The Influence of Outcome Desirability on Optimism

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People are often presumed to be vulnerable to a *desirability bias*, namely, a tendency to be overoptimistic about a future outcome as a result of their preferences or desires for that outcome. In this article, this form of wishful thinking is distinguished from the more general concepts of motivated reasoning and overoptimism, and the evidence for this bias is reviewed. The authors argue that despite the prevalence of the idea that desires bias optimism, the empirical evidence regarding this possibility is limited. The potential for desires to depress rather than enhance optimism is discussed, and the authors advocate for greater research attention to mediators of both types of effects. Nine possible mediational accounts are described, and critical issues for future research on the desirability bias are discussed.

Keywords: desirability bias, wishful thinking, optimism, pessimism, probability

People can foresee the future only when it coincides with their own wishes, and the most grossly obvious facts can be ignored when they are unwelcome.

—George Orwell (1945)

The ability of people to anticipate the future with some substantial degree of accuracy is critical for everyday functioning as well as survival. Consider an adolescent anticipating the consequences of smoking, an entrepreneur anticipating the success of a new business, a commander anticipating the outcome of a battle, and a student anticipating the results of an exam. In all of these cases, inaccuracies in predicting the future can have negative consequences ranging from unfortunate to tragic.

Psychologists have long recognized the important role of people's expectations (see e.g., Armor & Taylor, 1998; Olson, Roese, & Zanna, 1996). Numerous theories posit subjective uncertainty as a critical mediator of human behavior. These include models of attitude–behavior correspondence (e.g., Ajzen & Fishbein, 1980), health behavior (e.g., Becker, 1974), achievement (e.g., Atkinson, 1958; Bandura, 1997; Eccles & Wigfield, 2002), and decision making (e.g., Dane, 1985; W. Edwards, 1962; Einhorn & Hogarth, 1987). Moreover, any model that relies on expected-utility formulations (Von Neumann & Morgenstern, 1947) posits that perceived outcome likelihood is a key determinant of behavior.

Given that accuracy in anticipating the future has such clear value for functioning and survival, and given that numerous influ-

ential theories in psychology posit perceptions of likelihood as a key mediator of human behavior, one would expect that psychology would hold compelling answers to questions regarding one of the most popularly discussed forms of bias in likelihood judgments—the bias introduced by preferences or desires. As the opening quote illustrates, the notion that our desires influence our expectations of the future is invoked in many venues. A term often used to describe this possibility is *wishful thinking*; a more precise term is *desirability bias*. Despite the importance and general popularity of the notion that desires bias optimism, there have been no broad-based reviews of the empirical research on the desirability bias. There are also no articles containing an extensive analysis of the multiple ways in which desires might influence expectations about the future. Hence, our two initial goals for the present article were to review the empirical research on the desirability bias and to describe a theoretical framework that identifies the multiple mechanisms by which desires might bias expectations. As will be clear from our review, the empirical basis for the claim that desires influence various forms of expectations is surprisingly thin; the empirical work that has specifically tested the claim has yielded results that are mixed. Therefore, a third goal of the article is to articulate several ideas that we believe are important for moving toward a better understanding of how desires influence expectations.

In the following sections, we begin by specifically defining the desirability bias and distinguishing it from four related constructs: motivated reasoning, overoptimism, the preference–expectation link, and exaggerated perceptions of control. Next, we review the research that has tested for the desirability bias, and we draw conclusions about the strength of existing evidence for this bias under various task conditions. We then discuss what we believe are the critical insights from the literature review, and we introduce several cognitive mechanisms that might mediate between desires and biased expectations. Although many of these proposed cognitive mechanisms have not yet been specifically tested as possible mediators of the desirability bias, we argue that discussing these mechanisms is critical. Moreover, we argue that the most fruitful approach to studying the desirability biases is to explicitly identify and measure possible mediators of how desires can influence

expectancies—regardless of whether the influence is presumed to be in an optimistic or pessimistic direction. Finally, we close with some key suggestions for future research on motivationally biased predictions. Overall, then, our article places more emphasis on reviewing and stimulating research relevant to second-generation questions ("How and when does the desirability bias manifest?") than it does on drawing conclusions about "first-generation" questions (e.g., "Is there a desirability bias?"; see Zanna & Fazio, 1982).

What the Desirability Bias Is and What It Is Not

This article focuses specifically on the *desirability-bias hypothesis*, which posits that there is a causal influence of preferences (wishes, desires, motivations) on expectations[1] about the future (e.g., Budescu & Bruderman, 1995; Granberg & Brent, 1983; Hogarth, 1987). The desirability bias is said to occur when the desirability (undesirability) of an outcome leads to an increase (decrease) in the extent to which it is expected to occur. Besides *desirability bias,* terms such as *value bias* (G. Cohen & Wallsten, 1992; Yates, Cole, & Rodgers, 1989) and *wishful thinking* (e.g., Hogarth, 1987) have also been used to denote this phenomenon. Further explication of what the desirability bias is requires that we now distinguish it from four related constructs: motivated reasoning, overoptimism, the preference–expectation link, and exaggerated perceptions of control.

The Distinction Between the Desirability Bias and Motivated Reasoning

The desirability bias can be considered a subtype of the phenomenon commonly described as *motivated reasoning*. In her review of the evidence for motivated reasoning, Kunda (1990) described an impressive compilation of empirical findings showing that directional motives (motives to arrive at a particular conclusion) can often influence beliefs and conclusions of various sorts. We think that the overall evidence for motivated reasoning is compelling, but we also believe that on both empirical and rational grounds, further consideration of the desirability bias, in particular, is warranted. The empirical grounds for this belief are evidenced within the next section of the article. Regarding the rational grounds, we note that expectations about the future might be somewhat distinct (perhaps in a more quantitative than qualitative way) from other forms of judgment in that they more often involve verifiability constraints than do other forms of judgment.

Our use of the term *verifiability constraints* is an extension from Kunda's (1990) notion of reality constraints. In describing the influence of *reality constraints,* Kunda noted that a motivated thinker will arrive at a conclusion that he or she desires but only to the extent that he or she can construct a reasonable justification for it on the basis of available information. That is, the influence of desires is constrained by the ability to justify the desired conclusion. When we discuss verifiability constraints, we are suggesting that people's judgments are also constrained (i.e., less biased by a desire) when they believe that the truth value of their judgment can be or will be evaluated. When a person makes a prediction or likelihood judgment about a future outcome, he or she often knows that the accuracy of the prediction can be evaluated when the actual outcome is determined. This is less often true for other

forms of judgment that have been shown to be susceptible to motivated reasoning. Consider the following motivated reasoning effects noted by Kunda (1990). People change their attitudes to avoid dissonance (Festinger & Carlsmith, 1959), they change their self-ratings of traits and abilities after "learning" what kinds of traits and abilities are critical for a desired outcome (e.g., Dunning, 2003; Kunda & Sanitioso, 1989), they evaluate tests as more or less valid as a function of their performance (Wyer & Frey, 1983), and they rate the convincingness of an argument or research claim as a function of whether it would suggest a negative outcome for themselves (Kunda, 1987). For all of these forms of motivated reasoning, people who are being influenced by motivation do not need to worry much about the impending verifiability of their judgments or conclusions.

Contrast these cases with ones in which participants are asked to make likelihood judgments or predictions about whether a desired card will be selected from a deck, whether the stock market will go up tomorrow, or whether Person A will outperform Person B on a task. When making these and other judgments about future outcomes, people are often aware that their likelihood judgments or predictions can or will be measured against the actual outcomes. Furthermore, in a typical study testing for desirability bias, people know that they will be happy or disappointed when that outcome is determined. Hence, whereas there may be motivation to view a desirable outcome as being likely, there may also be significant motivation to not overstate its likelihood—for fear of being quite wrong and/or very disappointed (see, e.g., Gilovich, Kerr, & Medvec, 1993; Shepperd & McNulty, 2002; van Dijk, Zeelenberg, & van der Pligt, 2003). Given the potential importance of such *verifiability constraints* for likelihood judgments, we suggest that it is sensible to isolate the issue of desirability bias and to examine it as a special case of motivated reasoning.

Phrased another way, accuracy motivations, which have been shown to constrain the magnitude of various biases (see, e.g., Kruglanski & Freund, 1983; Tetlock & Kim, 1987) might be generally more influential in likelihood judgments and other predictions than in many other types of judgments (e.g., about one's personality traits, about blame, about the persuasiveness of an argument, or about the diagnosticity of an abilities test). This difference provides some rational grounds for treating investigations of motivated reasoning effects involving the latter types of dependent measures as distinct from investigations of desirability effects involving predictions. This difference also implies a compelling reason to question whether the robust nature of motivated reasoning effects in general will extend to predictions in particular. Moreover, given the importance of unbiased likelihood estimation in public policy and business decision making (see Hammond, 1996), examining to what extent predictions can be biased by preferences is a worthwhile goal in its own right.

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[1] In this article, the terms *expectations, expectancies,* and *predictions* are used interchangeably. However, the term *outcome prediction* refers to a person's prophecy about the specific outcome of a future event. Outcome predictions are measured by items with discrete response options (e.g., win or lose, red or blue marble). The term *subjective probability* is reserved for numeric judgments of probability (0–1.0 or 0–100%), and the term *likelihood judgment* is more general and refers to either numeric or nonnumeric expressions of likelihood or probability.

The Distinction Between the Desirability Bias and Overoptimism

A bevy of studies have shown that people are sometimes overoptimistic in the sense that they judge the probability of a desired outcome to be higher than relevant objective standards would dictate, or they judge the probability of an undesired outcome to be lower than relevant objective standards would dictate. At first blush, overoptimism might seem synonymous with the desirability bias or at least constitute evidence for it. However, there are a variety of task/situational factors and judgment factors that can lead people to be overoptimistic, even though they were not biased by motivational concerns or preferences. For example, people might underestimate their absolute likelihood of suffering from a particular disease because they have been inadequately informed about the conditions that make a person vulnerable to the disease (see, e.g., Fischhoff, Lichtenstein, Slovic, Derby, & Keeney, 1981). Roulette players might be overly optimistic about the marble landing on a desired slot because of a gambler's fallacy (see, e.g., Jarvik, 1951). Even simple response-scale biases might influence how participants use probability scales—pushing their estimates about the likelihood of any event (desired or undesired) higher than warranted (see e.g., Bruine de Bruin, Fischhoff, Millstein, & Halpern-Felsher, 2000; Windschitl, 2002). Hence, the desirability bias—or the influence of preferences on expectations—is merely one possible cause of overoptimism. Overoptimism, per se, is not evidence for the desirability-bias hypothesis. Consequently, we do not include in this review studies that merely report instances in which a sample of people were overoptimistic (or overpessimistic) about some outcome or set of outcomes. The desirability of the outcome in question must be varied in order for the study to be included in this review.

There is also research suggesting that people tend to be comparatively optimistic. That is, they report that their chances of suffering negative (or positive) events are lower (or higher) than other people's chances of experiencing those events (e.g., Weinstein, 1980; Weinstein & Lachendro, 1982). However, as with absolute measures of optimism, there are a variety of task/situational factors and judgment factors that can lead people to be comparatively overoptimistic, even though they were not biased by immediate motivational concerns or preferences. For example, recent research on comparative optimism has demonstrated how nonmotivated forms of egocentrism and focalism can account for various instances of overoptimism and overpessimism (Chambers, Windschitl, & Suls, 2003; Klar, Medding, & Sarel, 1996; Kruger & Burris, 2004; Price, Pentecost, & Voth, 2002; see also Moore & Kim, 2003; Windschitl, Kruger, & Simms, 2003). Given these accounts, comparative optimism studies will not be reviewed here (but see Chambers & Windschitl, 2004, for a review of motivational and nonmotivational sources of these effects).

The Distinction Between the Desirability Bias and the Preference–Expectation Link

As stated previously, the desirability-bias hypothesis implies that preferences for an outcome should lead to inflated optimism about that outcome. If that is indeed the case, then outcome preferences and expectations should at least sometimes be related such that desirable outcomes are viewed as more likely than undesirable outcomes. We refer to such an association as the preference–expectation link. Given that empirically establishing such links was a historical impetus for investigating the desirability-bias hypothesis, in the following section we briefly review evidence regarding this link and examine its implications for the assessment of the desirability bias.

