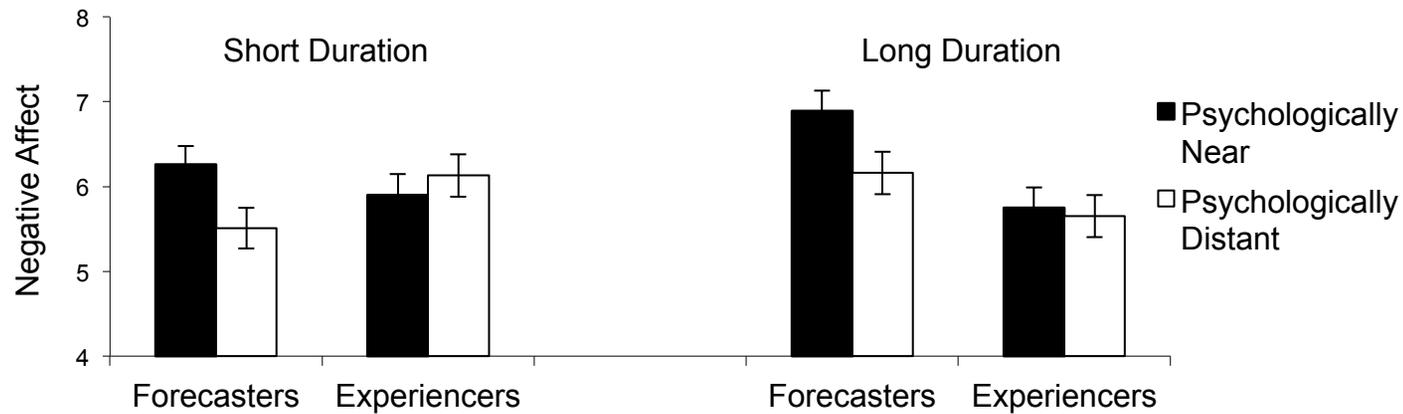
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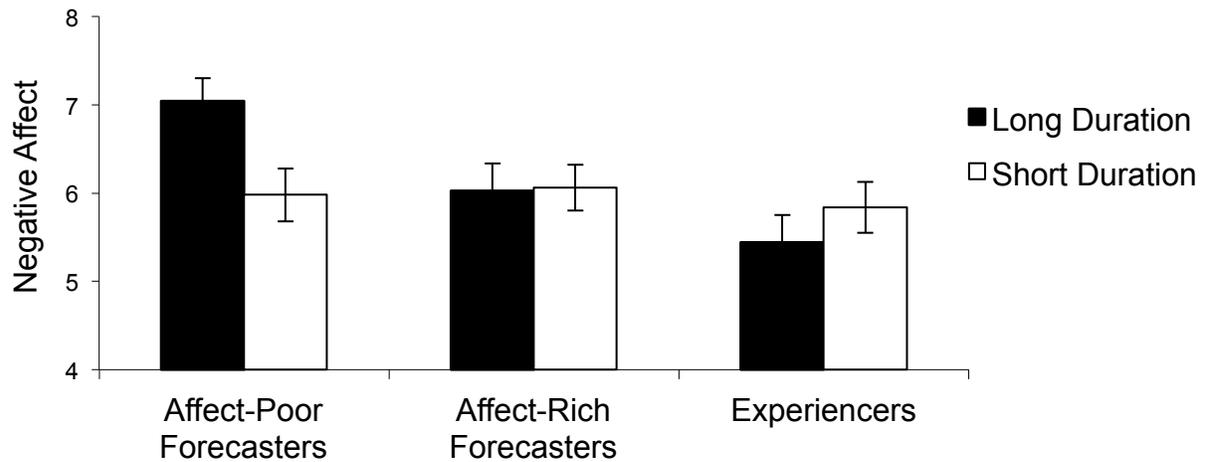
**FIGURES**

*Figure 1.* Affective forecasters were more sensitive than experiencers to the size of a prize and the probability of winning it.

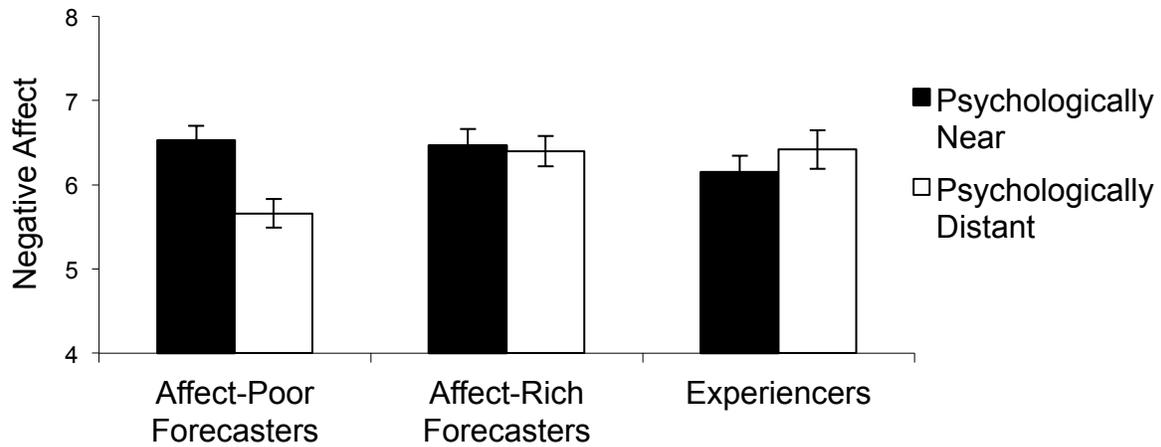
Forecasters underestimated the hedonic impact of winning a small prize they expected to win (90% chance) and overestimated the hedonic impact of winning a large prize that they did not expect to win (10% chance). Bars represent  $\pm 1$  SEM.



*Figure 2.* Affective forecasters were more sensitive than experiencers to the duration of a video of a negative event and its psychological distance. Forecasters underestimated the hedonic impact of watching a short video of a negative event that occurred in the distant past and overestimated the hedonic impact of a longer video of the event if it occurred the recent past. Bars represent  $\pm 1$  SEM.



*Figure 3.* Affective forecasters were more sensitive to the duration of a disturbing video than experiencers when their mental representation of the event during forecasting was affect-poor, leading them to overestimate the hedonic impact of the longer video about a recent event. By contrast, they were as (in)sensitive to its duration as experiencers when their mental representation of the event during forecasting was affect-rich, leading to more accurate forecasts. Bars represent  $\pm 1$  SEM.



*Figure 4.* Affective forecasters were more sensitive to the psychological distance of a disturbing video than experiencers when their mental representation of the event during forecasting was affect-poor, leading them to underestimate the hedonic impact of a short video about a psychologically distant event. By contrast, they were as (in)sensitive to its psychological distance as experiencers when their mental representation of the event was affect-rich, leading to more accurate forecasts. Bars represent  $\pm 1$  SEM.