Hayes (1936) was one of the first researchers to document the preference–expectation link. He observed that in the 1932 presidential election, 93% of Roosevelt supporters predicted Roosevelt would win, whereas 73% of Hoover supporters predicted Hoover would win. This finding was a clear indication that voters' preferences were foretelling of voters' outcome predictions, and the preference–expectation link was soon established with regard to a variety of social and political events (see e.g., Cantril, 1938; Cronbach & Davis, 1944; McGregor, 1938). The preference–expectation link in political contexts is one of the most well established and is observed across both time and cultures (e.g., Babad, 1997; Babad, Hills, & O'Driscoll, 1992; Brown, 1982; Dolan & Holbrook, 2001; Granberg & Brent, 1983; Granberg & Holmberg, 1988). For example, Granberg and Brent (1983) examined National Election Study data for all U.S. presidential races between 1950 and 1982 and reported correlations between preferences (i.e., voting intentions) and outcome predictions ranging from .42 to .68. Similar findings were reported in sports domains; for example, Babad (1987) examined predictions of more than 1,000 soccer fans before the start of the game and found that 93% of the fans predicted that their favorite team would win. Similar findings are reported in other sports domains (e.g., Hirt, Zillmann, Erickson, & Kennedy, 1992; Markman & Hirt, 2002; Ogburn, 1934; Wann & Dolan, 1994) and in contexts with more serious consequences, such as betting venues (e.g., Babad & Katz, 1991). The preference–expectation link has even been observed among professional investment managers (Olsen, 1997).

Although all of these findings reflect associations between preferences and expectations, they do not demonstrate that preferences exert a causal influence on expectations (see Fischer & Budescu, 1995). Just as is the case with overoptimism, there are plausible alternatives to assuming that a preference–expectation link is due to a causal influence of expectations. For example, environmental influences could lead to preferences and expectations that have a shared valence or direction. Within a political context, for example, people's knowledge about a political candidate might drive both their preferences and their expectations regarding that candidate's performance in an election. Another possibility is that people's expectations of who is likely to win the election influenced their preferences, a phenomenon known as the bandwagon effect (e.g., Navazio, 1977). Although the use of longitudinal designs, where preferences and expectations are assessed on multiple occasions, can be useful for disentangling these possibilities, such investigations are scarce and issues of causal flow in the preference–expectation link remain largely unsettled (cf. Granberg & Brent, 1983). In spite of these issues, authors often offer causal interpretations; for example, Babad (1987) claimed that "a presumable 'cognitive' prediction can serve as an operational measure of an affective/motivational construct such as wishful thinking" (p. 237). Such interpretations are problematic because they assume a specific cause–effect relation (implied by the notion of a desirability bias) as responsible for the preference–expectation link, even though competing interpretations are equally plausible. In

short, there may be a robust association between preferences and expectations, but such an association does not form convincing evidence for the presence of a desirability bias. Rather, documenting desirability bias requires use of experimental designs to establish that desires have a causal influence on expectations.

The Distinction Between the Desirability Bias and Exaggerated Perceptions of Control

Historically, researchers who have explicitly investigated the desirability bias have done so in situations in which the respondents did not have true control (even partial control) over the target outcomes. This is because when a respondent has real potential control or influence over an outcome, the normative dictate that desires should not influence expectations becomes inapplicable. In such cases, respondents can simply assume that they will take steps to facilitate a desired outcome, thus appropriately inflating their expectations about the outcome. For example, a runner's desire to win a race can enhance the actual and presumed likelihood that he or she will win, because the desire will influence his or her effort and preparation.[2] A researcher could investigate the question of whether people who have some control are unduly optimistic because of an inflated sense of personal control (or even an inflated estimate of any person's control in the situation), but this question is conceptually distinct from the question of whether people's desires for an uncontrollable outcome cause an optimistic inflation of expectations. We discuss this issue in more depth at the end of this article. Our review and analysis, like the prototypical investigations of the desirability bias, focus on predictions and likelihood judgments about outcomes that are not under the judge's control (e.g., an onlooker's prediction about the outcome of a competition; a likelihood judgment about a random drawing from a deck of cards). This does not preclude discussion of studies in which illusory control over purely chance events is an issue (see Langer, 1975); such studies are discussed in the body of our review (e.g., Budescu & Bruderman, 1995).

A Review of the Empirical Work on the Desirability–Bias Hypothesis

In this section, we review empirical evidence relevant to the desirability bias. Consistent with the previous sections defining the desirability bias and distinguishing it from four related constructs, the studies we review have the following properties. First, the dependent measures in the studies were outcome predictions, likelihood judgments, or bets regarding a future outcome. Second, there needed to be variability in outcome desirability that was manipulated as part of the study's design. Studies merely demonstrating overoptimism or a correlation between preferences and expectations are not reviewed. Third, the respondents must not have had real control over the target outcomes (about which they were making predictions or judgments).

Selection of Studies

In order to locate relevant studies, we searched the PsycINFO (1806–present) and Dissertation Abstracts International databases.[3] In order to access unpublished or yet-to-be-published studies, a request for data or information was sent to the listserv of the Society for Personality and Social Psychology in September 2004.

An additional request was sent to the listserv of the Society for Judgment and Decision Making in October 2005, and the online conference proceedings (1998–2005) of this society were searched for relevant papers and posters. We included any study located by these searches if the study met the criteria described in the above paragraph. This set of searches identified 17 separate empirical reports (15 published) meeting the inclusion criteria.

Desirability Effects in Experiments Involving Games of Chance

The bulk of experimental research testing the desirability hypothesis used games of chance in which outcome desirability was manipulated through monetary rewards (i.e., preferences were created by externally endowing specific outcomes with monetary value). Although somewhat contrived, such an approach allowed for experimental control of actual outcome probabilities and for creating novel outcome preferences independent of prior beliefs. The studies that involved games of chance are described below. Table 1 provides a summary of these studies, grouped in separate sections according to the type of dependent variable that was used in a given study: outcome predictions, subjective probabilities/confidence, or bets. Although all of these dependent variables can arguably be considered measures of a common underlying construct (i.e., people's expectations), they also differ in theoretically meaningful ways (see below) and are thus described separately. Nevertheless, the commonalities and differences of findings across the three types of measures are examined in the concluding portion of this section.

Desirability Effects on Outcome Predictions

Perhaps the first attempt to demonstrate the causal influence of outcome preferences on prediction was made by Marks (1951). She presented children with five pairs of card packs, with each pair containing a certain proportion of picture cards (proportions were .1, .3, .5, .7, and .9). Within each pair of packs containing a given proportion of picture cards, one pack was designated as a "winning" pack (children stood to gain one point if a picture card was selected), and the other was designated as a "losing" pack (children stood to lose one point if a picture card was selected). Children were informed about the proportions of marked cards in each deck and drew a card from each. Before each draw they were asked whether "you expect to pick a picture—what you really believe will happen" (Marks, 1951, p. 338). Results indicated that for each target proportion, considerably more children expected to pick a picture card when it meant gaining a point versus losing a point toward the game. For example, for the .1 outcome probability, almost 50% of children expected to draw a picture card when it meant gaining a point, whereas not a single child reported expecting to draw a picture card when it meant losing a point.

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[2] Additionally, forming overoptimistic expectancies can have motivational functions that contribute to realization of desired outcomes, rendering the expectancies realistic in retrospect (e.g., Campbell & Fairey, 1985; Oettingen & Mayer, 2002; Sherman, 1980).

[3] The keywords used in this search were *wishful thinking, desirability bias,* and *overoptimism.* In addition, we conducted searches combining the terms *optimism, pessimism, predictions, probability,* or *likelihood judgments* with *wishes, desires, motives,* or *goals.*

Table 1
Desirability Effects in Experiments Involving Games of Chance

Measure	Study	Outcome	Incentive	Accuracy incentive	Significance	Effect size
Outcome prediction						
	Marks (1951)	Card draw	Points		Yes	$OR = 15.9$
	Irwin (1953)	Card draw	Points		Yes	$OR = 1.7$
	Crandall et al. (1955)	Card draw	Monetary	Instructions	Yes	$OR = 1.6$
	Scheibe (1964)	Light flash	Monetary	Instructions	No	
	Morlock & Hertz (1964, Condition M)	Card draw	Monetary		Yes	$OR = 1.6$
	Irwin & Metzger (1966)	Card draw	Monetary	Monetary	Yes	$OR = 1.99$
	Pruitt & Hoge (1965)	Light flash	Monetary		Yes	$OR = 2.1$
	Budescu & Bruderman (1995, Exp. 1)	Card draw	Monetary	Instructions + Monetary	Yes	$OR = 3.6$
	Budescu & Bruderman (1995, Exp. 2)	Card draw	Monetary	Instructions + Monetary	Yes	$OR = 2.0$
	Budescu & Bruderman (1995, Exp. 3)	Card draw	Monetary	Instructions + Monetary	Yes	$OR = 1.8$
	Price & Marquez (2005, Study 1)	Card draw	Points toward prizes		Yes	$OR = 1.3$
	Lench & Ditto (2005, Study 3)	Card draw	Raffle ticket		Yes	$OR = 3.2$
	Lench & Ditto (2005, Study 4)	Card draw	Raffle ticket		Yes	$OR = 3.7$
	Lench & Ditto (2005, Study 5)	Card draw	Raffle ticket		Yes	$OR = 2.0$
Subjective probability						
	Pruitt & Hoge (1965)	Light flash	Monetary	No/Monetary	Yes/No	$g = 0.55/0.35$
	Bar-Hillel & Budescu (1995, Exp. 1)	Visual matrix element selection	Monetary	Monetary	No	$g = 0.13$
	Bar-Hillel & Budescu (1995, Exp. 2)	Visual matrix element selection	Monetary	Monetary	No	
	Bar-Hillel & Budescu (1995, Exp. 3)	Visual matrix element selection	Monetary	Monetary	No	$g = -0.45$
	Bar-Hillel & Budescu (1995, Exp. 4)	Selection of a colored bead from a jar	Monetary	Monetary	No	$g = -0.63$
	Price & Marquez (2005, Study 2b)	Card draw	Points toward prizes		No	$g = 0.02$
	Price & Marquez (2005, Study 3)	Card draw	Points toward prizes		No	$g = -0.18$
Confidence						
	Biner et al. (1998, Study 1)	Card draw	Food		Yes	$g = 0.40$
	Price & Marquez (2005, Study 2a)	Card draw	Points toward prizes		No	$g = -0.14$
Bet						
	Morlock & Hertz (1964, Condition 1)	Card draw	Monetary	Monetary	Yes	$OR = 1.55$
	Irwin & Snodgrass (1966)	Card draw	Monetary	Monetary	Yes	
	Pruitt & Hoge (1965)	Light flash	Monetary	Monetary	Yes	$g = 0.75$
	Irwin & Norris-Graae (1968)	Card draw	Monetary	Monetary	No	

Note. With regard to the column headings, "Measure" refers to the type of dependent variable used; "Study" provides the specific reference; "Outcome" notes the outcome that was predicted; "Incentive" describes the desirability incentive used to manipulate outcome desirability; "Accuracy incentive" indicates what, if any, accuracy incentive was used; "Significance" indicates whether the overall effect in the direction of increased optimism for desirable outcomes was significant at $p < .05$; and "Effect size" indicates the overall effect size (in terms of odds ratios or standardized mean differences) for that study. In the effect size column, a blank cell indicates that an effect size could not be computed because the relevant article did not provide adequate information.

In order to examine whether these findings generalize to adults, Irwin (1953) used the same paradigm (hereinafter referred to as the "Marks paradigm") with undergraduate students. Although Irwin's findings supported an overall desirability effect (the percentages of participants who expected to pick a marked card in the "win points" versus "lose points" conditions across all target proportions were 61% and 48%, respectively), this effect was much smaller than the findings by Marks (1951). Pruitt and Hoge (1965) also documented desirability effects on predictions when participants predicted stochastic light flashes that could lead to monetary

prizes (but see Scheibe, 1964). Finally, a recent investigation by Lench and Ditto (2005, Studies 3–4) revealed significant desirability effects in a blackjack game (see also Price & Marquez, 2005, Experiment 1).

Although these findings provide support for the desirability-bias hypothesis, the early studies, in particular, drew criticism given their use of fairly transparent procedures without incentives for accurate responding. Rotter (1954) was especially vocal in this regard, noting that "it may be asked whether the more valued reinforcements actually tend to increase the expectancy of their

Table 2
Results of Quantitative Syntheses of Desirability Effects Across Domain and Prediction Type

Type of domain	Type of dependent variable	Overall estimate	k	N	z	95% CI	Q	Fail-safe N[a]
Games of chance	Outcome prediction	$OR = 2.26$[*]	12	841	8.79	1.89 to 2.71	15.02	169
Games of chance	Likelihood judgment	$g = 0.01$	9	286	0.14	−0.10 to 0.12	28.20[*]	
Naturalistic	Likelihood judgment	$g = 0.20$[*]	5	409	3.29	0.08 to 0.31	19.31[*]	19

Note. With regard to column headings, "Overall estimate" = weighted meta-analytic mean effect size; k = number of independent samples; N = total number of participants; z = value of test statistic assuming no effect in the population; 95% CI = a 95% confidence interval around mean effect size; Q = heterogeneity statistic; Fail-safe N = number of undiscovered null findings necessary in order for the confidence interval to include zero.
[a] The fail-safe N represents how many null findings would have to be included in the analysis in order to change the conclusion that a relation exists (Rosenthal, 1979) and, as such, is an index of tolerance for unretrieved null results. However, this statistic does not explicitly afford greater weight to studies with larger sample sizes and assumes that unretrieved studies have null (rather then reverse) effects (see H. Cooper, 1998). It is included, however, to provide readers with a general sense of tolerance for null results.
[*] $p < .001$.

occurring or whether under certain conditions they may only increase the potential of the subject stating that he [or she] thinks they will occur, partly because he [or she] has no need to differentiate his [or her] true expectancies from his [or her]wishes" (p. 164). Some investigations using the Marks paradigm addressed this criticism by stressing accurate responding via instructions or monetary incentives. After stressing accurate predictions to participants, Crandall, Solomon, and Kellaway (1955) found reliable desirability effects on outcome predictions (induced by small monetary rewards), but these were apparent only for .5 outcome probabilities. Budescu and Bruderman (1995) observed significant desirability effects for other outcome probabilities even when offering small monetary incentives for accuracy, but these were smaller than effects for .5 outcome probability (see Irwin & Metzger, 1966, for similar findings).

We should note that for equiprobable outcomes (such as the draw of a marked versus unmarked card from a deck with .5 proportion of marked cards), any basis for predicting one outcome over the other is equally valid, given that the objective probability information does not favor either outcome. Critically, for participants faced with such scenarios, outcome desirability might have been a particularly salient characteristic on which to base their outcome predictions (cf. Crandall et al., 1955).

Quantitative synthesis of findings. In order to more precisely examine the overall support for the presence of a desirability bias in outcome predictions within games of chance, we performed a quantitative synthesis of individual effect sizes (odds ratios; see Table 1).[4] This synthesis (and all others reported in this article) was performed using the Comprehensive Meta-Analysis Version 2 software (Borenstein & Rothstein, 1999) according to procedures specified by Hedges and Olkin (1985). The procedures assume a fixed effect across studies, and the computation of the overall effect estimate assigns greater weight to effect sizes coming from studies with larger samples. When interpreting magnitudes of effect sizes reported throughout this article, readers should note that J. Cohen (1988) recommended values of 0.2, 0.5, and 0.8 to represent small, medium, and large standardized mean differences. This can be translated to approximate values of 1.4, 2.5, and 4.3 on an odds-ratio (OR) scale (see Chinn, 2000).[5]

The results from this synthesis are reported in the top row of Table 2. Across studies, there is a significant moderate effect of outcome desirability on predictions ($OR = 2.26$). In addition, the

magnitude of effect sizes across studies was fairly homogeneous ($Q = 15.02$, $p = .18$). Clearly, there is a robust effect of outcome desirability on outcome predictions in games of chance.

Although the heterogeneity analysis did not suggest the presence of any substantial moderators, we conducted a statistical comparison to test whether studies that used accuracy incentives reported smaller desirability effects than studies that did not use any accuracy incentives. Each study was assigned to one of two levels of this moderating factor depending on whether it used any accuracy incentives (in the form of instructions, monetary incentives, or both; see Table 1). The results of this analysis are presented at the top of Table 3. A clear desirability effect emerged both when no accuracy incentives were present ($OR = 2.31$) and when the importance of accuracy was stressed to participants via instructions, monetary incentives, or both ($OR = 2.09$). The test of this difference was not significant ($Q_{\text{between}} = .18$, $p = .67$), but given the small number of studies in this analysis, it would be premature to conclude that accuracy incentives do not moderate desirability effects.

Another potential moderator of interest was the objective outcome probability used for a given trial. Recall that most studies manipulated the objective probabilities of outcomes that were predicted (e.g., the proportion of marked cards in the deck). Results *within* individual studies suggested that desirability effects were most pronounced when the outcome probability was .5. In order to more systematically address the possibility that outcome probability constrained desirability effects in these studies, we estimated desirability effect sizes separately for each outcome

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[4] Only Lench and Ditto (2005) directly reported odds ratios. For other studies, these were computed from information about response proportions and sample size. Odds ratios with a value greater than 1 indicate that odds of predicting a desirable outcome were greater than odds of predicting an undesirable outcome. Two studies were excluded from this quantitative synthesis. A study by Scheibe (1964) was excluded, as it did not report proportions of responses across desirability conditions, so an odds ratio could not be calculated. The classic study by Marks (1951) was also excluded because it reported an effect size that was a clear outlier (see Table 1), and it was the only study in which the participants were children rather than adults.

[5] These values should be interpreted as rough guidelines; the magnitude of effects should always be considered within their particular context (see Valentine & Cooper, 2003).

Table 3
Results of Quantitative Syntheses Examining Presence of Accuracy Incentives as a Moderator of Desirability Bias in Games of Chance

Type of dependent variable	Accuracy incentives	Overall estimate	k	N	z	95% CI	Q	Fail-safe N[a]
Outcome prediction	Present	$OR = 2.09^{**}$	5	192	3.52	1.39 to 3.15	1.92	11
	Absent	$OR = 2.31^{**}$	7	539	8.06	1.88 to 2.83	12.92^{*}	83
		$Q_{\text{between}} = .18, df = 1, p = .67$						
Likelihood judgment	Present	$g = -.05$	4	122	-0.53	-0.23 to 0.13	14.31^{*}	
	Absent	$g = .04$	5	236	0.59	-0.10 to 0.18	13.29^{*}	
		$Q_{\text{between}} = .56, df = 1, p = .46$						

Note. With regard to the column headings, "Overall estimate" = weighted meta-analytic mean effect size; k = number of independent samples; N = total number of participants; z = value of test statistic assuming no effect in the population; 95% CI = 95% confidence interval around mean effect size; Q = heterogeneity statistic; Fail-safe N = number of null findings necessary in order for the confidence interval to include zero; Q_{between} = inferential statistic of between-groups variance.
[a] The fail-safe N is described further in Footnote a to Table 2.
$^{*} p < .05.$ $^{**} p < .001.$

probability across the relevant studies.[6] The results of this synthesis are displayed in Table 4. Although the test of the difference between desirability effects across outcome probabilities did not reach significance (but see Footnote b in Table 4), there is trend for desirability effects to be greater for moderate probabilities such as .5. This result suggests that the influence of outcome desirability on optimism may be constrained by objective probability information available to participants when making predictions.

Desirability Effects on Subjective Probabilities and Confidence

Although the above findings provide compelling evidence that discrete outcome predictions are influenced by event desirability, they do not provide direct evidence that event desirability actually influenced participants' subjective uncertainty. As noted by Bar-Hillel & Budescu (1995), although it is often reasonable to infer subjective probabilities from behavior such as choice and prediction, one should not assume that these show direct correspondence (see also Kahneman & Tversky, 1979). Simply put, direct evidence that outcome desirability influences the perceived likelihood of an event requires that the dependent measure in a study elicit likelihood judgments of some form, such as numeric subjective probabilities.

In the study by Pruitt and Hoge (1965) described earlier, some participants provided subjective probabilities (rather than outcome predictions) that a light will flash following a sequence of random flashes. Although there was a significant overall effect of desirability on subjective probabilities, this effect was clearly smaller than the effect on outcome predictions. Moreover, the participants who were promised a cash reward for accurate predictions did not show a significant desirability effect. Similarly, Bar-Hillel and Budescu (1995) reported either no significant effect of preferences on subjective probabilities (Experiments 1 and 2) or weak effects in the opposite direction (Experiments 3 and 4) when participants judged the probability that a certain color would be drawn at random from various visual displays and an award was offered to the most accurate participant (see also Yates et al., 1989). A recent pair of studies by Price and Marquez (2005) utilizing the Marks paradigm also failed to document desirability effects on subjective probabilities, even though no accuracy incentives were involved. In short, unlike outcome predictions, subjective probabilities do not seem to be sensitive to the desirability of chance outcomes (see Table 1).

Next, we examined the possibility that effects could be different for confidence measures, as opposed to subjective probability measures. An additional study by Price and Marquez (2005, Study 2a) used a 5-point confidence scale within the same Marks paradigm, but again found no significant desirability effect. However, there is one study that used a 9-point confidence scale to detect a significant desirability effect (Biner, Huffman, Curran, & Long, 1998, Study 1). Participants were given an opportunity to win a hamburger if they selected the winning card from a deck of 10 cards. Outcome desirability was manipulated by inducing hunger in half of the participants. Hungry participants indicated greater preferences for winning the hamburger and reported greater confidence in drawing the winning card.[7]

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[6] The most common outcome proportions used across studies were .1, .3, .5, .7, and .9. Thus, for this moderator analysis we have used data from studies that included all or some of these proportions in the experimental design. All studies that measured outcome predictions from Table 1 provided data for this analysis except Marks (1951), Scheibe (1964), Budescu and Bruderman (1995, Study 3), and Price and Marquez (2005). Studies 1 and 2 by Budescu and Bruderman (1995) also provided data only for the .3, .5, and .7 outcome proportions (resulting in unequal sample sizes across outcome proportions evident in Table 4).

[7] There are two investigations that differed substantially from those reviewed here yet are nonetheless worth mentioning in this context. Slovic (1966) tested whether participants' posterior conditional probabilities (not subjective probabilities about future outcomes) about the contents of five bags were influenced by monetary rewards that were promised if the bags contained a particular proportion of target chips. Although some participants systematically overestimated the probabilities that the source bag was "desirable," others systematically underestimated the same probabilities. This pattern of overpessimism was especially visible when participants were promised monetary rewards for accurate estimation. In a G. Cohen and Wallsten (1992) study, participants' comparative interpretations of another participant's verbal uncertainty expression (e.g., "likely") about whether a red-and-white spinner would land on white were influenced by whether the expression was relevant to a case in which "white" meant winning money or "white" meant losing money. The comparative judgments of participants suggested that most participants had more optimistic interpretations in the former cases than in the latter cases.

Table 4
Results of Quantitative Syntheses Examining Desirability Effects Across Outcome Probabilities in Games of Chance

Objective probability of outcome	Overall estimate (*OR*)	*k*	*N*	*z*	95% CI	*Q*	Fail-safe *N*[a]
.10	2.55[*]	7	620	2.36	1.17 to 5.54	7.81	2
.30	2.67[**]	9	682	4.51	1.74 to 4.10	4.65	34
.50	4.26[**]	9	682	9.38	3.15 to 5.76	5.43	196
.70	3.34[**]	9	682	4.64	2.01 to 5.57	5.64	35
.90	3.89[**]	7	600	3.37	1.76 to 8.56	1.46	13
	$Q_{\text{between}} = 3.87$; $df = 4$; $p = .42$[b]						

Note. The column headings should be interpreted as follows: "Overall estimate" = weighted meta-analytic mean effect size; *k* = number of independent samples; *N* = total number of participants; *z* = value of test statistic assuming no effect in the population; 95% CI = 95% confidence interval around mean effect size; *Q* = heterogeneity statistic; Fail-safe *N* = number of null findings necessary in order for the confidence interval to include zero; Q_{between} = inferential statistic of between-groups variance.
[a] The fail-safe *N* is described further in Footnote a to Table 2.   [b] Effect sizes across different outcome probabilities are based on the same participants and thus cannot be considered independent. This results in standard error of the difference being too large, and statistical significance tests comparing effects across outcomes tending to be too conservative (see Borenstein & Rothstein, 1999). The observed lack of significant differences should thus be interpreted with caution.
[*] $p < .05$.   [**] $p < .001$.

Quantitative synthesis of findings. In order to more precisely examine the overall support for the presence of desirability bias in likelihood judgments (subjective probabilities and confidence estimates) within games of chance, we performed a quantitative synthesis of individual effect sizes (standardized mean differences, see Table 1) according to the procedures described earlier.[8]

The results from this synthesis are reported in the second row of Table 2. Across studies, there was no effect of outcome desirability on likelihood judgments (Hedge's *g* = .01). Effect sizes were fairly heterogeneous ($Q = 28.2$, $p < .001$), as half of the effect sizes were in the direction of decreased, rather than increased, optimism for more desirable outcomes. As was the case for outcome predictions, whether a study used any accuracy incentives (see Table 1) was not a significant moderator of desirability effects (see bottom of Table 3). Again, this null result should be interpreted with caution given the low number of studies available for the analysis.

Desirability Effects on Bets

Besides requesting outcome predictions or subjective probabilities, another approach to studying desirability bias has involved requesting that participants make bets regarding the target outcome. Examining bets is a common way of indirectly investigating subjective uncertainty, under the assumption that subjective uncertainty about outcomes is a determinant of bets (e.g., Savage, 1954).

Four studies were identified that examined the influence of desirability on bets. Irwin and Snodgrass (1966) used the Marks paradigm but instructed participants to place bets on each card draw. The researchers manipulated the range of desirability regarding the target outcome (lose vs. win up to $0.10 or lose vs. win up to $0.50) and provided variable incentives for accuracy by increasing the maximum bet ($0.10 or $0.50; $1.00 during the time of that study would be worth around $5.50 today). Sixty-two percent of participants placed larger bets on desirable than undesirable outcomes, whereas 22.5% did the reverse. However, as was the case with Irwin (1953), examination of mean betting percentages across the probability and desirability levels reveals signifi-

cant desirability effects only for .5 target proportion. Moreover, the absence of analyses testing for desirability effects within a given target proportion leaves it unclear whether these effects existed for more extreme proportions. Similar effects were observed in a study by Morlock and Hertz (1964). In an experiment by Irwin and Norris Graae (1968), in which desirability effects on bets were specifically examined within each target proportion, no significant desirability effects were observed. Finally, the study by Pruitt and Hoge (1965) discussed earlier also revealed desirability effects in a betting condition in which a participant could earn or lose points that were redeemed for money.

A full quantitative synthesis of the effect sizes across these 4 studies was not possible because the published reports for 2 of them did not supply sufficient information for effect sizes to be adequately calculated (Irwin & Norris Graae, 1968; Irwin & Snodgrass, 1966). However, given the effect sizes for the other two studies (see Table 1) and given the pattern of significance findings reported for the 2 studies by Irwin and colleagues, it seems appropriate to characterize the results from betting studies as generally supportive of the conclusion that outcome desirability does influence bets when outcome probabilities are .5.

Before we proceed, however, it is important to recognize that bets might involve additional psychological factors relative to likelihood judgments and thus should be interpreted with caution. In a betting study involving marked cards, participants have two separate ways of making money: when a marked card is drawn from a winning deck and when a bet pays off. An important consideration regarding such studies is that participants might have two motives that could have conflicting influences on their bets: a

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[8] For most studies, effect sizes were computed on the basis of reported means and standard deviations and are expressed as Hedge's *g* (see e.g., Hedges & Olkin, 1985). Positive values reflect greater optimism for more desirable outcomes. Several experiments (Bar-Hillel & Budescu, 1995, Experiments 1, 3, and 4; Pruitt & Hoge, 1965) did not report standard deviations or means; effect sizes for these studies were estimated on the basis of the values of the inferential statistics reported (cf. Rosenthal, 1991).

motivation to view marked cards from a winning deck as more likely to be picked than marked cards from a losing deck (causing a desirability effect in their betting pattern) and a motivation to win maximal money via their bets (causing them to make normatively appropriate bets that do not exhibit desirability effects). Thus, bets create an incentive for accuracy that might suppress or offset a motivational bias (see Irwin & Snodgrass, 1966).

On the other hand, a different dynamic involving betting might ultimately lead to betting patterns that seem to reflect distortions in perceptions of likelihood (namely a desirability bias) but actually reflect a particular betting strategy. It is obvious that within an experiment participants are aware of the desirability of the outcome on which they are betting. As a result of this awareness, participants might be reluctant to place bets on undesirable outcomes—to avoid "betting against themselves." In other words, a participant might not want to bet money on getting a marked card when drawing from a losing deck, because this would create a situation in which they win and lose regardless of whether a marked card is drawn. Although we know of no research on this topic, we think it is possible that this type of "betting against oneself" might seem unattractive to participants because of superstitious concerns, because such bets seem rather conservative and perhaps uninteresting, or because such bets pose computational challenges for the participant. Instead, participants might be more inclined to bet money on drawing marked cards from a winning deck, because this sets up cleaner possibilities—either the participant wins the wagered amount and the card's separate award value (if a marked card is drawn), or he or she loses the wagered amount and does not get a separate award value. This type of betting strategy, which has nothing to do with biased perceptions of likelihood, could account for betting patterns that resemble desirability effects. Overall, then, one must be quite cautious when interpreting desirability effects that involved bets as a dependent variable.

The Role of Illusory Control

We have mentioned earlier that our analysis of the desirability bias focuses on outcomes that are not under a perceiver's full or partial control. Although chance outcomes are, by definition, uncontrollable, this does not guarantee that research participants in studies using chance events viewed them as such. In fact, it has been documented that people often perceive chance events as somewhat controllable when cues that one's skill may influence the outcome are present; a phenomenon termed "illusion of control" (e.g., Langer, 1975; see Presson & Benassi, 1996, for a review). Critically, such illusion of control may lead to unwarranted optimism about the outcome. For example, participants are more optimistic that a coin toss will yield a particular outcome when they themselves (rather than the experimenter) tossed the coin (Langer & Roth, 1975).

It is thus important to consider what role perceptions of control played in the studies that used games of chance. In virtually all studies that used the Marks paradigm, participants picked a card themselves (cf. Crandall et al., 1955), which raises the question of whether participants' optimism in these studies was due to illusory beliefs in personal control instigated by skill cues. Budescu and Bruderman (1995) examined this possibility by instructing some participants in the Marks paradigm to choose their own cards,

while other participants had their cards chosen by the experimenter. In two experiments, these authors failed to find any effect of individual choice on outcome predictions. Allowing participants to select their own cards influenced predictions only when using a repeated measures design (Experiment 3), which likely made the contrast between the choice and no-choice conditions salient (see also J. J. Koehler, Gibbs, & Hogarth, 1994). Using the same paradigm with a between-subjects design, Price and Marquez (2005, Experiment 1) also failed to document any effect of individual choice on participants' outcome predictions.[9] Overall, then, these findings suggest that illusory control beliefs resulting from skill cues did not play a significant role in the findings from the Marks paradigm.

Conclusions Regarding Desirability Effects in Games of Chance

The review of studies testing the desirability bias hypothesis within the context of chance events reveals a mixed picture, with results appearing to differ as a function of the type of dependent variable. The vast majority of studies examining outcome predictions produced significant desirability effects (most pronounced when the outcome probability was .5), whereas the vast majority of likelihood-judgment studies (involving subjective probabilities or confidence meausures) did not produce significant desirability effects. We conducted an overall synthesis that examined the type of dependent variable (outcome predictions versus likelihood judgment) as a moderating factor of desirability effects. In this analysis, after transforming all effects into odds ratios (see Hasselblad & Hedges, 1995), there was a clear desirability effect for outcome predictions ($OR = 2.26$) but not for likelihood or confidence judgments ($OR = 1.01$), $Q_{between} = 33.31$, $p < .001$. Finally, some betting studies have produced significant desirability effects, but as we discussed above, the question of whether these effects reflect a bias in optimism or merely a particular betting strategy is unclear.

Desirability Effects in Experiments Involving Naturalistic Domains

Although understanding whether preferences might influence expectations for stochastic events in games of chance is valuable in its own right, many intriguing field findings that demonstrated the preference–expectation link involve "naturalistic" events (e.g., competitions) whose outcomes are not determined by strictly random processes (and are not under personal control). Only a few investigations utilized such events in order to test for the presence of a desirability bias while manipulating the desirability of the target outcome. In two studies, Bar-Hillel and Budescu (1995) presented participants with several hypothetical scenarios in which two contesting parties were at odds (e.g., two contracting firms vying for the same bid), and participants' task was to predict the chances that a given outcome would occur for each party. In the first of these two studies, preferences were manipulated by adding

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[9] These two investigations did not report exact means or test statistics that would allow us to present exact effect sizes for the influence of personal choice on optimism. Both studies, however, report Fs < 1.1, indicating a negligible influence.

attractive features to one of the contesting parties (e.g., participants imagined that they held stock in one of the contracting firms). Results revealed that this preference manipulation did not have any effect on subjective probability regarding the outcomes for parties involved. One should note, however, that these outcomes were not truly self-relevant (only hypothetical), so it is not clear why participants should have a preference for any particular conclusion. In the second study of this set, however, desirability was manipulated by promising a ticket for a $75 lottery to the participants if one of the two outcomes (randomly assigned) for a particular scenario occurred. This preference manipulation was successful in biasing probabilities in the expected direction; participants provided higher subjective probabilities for the outcomes that would earn them a lottery ticket. In order to replicate this effect, Bar-Hillel and Budescu (1995) conducted a final study that required participants to estimate the probability that the Dow Jones index (a measure of stock market value) would change 20 or more points in a given week. Participants were instructed that if the Dow Jones index does or does not change 20 or more points, depending on the desirability condition, they would receive a ticket for a $75 lottery. There were no desirability effects; that is, participants' subjective probability judgments that the index would change 20 or more points did not systematically vary depending on whether this change was desirable or undesirable. However, it was also promised that the most accurate participant (whose judgments most closely aligned with those of an expert) would receive $20, thus providing an accuracy incentive. As the authors themselves recognized (Bar-Hillel & Budescu, 1995, p. 97), participants' comments indicated the possibility that this incentive suppressed any potential desirability effects. Overall, the above-mentioned three studies provided very weak evidence for a desirability bias.

Aside from the studies by Bar-Hillel and Budescu (1995), we identified no additional studies that directly manipulated outcome desirability and measured expectancies in naturalistic domains. However, there are three experiments (and one replication) that should also be included in this part of the review because they did effectively manipulate desirability of an outcome, albeit in a slightly indirect way (W. P. Klein, 1999; Price, 2000; Krizan & Windschitl, in press). In two experiments, Price (2000) used a minimal groups procedure (e.g., Tajfel, 1981) to assign participants to Teams "A" and "B", which were to compete in a dart throwing game. Price (2000) reasoned that if arbitrary designation of group affiliation is sufficient for people to treat ingroup members preferentially (e.g., Tajfel, 1981; Tajfel & Turner, 1986), then it also might result in the desirability bias regarding the outcome of the competition between the two groups: an ingroup (more desirable) and an outgroup (less desirable). After participants were assigned to one of the teams, each participant threw one dart at the dartboard while the others observed. Next, one contestant from each team was randomly selected, and the remaining participants judged the probability that each contestant would come closer to hitting the bull's-eye (probabilities had to sum to 100% for each pair of predictions). Each participant provided eight pairs of such judgments. In both studies, participants provided more optimistic predictions that their own team was going to win than did participants of the opposing team, with differences between these judgments varying from 3% to 10%.

W. P. Klein (1999, Study 1) used a somewhat related paradigm in which participants had to judge the likelihood that one of two competitors would outperform the other on a 10-trial dot-estimation competition. Outcome desirability was manipulated by informing participants that if one competitor won, the participant would win a $15 prize but that he or she would win nothing if the other competitor won. Half of the participants immediately provided probability judgments about one of the two contestants winning (no evidence condition) while the other half first learned that the person that they would make a likelihood judgment about won the first trial of the competition (evidence condition). Results indicated that desirability effects emerged in the evidence condition but not in the no-evidence condition. In other words, participants appeared to use evidence from the preliminary trial in a way that supported optimism that the desired outcome would occur.[10]

A recent study by Krizan and Windschitl (in press) suggests a more complex conclusion about how outcome desirability might influence people's likelihood judgments about a competition. Participants arrived in the lab in groups of four and were split into teams of two based on a minimal-groups procedure (e.g., Tajfel, 1981). Participants were informed that their teammate would face off against the player from the other team (i.e., the *outgroup competitor*) in a trivia competition. Participants also learned that they would earn more money in the experiment if their teammate beat the outgroup competitor (maximum payout for a participant was $8). Participants then provided subjective probabilities that their teammate or the outgroup competitor would win each of 20 trivia categories—10 of which appeared hard (e.g., baroque music) and 10 of which appeared easy (e.g., fast food chains). Participants' probability estimates did not reveal a desirability main effect; participants did not judge their teammate as more likely to win than the outgroup competitor (collapsing across responses for hard and easy trivia categories). Instead, participants were overly optimistic about their teammates (the desirable competitor) winning the easy categories, but they were overly *pessimistic* about their teammates winning the hard categories. We discuss the theoretical implications of this finding at greater length later in the article.

In summary, for studies involving non-stochastic or more realistic outcomes, we located 4 sets of experiments (7 experiments in total) in which outcome desirability was manipulated (directly or indirectly but without obvious confounds). Only one of three studies conducted by Bar-Hillel and Budescu (1995) detected desirability effects, and that study involved a scenario outcome rather than a real future event. Two studies by Price (2000) and one by Klein (1999) produced significant desirability effects when desirability was manipulated by varying whether a person was or was not a teammate of the respondent or whether the participant would win a prize if a particular person won, respectively. However, a similar manipulation did not produce an overall desirability effect in a study by Windschitl and Krizan (in press). None of these

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[10] One potential confound for the desirability effect in this study was that participants were told that the desired opponent was someone that they themselves had already beat in a dot-estimation competition. Hence, participants might have had an inflated sense of the capabilities of that person, an interpretation that is plausible given the results of Alicke, LoSchiavo, Zerbst, and Zhang (1997). However, explaining why this influence would interact with the evidence–no evidence manipulation is difficult, which bodes well for Klein's (1999) original interpretation.

studies measured discrete outcome predictions; subjective probabilities were the main dependent variables in all of these studies.

Quantitative synthesis of findings. We performed a quantitative synthesis of the effect sizes (standardized mean differences; see Table 5) across 5 of the 7 experiments reviewed above. For 2 of the 7 experiments (both producing nonsignificant desirability effects), the relevant article did not provide sufficient information for effect sizes to be calculated (Bar-Hillel & Budescu, 1995, Studies 2 and 4). The results of this analysis are presented in the bottom row of Table 2. Overall, there was a small but significant effect of outcome desirability on likelihood judgments (Hedge's $g = .20$), and the effects were clearly heterogeneous ($Q = 19.31$, $p < .001$). Given the use of vastly different paradigms across studies and the small number of studies in this sample, no moderators were examined.

General Observations From the Review of Research on the Desirability Bias

Our review of the relevant literature leads us to the following summary observations.

1. Experiments in which games of chance are used and in which outcome desirability is directly manipulated have yielded a mixed set of findings. Robust desirability effects were detected in many experiments in which outcome predictions were the dependent variables, and the average effect size across studies was substantial. Desirability effects were generally not detected when the dependent variables were judgments of subjective probability or confidence, and the average effect size across studies was negligible. Although bets seemed somewhat sensitive to outcome desirability, the interpretation of findings involving bets is ambiguous (see earlier discussion).

2. The phenomenon known as illusion of control does not appear to play an important role for desirability effects in studies involv-

ing games of chance. In addition, accuracy incentives did not substantially moderate the desirability effects, regardless of the type of dependent variable. Finally, there was a trend suggesting that the objective probability of outcomes may moderate the desirability bias in games of chance, with the largest desirability effects found when the objective probability of the target outcome was 0.5.

3. There is a dearth of studies in which the desirability of realistic and nonstochastic outcomes was manipulated to investigate the resulting effects on expectations. All studies fitting this description used likelihood judgments rather than outcome predictions as dependent variables. The pattern of results across these studies is quite mixed in terms of the heterogeneity in effect sizes and the proportion of significant effects (4 of 7 studies). The average desirability effect size across the 5 studies for which effect sizes could be calculated (leaving out 2 studies with null effects) was significant but small.

4. Overall, then, strong and consistent support for a desirability bias is restricted to studies that have asked participants for outcome predictions regarding games of pure chance. Findings from only one paradigm—the Marks paradigm—have been replicated across researchers and laboratories. Studies asking participants to estimate the likelihoods of outcomes have produced very limited support for the idea that desires bias optimism.

Differences Between Outcome Predictions and Subjective Probabilities

Perhaps the most striking finding from our literature review is that outcome predictions and subjective probabilities appear to differ substantially in the extent to which they are susceptible to desirability bias. In research utilizing games of chance, outcome predictions but not subjective probabilities, were sensitive to outcome desirability (e.g., Price & Marquez, 2005). Why is there a discrepancy? We speculate about three interrelated explanations.

Table 5
Desirability Effects in Experiments Involving Naturalistic Domains

Measure	Study	Outcome	Incentive	Accuracy incentive	Significance	Effect size
Subjective probability	Bar-Hillel & Budescu (1995, Study 2)	Hypothetical competitive outcomes	Hypothetical desirability		No	
	Bar-Hillel & Budescu (1995, Study 3)	Hypothetical competitive outcomes	Lottery ticket for a monetary prize		Yes	$g = 0.15$
	Bar-Hillel & Budescu (1995, Study 4)	Change in stock market value	Lottery ticket for a monetary prize	Monetary	No	
	Price (2000, Experiment 1)	Relative distance from the bull's-eye on a dartboard	Shared team membership		Yes	$g = 1.30$
	Price (2000, Experiment 2)	Relative distance from the bull's-eye on a dartboard	Shared team membership		Yes	$g = 0.67$
	Krizan & Windschitl (in press)	Win on various trivia game categories	Monetary / shared team membership	Instructions	No	$g = -0.21$
	Klein (1999)	Relative performance on a dot estimation task	Monetary		Yes	$g = 0.71$

Note. With regard to the column headings, "Measure" refers to the type of dependent variable used; "Study" provides the specific reference; "Outcome" describes the outcome that was predicted; "Incentive" describes the desirability incentive used to manipulate outcome desirability; "Accuracy incentive" indicates what, if any, accuracy incentive was used; "Significance" indicates whether the overall effect in the direction of increased optimism for desirable outcomes was significant at $p < .05$; and "Effect size" indicates the overall effect size (in terms of standardized mean differences) for that study. In the effect size column, a blank cell indicates that an effect size could not be computed because the relevant article did not provide adequate information.

First, as Bar-Hillel and Budescu (1995) have noted, most people are aware that if a deck of cards contains 50% marked cards, then the probability of drawing a marked card is .5. As a result, it seems reasonable to speculate that asking people for subjective probabilities of outcomes in these studies might have resulted in participants deriving (in large measure) their probabilistic responses directly from objective outcome probabilities, overriding any influence of outcome desirability. When stating outcome predictions, however, participants cannot directly map a given response from objective probabilities unless they use an optimization strategy on every trial, which is often an atypical strategy.[11] If people are not using optimization, they would be using other input in deciding what to predict on a given trial. Outcome desirability could be an especially salient input for influencing such a prediction, given that participants in desirability-bias studies are given rather explicit information about the value or desirability of various outcomes.

A second and closely related explanation is that accountability for an accurate response may be greater in the case of subjective probabilities than in the case of outcome predictions. When people are asked to give an uncertainty estimate in the form of a numeric subjective probability, and they have been given numeric input information (such as the proportion of marked cards), people may become particularly sensitive to the defensibility of their response and the use of appropriate mathematical rules (e.g., Windschitl & Wells, 1996). Hence, some or many participants in an experiment who are asked to provide subjective probability estimates might conclude that the experiment is testing whether they can accurately answer probability questions. In contrast, participants who are asked to provide outcome predictions might be less particularly concerned with the accuracy of any given response. Even if they are given external rewards for accuracy (cf. Budescu & Bruderman, 1995), the goal to be accurate has a somewhat unclear implication for how a participant should respond on a particular trial (aside from the straightforward implication to use optimization).[12]

Finally, the idea that outcome desirability effects for ".5 trials" reflect a type of tie-breaking influence on predictions leads to yet another closely related explanation for why desirability effects are robust for outcome predictions but largely absent for subjective probabilities. Price and Marquez (2005) have recently argued that small incentives used in studies involving the Marks paradigm do not influence subjective probabilities but rather may influence prediction thresholds on the basis of these probabilities. These authors assumed that for a given objective probability, subjective probabilities will vary somewhat across trials and desirability levels, although generally converging on the objective value (explaining the absence of desirability effects on probability judgments). However, in order to make an outcome prediction, participants need to assess whether their subjective probability exceeds a particular decision threshold. Critically, in terms of signal detection theory (Green & Sweets, 1966), participants might be especially sensitive to maximizing "hits" when the outcome is desirable, and thus might have a very low threshold for predicting desirable outcomes. On the other hand, when the outcome is undesirable, participants might be more concerned about avoiding "false positives" and thus might have a relatively high threshold for predicting negative outcomes. Such a process would then result

in more optimistic predictions for desirable outcomes (Price & Marquez, 2005; but see Weber, 1994).

These three explanations for why desirability effects differ for outcome predictions versus subjective probabilities should be considered speculative and clearly warrant additional investigation, especially given the extent of the differences between the two dependent variables revealed by the literature review. Additionally, although the research studies in which outcome predictions are the dependent variables provide compelling evidence that outcome desirability can have a significant effect on predictions, these studies do not provide evidence that outcome desirability (a) biases how evidence regarding outcomes is processed or (b) changes the perceived likelihood of such outcomes (see Bar-Hillel & Budescu, 1995). These two issues are critical for fully understanding the interplay between motivation and information processing in shaping optimism—an interplay that we discuss in the next section.

Possible Mechanisms Mediating Between Desires and Expectations

We believe that to truly understand whether the desirability bias is a robust phenomenon and how it occurs, researchers must speculate about and investigate specific mechanisms that could mediate between the desirability of an outcome and the judged likelihood of that outcome. It is also important that this work recognizes the possibility that desirability might sometimes have an optimism-reducing influence rather than only an optimism-enhancing influence. This is especially important given verifiability constraints described earlier; whereas one psychological mechanism might be involved in increasing optimism because of desires for a positive outcome, another mechanism might be involved in decreasing optimism because of fear of being wrong or disappointed if the outcome is negative. In this section we speculate about nine possible influences that outcome desirability can have

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[11] Optimization would require that in the Marks paradigm, for example, participants would always predict a marked card when the proportion of marked cards in a deck was greater than .5 (see e.g., Shanks, Tunney, & McCarthy, 2002).

[12] Imagine a participant in an experiment in which marked cards are desirable in some decks but undesirable in others. Imagine as well that the participant (like most) is using a probability matching strategy rather than optimization. If that participant is actively trying to be unbiased by desirability information, he or she must ensure that his or her rate of predicting marked cards is the same for decks in which the marked cards are desirable and for decks in which the marked cards are undesirable. The question of how that participant should respond on any trial depends entirely on how he or she responded on other trials. Hence, trying to be unbiased by desirability on a given trial in a desirability bias experiment is more complex when one is making outcome predictions rather than subjective probability judgments. Even for a person using an optimization strategy, determining an unbiased response for a "favorable" deck with a .5 proportion of marked cards is impossible unless one is aware of how he or she previously responded to favorable and unfavorable decks that also held a .5 proportion of marked cards. Outcome desirability effect for ".5 trials" may simply reflect a small influence of outcome desirability on participants' decision of "which way to go," because there are no normative standards relevant to such predictions. This is an important observation given that desirability effects are far more robust in ".5 trials" than in all other trials.
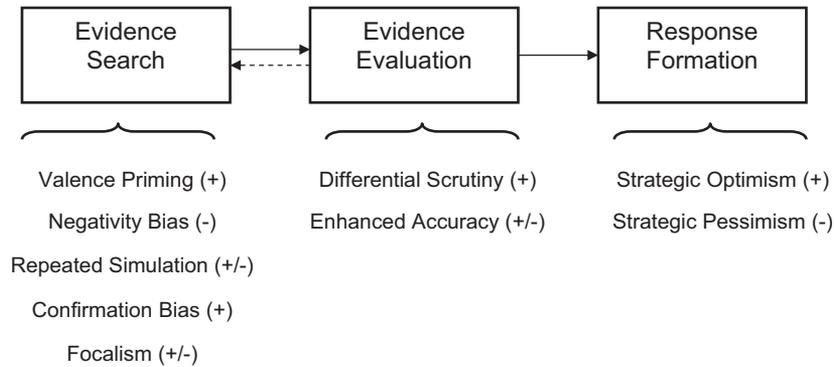
Figure 1. A schematic representation of information-processing stages and psychological mechanisms hypothesized to operate at each stage. Located at the top are stages of information processing representing the steps involved in formation of a likelihood judgment, with arrows indicating the flow of information. Located beneath each stage are respective psychological mechanisms hypothesized to mediate the influence of desires on expectations. The signs in parentheses indicate the potential for optimism-enhancing ($+$) or optimism-reducing ($-$) influences of each mechanism.

on judgments of likelihood. All of these accounts of influence refer to plausible psychological mechanisms that might mediate between desires and expectations. Some of these mechanisms have already been proposed and studied—in research on motivated reasoning—as mediators between motivations and various judgments (see reviews by Kunda, 1990; Kruglanski, 1996). However, for most of these accounts, there is little or no research specifically testing whether these mechanisms serve as mediators of desirability effects on predictions. Also, five of these accounts describe mechanisms by which the desirability of an outcome could ultimately *reduce* optimism about that outcome occurring.

Before considering these possible mechanisms, it would first be helpful to briefly discuss a generic framework for how a dispassionate thinker—one who is not swayed by desires for any particular outcome—would generate a likelihood estimate about a specified outcome. In general terms, let us assume that when the dispassionate thinker is developing an expectancy about the outcome of an event, his or her reasoning can be roughly divided into three broad stages: evidence search, evidence evaluation, and response formation (see Curley & Benson, 1994; Kruglanski, 1996; Trope & Liberman, 1996, for related proposals). During the evidence search stage, the dispassionate thinker would consider a wide variety of evidence both for and against possible outcomes. A person could access this evidence or information through a variety of means (e.g., the information might be retrieved from memory or gleaned from available information sources), and this information could take different forms (e.g., similarity based, frequency information). The evidence that is actually considered would depend both on top-down factors, such as what kinds of evidence a person believes are relevant, as well as bottom-up factors, such as what evidence is naturally salient within a person's environment.

During the evidence evaluation stage, available evidence is processed or used in a variety of ways (e.g., availability heuristic, representativeness heuristic, calculation). Selected pieces of evidence are scrutinized and given more or less weight as a function of their perceived importance and reliability. If a given piece of evidence is deemed unsatisfactory, additional evidence might be sought.[13]

Finally, during a response formation stage, an expectation or likelihood judgment is established internally and translated into a relevant expression or response on a relevant likelihood scale. Of course, a key characteristic of the dispassionate thinker would be that evidence for and against the target outcome gets equal treatment at each stage of the likelihood judgment process and that the scaling from internal assessments of uncertainty to external assessments is uninfluenced by desires. With this generic framework of a dispassionate thinker as a backdrop, we turn now to a discussion of nine possible mediators of desirability effects. Each mediating mechanism is assumed to exert its primary impact on one of the stages of information processing just described. A summary of these nine possible mediators and their consequences for likelihood judgments is shown in Figure 1, together with a diagram of reasoning stages just described.

Valence Priming Account

The first two accounts focus on how desires could have an influence on the very early and largely automatic processes that shape likelihood judgments (and judgments in general). The valence priming account suggests that a particular outcome could influence predictions through a low-level spreading activation that is ultimately tied to the valence that a desired outcome has or is imbued with. Consider a case in which people read information about two companies (A and B) vying for a big contract. Now imagine that some people believe they will receive $1,000 if

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[13] It should be noted that reasoning processes involved in the first two stages are likely bidirectional; evaluating a particular piece of evidence as valid is likely to increase the perceived validity and relevance of other evidence with similar implications (see Holyoak & Simon, 1999; McGuire, 1990). In this vein, processing within the evidence search and evaluation stage often occurs in parallel, and we present these stages separately mainly for easier exposition of individual mediating mechanisms.

Company A wins the contract. People in a control condition are told nothing about receiving any money. Participants in the $1,000 condition would hope for Company A to win, which presumably could lead to positively valenced evaluation of Company A (and perhaps negatively valenced evaluation of Company B). In much the same way that activation of a mental concept spreads more readily to similarly valenced concepts than to differently valenced concepts (see e.g., Fazio, Sanbonmatsu, Powell, & Kardes, 1986; Greenwald et al., 2002), the positive valence of Company A might yield enhanced activation of characteristics of that company that are positive (e.g., longer history, more employees) rather than negative (e.g., recent layoffs). This differential activation of positive and negative aspects of the companies could ultimately lead to a biased appraisal of Company A's fitness and its likelihood of winning the contract. Hence, the judged likelihood that Company A would win the contract would be greater in the $1,000 condition than in the control condition. Because the evaluative priming account is based on the enhanced activation of positively valenced knowledge (knowledge consistent with desired outcome), the boost would—if having any effect on likelihood judgment—serve to make people more optimistic (never less optimistic) about the desired outcome.

A similar process is often hypothesized to mediate the influence of moods on likelihood judgments. Affective states often encourage recall of evaluatively congruent information, resulting in more pessimistic or optimistic predictions under negative or positive moods, respectively (see Bower & Forgas, 2001; Johnson & Tversky, 1983; W. F. Wright & Bower, 1992). To the extent that desirability of an outcome encourages attention to or recall of evaluatively congruent information in a similar fashion, one could expect more optimistic predictions about desirable outcomes.

Negativity Bias Account

Another account that focuses on the very early stages of information processing suggests results that are quite different from the evaluative priming account. The negativity bias account suggests that desire might make people more pessimistic. A strong desire for an outcome makes information that is inconsistent with that outcome more negative in valence than it normally would be. For example, if a person knows that he or she will receive $1,000 if Company A wins the contract, then negative information about Company A will presumably have an especially large affective impact relative to a control condition in which no money is at stake. Moreover, research on the negativity bias (see Rozin & Royzman, 2001, for review) suggests that negative information has more salience and impact than positive information. For example, losses appear more negative than corresponding gains appear positive (Kahneman & Tversky, 1979), and negative stimuli are often more salient than positive stimuli (e.g., Pratto & John, 1991). Therefore, to the extent that the desirability of an outcome is increased, the difference in the salience and impact of negative versus positive information might increase. When negative information about an outcome carries far greater salience and impact, this would result in less optimistic assessments about the likelihood of the desired outcome. Hence, although the valence-priming

and negativity-bias accounts are similar in that they both refer to the enhanced activation of selective sets of information, they predict opposite effects. The former suggests that positive information associated with the favored outcome will have enhanced activation and weight, ultimately enhancing optimism. The latter suggests that negative information about a preferred outcome will have enhanced activation and weight, ultimately reducing optimism.

Repeated Simulation Account

A third account bears some resemblance to the first two, yet it is distinct in important ways. The repeated simulation account assumes that the desirability of an outcome influences the extent to which people passively or actively simulate its occurrence, perhaps even repeatedly. One reason why a person might repeatedly simulate a positive or desired outcome is because the mere process of imagining that outcome can be enjoyable. If a person believes he or she will receive $1,000 if Company A wins the contract, then he or she might actively or passively simulate that outcome simply because the mental simulation of receiving $1,000 is rewarding. This simulation might include not only the ultimate outcome (finally learning that Company A wins) but also a simulation of the causes or precursors of this outcome. Previous research indicates that imagining an outcome or simulating ways in which an outcome can occur can increase the judged likelihood of that outcome, because the process of imagining the outcome makes the precipitating causes of that outcome more available in memory than precipitating causes of alternative outcomes (see e.g., Kahneman & Tversky, 1982; D. J. Koehler, 1991; Levi & Pryor; 1987).

Although this account might appear to suggest that outcome desirability will always inflate optimism, this presumes that people tend to simulate positive outcomes more so than negative ones (because of the reward inherent in imagining something positive). It is possible, however, that some people will tend to simulate negative outcomes, either out of a passive generalized habit (perhaps fueled by chronic anxiety or dysphoria; see Kagan, MacLeod, & Pote, 2004) or out of a more active habit of preparing for negative outcomes (which is related to the "strategic pessimism account" that is discussed later). Hence, in principle, this account allows for outcome desirability to lead to either enhanced optimism or pessimism.

Confirmation Bias Account

The past three accounts assume that even before a person tries to generate an expectancy or likelihood judgment about an outcome, certain types of information or knowledge already enjoy enhanced accessibility or availability because of spreading activation, negativity biases, or repeated simulations. However, when a person generates an expectancy or likelihood judgment, he or she does not simply use information that is highly accessible or available in a passive fashion, he or she also plays an active role in deciding what evidence to search for in order to make an appropriate judgment. The confirmation bias account explains the desirability bias by positing a specific search strategy that a forecaster would adopt. To explain this account, we must first note that even in the absence of strong desires, people are known to be biased in the manner in which they evaluate hypotheses (for a

review, see Klayman & Ha, 1987). One general bias is the positive-test strategy, in which people tend to test for or search for evidence that is consistent with the hypothesis being considered rather than testing or searching for evidence that might conflict with the hypothesis. In many cases, this strategy can unduly facilitate the confirmation of the hypothesis (Klayman & Ha, 1987; Trope & Liberman, 1996). Kunda (1990) noted how this positive-test strategy might play a role in motivated reasoning (see also Sanitioso, Kunda, & Fong, 1990). Specifically, she argued that a directional motivation (e.g., wanting to view a medical test as invalid) can shape the hypothesis considered by a person ("Is the medical test invalid?"). The person then uses a positive test strategy in searching for evidence regarding this hypothesis (searching either memory or one's environment). To the extent that the person finds some information consistent with the hypothesis as it is framed, the person would be confident about the belief he or she wished to hold, even if diagnostic information that contradicts the hypothesis were available but not fully considered.

The confirmation bias account assumes that the directional motivation has its main influence by shaping the framing of the hypothesis that is tested, but it could also be the case that a directional motivation could have an influence even when the hypothesis is externally formulated (e.g., when a person is asked, "What is the likelihood that Jane will win her game?"). Namely, if the person desperately wants Jane to win, he or she might engage in a positive test strategy that is even more biased or aggressive than it normally would be. Moreover, the preferences for a given outcome could shape framing of more specific hypotheses regarding evidence relevant for the prediction; if the person wants Jane to win her game, he or she might test hypotheses such as "Is Jane familiar with this game?" and "Did Jane ever win such games in the past?" both of which exemplify a positive test strategy and could lead to accessing evidence consistent with the hypothesis (see Snyder, 1981, for a discussion about how more specific hypotheses are generated). Like valence priming, the confirmation bias, if having an effect on likelihood judgment, would serve to make people more optimistic about the desired outcome (see Figure 1).

Focalism Account

Although Kunda (1990) discussed the potential role of the confirmation bias in motivated reasoning, there is another closely related bias that was not discussed. This additional bias is important to consider because it suggests different implications for how desires might influence expectations. This bias is called *focalism,* and it has been recently investigated as one of many nonmotivated causes of above-average effects (e.g., Klar, 2002; Kruger, 1999), comparative optimism effects (e.g., Chambers et al., 2003), non-selective superiority and inferiority biases (e.g., Giladi & Klar, 2002; Suls, Krizan, Chambers, & Mortensen, 2005), and shared circumstance effects (e.g., Moore & Kim, 2003; Windschitl et al., 2003; for a review see Chambers & Windschitl, 2004). As defined within these areas of research, the typical focalism account suggests that when people are asked to make a comparative judgment (or a likelihood judgment that requires a comparison), they tend to evaluate the evidence—both positive and negative—relevant to the focal entity while neglecting the evidence relevant to the

nonfocal entity (i.e., the referent entity). For example, research on shared-circumstance effects suggests that dispassionate observers (those in the control condition of our earlier example) who were asked to indicate how likely it is that Company A would win the contract instead of Company B would consider the strengths and weakness of Company A and neglect to think much about the strengths and weakness of Company B. Hence, even if both Company A and Company B are very well suited for the contract, a respondent would report a high likelihood that A would get the contract. Also, even if both Company A and Company B are very poorly suited for the contract, a respondent would report a low likelihood that Company A would get the contract. Therefore, the key difference between focalism and the positive test strategy is that the positive test strategy would suggest that people would examine evidence consistent with the full hypotheses (i.e., both the subject "Company A" and the predicate "wins"), whereas focalism suggests that people examine evidence about the focal entity (the subject, "Company A"), irrespective of whether the evidence is consistent with the full hypothesis.

Whereas in previous research the outcome or entity on which participants focused was induced via the format of the question presented to participants (see, e.g., Windschitl et al., 2003), the tendency to focus on a particular outcome or entity could also be shaped by other factors. Critically, one's desires might exacerbate the tendency to focus on the entity involved in a desired outcome, which could impact optimism about that outcome. The broader implication of this account is important. If desire enhances focalism, then increasing the desirability of an outcome would produce more optimism in cases where the evidence for the focal entity is generally positive (i.e., supportive of the outcome for the focal entity). However, increasing the desirability of an outcome would produce pessimism in cases where the evidence for the outcome is generally negative or not supportive of the outcome. For example, telling people that they would be given a million dollars if a Honduran wins a 2006 Olympic figure skating medal might make them more pessimistic about that outcome, rather than more optimistic (assuming that people generally view the climate, size, and athletic history of Honduras as unfavorable for producing figure skating champions).

Is there any evidence that desire can enhance focalism, thereby influencing likelihood judgments? A recent study mentioned earlier (Krizan & Windschitl, in press) provides support for this account. Recall that in this study participants were asked to predict either their teammates' or outgroup competitors' chances of winning easy and hard trivia categories in a competition. In line with the focalism account, participants were more optimistic about their teammates' chances of winning than their teammates' opponents' chances for easy trivia categories but more pessimistic about their teammates' chances in comparison with their teammates' opponents' chances for difficult categories. Path analyses also supported the idea that when participants were providing likelihood judgments, they tended to give more weight to their category-knowledge estimates of the preferred winner (their teammate) than to their category-knowledge estimates of the nonpreferred winner. Hence, consistent with a focusing account, outcome preferences can lead to increased focalism, which thereby results in either enhanced optimism or enhanced pessimism, depending on the nature of the evidence.

Differential Scrutiny Account

Although preferences might influence evidence search (how evidence is sought or what evidence is likely to be found), they may also influence evidence evaluation (how that evidence is utilized and whether it is seen as valid). Specifically, desires could lead to quick acceptance of information with favorable implications but to effortful scrutiny and vigilant analysis of unfavorable information, resulting in overoptimistic predictions. We subsume this class of processes under the differential scrutiny account. A considerable amount of empirical and theoretical work supports the notion that people often hold differential standards for evaluating evidence that is consistent versus inconsistent with desired propositions (e.g., Dawson, Gilovich, & Regan, 2002; Ditto & Lopez, 1992; Doosje, Spears, & Koomen, 1995; Dunning, 2003; K. Edwards & Smith, 1996; Kunda, 1990; Liberman & Chaiken, 1992; Nisbett & Ross, 1980; Pyszczynski & Greenberg, 1987; Schaller, 1992). These findings about differential use of evidence are reflected in conceptualizations such as *asymmetric confidence thresholds,* proposed by Trope and Liberman (1996), and in the "Can I? Must I?" distinction proposed by Gilovich (1991). Both of these proposals assume that standards for accepting a desirable proposition are more lenient (lower confidence threshold, "*Can* I believe this?") than standards for accepting undesirable propositions (higher confidence threshold, "*Must* I believe this?"). It is important to note that such differential standards need not be products of motivational forces; they can also be the result of prior beliefs and expectancies, which, when violated, instigate more effortful processing (e.g., Lord, Ross, & Lepper, 1979; Nisbett & Ross, 1980; Tetlock & Levi, 1982). However, research that has manipulated motivational factors while attempting to hold relevant cognitive factors constant shows that directional motivation can sometimes result in differential scrutiny of evidence (see Dunning, 1999; Kunda, 1990, for reviews). This differential scrutiny seems to result from both *quantity* (the extent of scrutiny) and *quality* (the aim of scrutiny) of processing directed toward unfavorable evidence (Kruglanski, 1996). Sometimes this differential scrutiny is reflected in the quantity of processing. Unfavorable evidence will then be more effortfully processed, and therefore any weaknesses or inconsistencies in the arguments will more likely be noticed (see e.g., Ditto & Lopez, 1992; K. Edwards & Smith, 1996). At other times, differential scrutiny will be reflected in the quality of processing such that people will use different rules to evaluate favorable versus unfavorable evidence (see, e.g., Giner-Sorolla & Chaiken, 1997; Kunda, 1990; Pyszczynski & Greenberg, 1987) or will generate self-serving theories about themselves and others (see, e.g., Dunning, 1999, 2003).

Consider an influential study by Kunda (1987, Study 1), in which participants were informed that the likelihood of divorce in the United States is 50% and then read about a fictitious target person. Some participants were told about six particular attributes the target person possessed (e.g., "independent"), whereas other participants were told about six exactly opposite attributes (e.g., "not independent"). Participants then rated to what extent these personal attributes contributed to the likelihood of divorce. Finally, participants rated themselves on these attributes and provided their personal likelihood of getting divorced. For both sets of attributes (although opposite), participants rated attributes they shared with the target person as more likely to prevent divorce. In other words,

they generated self-serving causal explanations about which personal characteristics are likely to decrease divorce. Notably, after this exercise, participants believed that their personal chances of getting a divorce, on average, were only 20% rather than 50%, as mentioned at the beginning of the study as the average divorce rate. Although not providing direct support for differential scrutiny as a cause of overoptimism, these data do suggest that preference for an outcome (in this case, a successful marriage) led to construction of self-serving causal explanations that contribute to participants' optimism about avoiding divorce (Kunda, 1987, p. 640). Kunda (1987) wrote that "perhaps the motivation to maintain an optimistic view of their future health led these subjects to access those inferential rules and background beliefs that would allow them to reduce the credibility of the threatening research" (p. 644).

In a study illustrating the quantity of processing view, Ditto and Lopez (1992, Study 2) conducted an experiment in which participants were tested for a bogus enzyme deficiency. Participants who believed this to be an unfavorable medical diagnosis took more time to decide that their test result was complete, were more likely to repeat the test, and believed the test to be less accurate than participants who saw the enzyme deficiency as inconsequential. The authors interpreted these findings as resulting from increased quantity of processing aimed at the unfavorable information.

In sum, the differential scrutiny account specifies self-serving handling of evidence as responsible for the desirability bias. As is the case with the earlier accounts noted here, this one also implies that desires lead to enhanced optimism (not pessimism).

Enhanced Accuracy Account

Thus far, we have discussed possible ways in which a desire for one outcome can result in a directional bias that either increases or decreases the judged likelihood of the outcome. However, it is also possible that desires can have a nondirectional influence on the judgments of likelihood. Increasing the desirability of an outcome could trigger greater accuracy motivation because more is "on the line" regarding the outcome in question (i.e., there is a potential for large psychological or interpersonal costs). Moreover, the ability to accurately anticipate the future creates a sense of predictability and control over the environment (e.g., Burger & Arkin, 1980), a disposition that might acquire additional value in cases of highly desirable outcomes. For example, finding out that her study partner will be a boy she really likes (rather than another boy) might make a high school student especially concerned about the accuracy of predictions she makes about the boy's behaviors during the study session.

Enhanced accuracy motivation spurred by the fact that a key outcome is a "high stakes" outcome would presumably have the same influence on judgment as would an enhanced accuracy motivation spurred by other sources, such as pressures for accountability to others (e.g., Tetlock, 1983) or a general "fear of invalidity" (Kruglanski & Freund, 1983). Namely, the enhanced accuracy motivation could cause people to consider more information, process that information to a greater extent, and more appropriately weight relevant information when making their judgments (e.g., Eagly & Chaiken, 1993; Lerner & Tetlock, 1999; Neuberg & Fiske, 1987). Hence, instead of biasing expectations in a pessimistic or optimistic direction, the high desirability of an outcome

could simply cause people to make likelihood judgments in a more deliberative and effortful fashion than usual.[14] This bears resemblance to the hypothesis from the elaboration likelihood model of persuasion that people for whom an attitude issue has high personal relevance will process persuasion attempts in an effortful and elaborative fashion (e.g., Petty & Cacioppo, 1986).

An idea related to the enhanced accuracy account comes from Gilovich et al. (1993), who studied how temporal perspective influences subjective confidence. In their studies, which involved timing manipulations, Gilovich et al. (1993) showed that their research participants' tendencies to be overly optimistic about their own performance at a task decreased significantly as the time of the performance drew nearer. Gilovich et al. (1993) argued that people felt more accountable for their estimates as the performance drew nearer and, hence, were more willing to consider their potential weakness and possible causes of a performance failure. Data from one of these studies support the notion that possible negative factors were considered by participants more frequently as the performance drew nearer. Whether this increased tendency to consider potential weaknesses as a performance draws nearer reflects a time-dependent correction of some form of overoptimism caused by non-motivated factors or overoptimism caused by motivated factors is unclear. Nevertheless, these findings could be viewed as consistent with the notion that people take a more balanced approach to formulating expectancies about an outcome when that outcome is important and impending (see also G. Wright & Ayton, 1992).

Strategic Pessimism and Optimism Accounts

Thus far, we have described accounts for how outcome desirability might influence processes in the evidence search or evaluation stage. The last two accounts that we discuss are perhaps best viewed as being more relevant to the response formation stage (although these accounts are relevant to the first two stages as well). These two accounts assume that people are strategically regulating their optimism/pessimism about a desired outcome. Essentially, the accounts assume that people strategically bias their expectations, or *expectancy responses,* about an outcome, and the level and direction of the bias is a function, in part, of how desirable the outcome is.

The strategic pessimism account proposes that people become unduly pessimistic about a desirable outcome as a way of protecting themselves from severe disappointment if the outcome fails to materialize. This conception has been researched as an individual difference in tactics people use to prepare for upcoming performances (defensive pessimism; see Norem, 2001) and as a general tendency to deflate expectations ("brace for loss") as an important outcome nears (e.g., Shepperd, Ouellette, & Fernandez, 1996). Although this notion of strategic pessimism is often used in reference to controllable outcomes (e.g., performance; see Norem, 2001), it has also been observed for outcomes not under personal control. For example, financially needy students were found to be more pessimistic about their chances of receiving an additional university bill in comparison with less financially needy students (Shepperd, Findley-Klein, Kwavnick, Walker, & Perez, 2000), and students were more pessimistic about testing positive for a fictitious enzyme deficiency when this condition was described as severe rather then benign (K. M. Taylor & Shepperd, 1998).

Interestingly, such enhanced pessimism was observed only for negative self-relevant outcomes (Shepperd et al., 2000) and seems to increase as the time of feedback nears (e.g., Shepperd et al., 1996). Shepperd and his colleagues (e.g., Shepperd et al., 1996, 2000) interpreted such pessimism as reflecting the act of "bracing for loss," a cognitive strategy in which participants deflate outcome expectations in order to avoid potential disappointment when the outcome (or relevant feedback) occurs. Increased anxiety and thoughts about potential bad news seem to be the factors primarily responsible for this increased pessimism (e.g., Shepperd et al., 2000).

The flip side of the strategic pessimism account is the strategic optimism account, which assumes that optimistic expectancies are beneficial and may even be strategically constructed. In their review of literature on unrealistic optimism, Armor and Taylor (1998) argued that having (unrealistically) positive outcome expectations can aid people in developing appropriate action plans, motivate them to persist when appropriate, and help them deal more effectively with negative outcomes if those materialize. Perhaps the most important conclusion from their analysis was that unrealistic optimism is *situated,* that is highly responsive to demands of the immediate situations. Thus, when the outcomes to be predicted are controllable, temporally distant, and ambiguous, unrealistic expectations are more likely to be observed. It is in such situations, these authors argued, that optimism is likely to confer the benefits just outlined. In sum, in many contexts unrealistically optimistic expectations can confer a strategic benefit to the organism, fostering appropriate action plans, persistence, and resilience in case of negative outcomes. This line of reasoning suggests that people might intentionally construct overoptimistic expectations in order to increase their chances of obtaining (or perceive that they have obtained) desired outcomes (see also Norem & Cantor, 1986; Sanna, 1996).

It is worth repeating, however, that such strategic optimism is most likely to be beneficial in the case of controllable outcomes. With regard to uncontrollable outcomes, the focus of our review, strategic optimism might not play such an adaptive role given that people cannot use it to motivate goal-relevant behaviors (see Armor & Taylor, 1998; Bandura, 1997). Strategic pessimism, however, would still be a potentially useful strategy for avoiding disappointment even in the case of uncontrollable outcomes.

Both the strategic optimism and pessimism accounts propose that people bias their level of optimism to serve other goals. However, exactly how they bias optimism is an open question, and people may have considerable flexibility. One possibility is that people search for and evaluate evidence in a relatively balanced way, but because they want to be pessimistic or optimistic, they simply adjust their ultimate conclusions or responses in a rather superficial way—in much the same way that the flexible correction model assumes that people will adjust responses to avoid bias (Wegener & Petty, 1995). Another possibility is that because people want to be either pessimistic or optimistic, they actively search for and evaluate evidence in a way that supports a desired conclusion. These possibilities raise an intriguing issue discussed

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[14] This is different from the possibility that external pressures to make accurate judgments (e.g., getting paid to make accurate likelihood judgments) can improve accuracy.

and investigated by Siepmann (1999), namely, whether and how people could simultaneously believe and disbelieve a proposition (see also Mele, 1997). Does it make sense for a person to consciously or strategically bias their optimism? If so, what is the consequence of the "old" or "true" assessment of optimism? Unfortunately, these interesting questions are not easily addressed through current empirical methods. Nevertheless, it is important that they have some airing in future accounts of the desirability bias.

Summary of the Nine Accounts

In the preceding sections, we outlined nine general accounts that specify how preferences can bias outcome predictions. Although some of these accounts exclusively imply an optimism-enhancing influence of preferences (valence priming, confirmation bias, differential scrutiny, and strategic optimism accounts), some imply both optimism- and pessimism-enhancing influences (focalism, repeated simulation, and enhanced accuracy accounts), and others imply overpessimism (negativity bias and strategic pessimism accounts). Some of these accounts rely on low-level processes basic to cognitive operations as a cause of biased predictions (valence priming and negativity bias), whereas others rely on higher level reasoning processes that may be either largely unintended (repeated simulation, confirmation bias, focalism, and differential scrutiny) or somewhat more controlled (enhanced accuracy, strategic pessimism, strategic optimism). Finally, some accounts already enjoy some, albeit limited, empirical support as a cause of preferentially biased predictions, whereas others have yet to be directly tested.

We do not assume that the nine accounts we list here are mutually exclusive. In fact, it is quite plausible for the mechanisms in two or more accounts to act as simultaneous mediators between outcome desirability and expectancies, which we discuss below. We also do not assume that our list of nine accounts is exhaustive. Indeed, as is discussed later (see *Limitations of the Present Analysis*), our description of possible mediators focuses on the possible immediate impacts of bias on information processing; the focus on immediate impacts is consistent with that of the experimental tests of desirability bias reviewed in this article. Hence, our list of mediators does not include possible mediators that might have a long time course for ultimately influencing expectations. Nevertheless, we think that the explication of our list—focusing on possible immediate mediators of bias—is important for facilitating a more systematic approach in future research for understanding the complexities of how desires influence expectations.

Toward a Better Understanding of How Desire Influences Expectations

Thus far, we have reviewed the literature examining the desirability bias hypothesis and outlined nine possible accounts for how desires might influence expectations about the future. This review has yielded mixed results, and although each of the nine accounts is quite plausible from a general point of view, there is very limited empirical work directly testing whether the mechanisms proposed in these accounts actually serve as mediators between desires and expectations. Hence, as a field, psychology's understanding of how desires might influence expectations is perhaps far less de-

veloped than one might initially assume. In the remainder of the article, we discuss a variety of ideas that we believe are important to consider in moving toward a better understanding of how desires influence expectations.

Distinguishing Overoptimism From the Motivated Influence of Desires on Optimism

One broad but important point is that researchers must do a better job of distinguishing between overoptimism and hypotheses stipulating that there is a motivated influence of desires on optimism. Overoptimism does not refer to a particular process. Instead, it is a term that describes instances in which a person's beliefs are more positive than warranted, such as when an expectation regarding a desired outcome is higher than warranted. As mentioned earlier, there are a host of causes of overoptimism and overconfidence that do not require a motivational bias (see e.g., Fischhoff, 1975; Fischhoff & Bruine de Bruin, 1999; Chambers et al., 2003; Chambers & Windschitl, 2004; Klar et al., 1996; Kruger, 1999; Kruger & Burris, 2004; Moore & Kim, 2003; Windschitl, 2002; Windschitl et al., 2003). Hence, findings that people are overoptimistic in their predictions about the future are of limited use for evaluating the general desirability bias hypothesis unless the researchers take steps to separate the motivated and nonmotivated causes of optimism.

This point may seem confusing given that some of the mechanisms discussed as mediators of desirability bias in this review can also be mediators of overoptimism that is not motivated. An example of such a mechanism is differential attention (i.e., attending more to some evidence than to other evidence, as in the focalism account described earlier). Although differential attention clearly refers to cognitive processes, it can be part of either a motivated or a nonmotivated explanation for overoptimism, depending on the trigger for causing the differential attention. A nonmotivated focalism account of overoptimism suggests that people tend to attend to evidence that is directly related to a target outcome (the outcome explicitly asked about in a likelihood question) more than to evidence that is directly related to a referent/alternative outcome (see, e.g., Windschitl, 2000; Windschitl et al., 2003). A motivated focalism account of overoptimism suggests that people tend to attend to evidence that is directly related to a desired outcome more than to evidence that is directly related to a neutral outcome (see Krizan & Windschitl, in press). Although both of these accounts can describe valid causes of optimism in some cases, the two accounts differ in whether the initial cause of focalism or differential attention was triggered by the wording of the likelihood question or the desirability of the outcomes. More generally, then, the distinction between motivated and nonmotivated accounts is not whether they involve cognitive mediators (both do) but whether a bias carried by those mediators was triggered by a motivational trigger (e.g., wanting one outcome to occur more than another).

Assessing the Mediating Mechanisms

Our description of the possible mechanisms mediating between desire and likelihood judgments highlights what we believe is another crucial point regarding research on the desirability bias. Experiments that assess the influence of a specific mediating

mechanism are likely to be more effective in advancing understanding of the desirability bias than are experiments that simply manipulate incentive or desire and test whether it produces a main effect on likelihood judgments. Although many of the nine mediating mechanisms we describe here have not undergone direct empirical tests, their plausibility on a logical basis is compelling enough to speculate that a manipulation of desire might have an optimism-enhancing effect in one context or study but have a precisely opposite effect in another context or study. In fact, a desirability manipulation could even have opposing effects on likelihood judgments within the same study. For example, knowing that one has a lot of money riding on the outcome of a game might cause greater attention to evidence supporting the desirable outcome but might also cause restraint of one's stated optimism as a way of protecting oneself from disappointment. Hence, experiments that do not directly test one or more of the possible cognitive mediators of the desirability bias can produce misleading null results for the influence of desire on optimism, because competing influences of desirability cancel each other's influence on likelihood judgments (such a scenario can be seen in betting studies conducted by Irwin & Snodgrass, 1966). Even when a desirability manipulation has a significant directional influence on likelihood judgments in a particular study, it might be difficult for a researcher to conceptually replicate that finding without some knowledge about the mediating mechanism that drove the effect.

Specifically, then, we encourage researchers to establish paradigms in which two or more mediating mechanisms can be examined simultaneously. Process tracing methodologies are one way in which potential mediators should be investigated. Consider a generic paradigm in which participants are allowed to process information about two possible outcomes of a situation, "A" and "B." An incentive (e.g., money) is used to make one outcome more desirable than the other (by either a minimal or large amount). An information display would allow participants to learn about evidence relevant to A and B (some supportive, some neutral, and some against). Eye-tracking methodologies or mouse-tracking methodologies could be used to measure information seeking and exposure time. The focalism and confirmation-bias accounts make separate predictions for the process-tracing results, with focalism predicting enhanced information-seeking of all types of evidence directly relevant to the subject of the preferred outcome (e.g., relevant to Person A if the preferred outcome is that Person A wins a competition). Alternatively, the confirmation-bias account predicts enhanced information seeking of evidence that is supportive of the preferred outcome or against the nonpreferred outcome. If the evidence available to participants is subjective in nature (i.e., partially open to interpretation), then the differential scrutiny and enhanced accuracy accounts can be simultaneously examined. For example, the differential scrutiny account suggests that making Outcome A very desirable rather than minimally desirable (when Outcome B is always neutral) would lead to greater scrutiny (and presumably greater processing time) of information against Outcome A. The enhanced accuracy account suggests that such a manipulation would increase the processing time for all information irrespective of its implications for the outcomes. Information recall measures would offer another opportunity to assess the plausibility of mediator accounts, with accounts such as the differential scrutiny account and enhanced accuracy account making different predictions about the types of evidence participants

would best remember after the information display is removed from view. A host of other methodologies could be used to examine other accounts within the same paradigm. Again, our overall point is that without hypothesizing about and testing possible mediators in a sustained and systematic fashion, psychologists' understanding of how and why desires can influence optimism will remain rather limited.

Manipulating Desirability: Interactions With Various Mechanisms

One of the critical elements of any experiment testing for desirability bias is the manipulation of outcome desirability. If, as we have suggested above, there are multiple possible mediators between outcome desirability and expectations, then there is a very real possibility that the manner in which desirability is manipulated can interact with potential mediators. For example, desirability manipulations of differing magnitudes could influence mediators in quite different ways. Imagine a study in which participants learn about Teams A and B, and then learn that they can win $0, $1, or $50 if Team A beats Team B in a competition (in the $0 condition, nothing is said about winning money as a function of one team beating another). All participants are asked to provide a judgment on a scale with the following anchors: "Team A is certain to win" and "Team B is certain to win." The difference between the $0 condition and the $1 condition is probably insignificant with respect to participants' worries about being disappointed, whereas the difference between the $1 and $50 conditions could be important for worry and, hence, strategic pessimism (i.e., worry and bracing for loss would be much stronger in the $50 condition than in the $1 condition). However, the manipulation between the $0 condition and $1 condition could be very influential with respect to information search, because even a $1 reward would give a person a direction or a favored outcome, whereas $0 (no reward) would not. Information search patterns might largely be the same in the $1 and $50 conditions, if direction of the reward is key. This result would not bode well for the relevance or importance of strategic optimism or pessimism accounts in explaining the observed desirability effect. Instead, accounts focusing on information search would be implicated. In addition to illustrating that the magnitude of a desirability manipulation might have importance, this example serves as an illustration of why attention to mediating mechanisms might be critical to the generation of maximally informative experiments about how desire influences likelihood judgments.

Nonmonetary Manipulations of Desirability

Using money as a manipulation of outcome desirability is attractive from a methodological standpoint given the absence of potential confounding variables. However, two related reasons might make alternative manipulations of desirability attractive to researchers. First, there are many potential sources of desire that differ substantially from money (e.g., pride, fear, physical stimulation). Second, it is unclear whether a monetary payoff of the type offered in a laboratory experiment can match the motivational power produced by these other sources.

The difficulty in manipulating desirability through nonmonetary means is that such manipulations often simultaneously manipulate

factors other than desirability, and these alternative factors might sometimes be reasonably expected to influence likelihood judgments. For example, Ditto, Munro, Apanovitch, Scepansky, and Lockhart (2003) described a confounding role for expectations in a manipulation that would otherwise appear to be a desirability manipulation. In their paradigm, college student participants self-administered a test that suggested that they were negative for a bogus enzyme (TAA). This test result was said to be associated with either positive or negative consequences, and participants were asked to rate the likelihood they would be TAA-negative. Ditto et al. (2003) noted that although the manipulation of positive versus negative consequences was clearly a desirability manipulation, the manipulation also varied depending on whether the TAA test results would be consistent or inconsistent with the participants' general health expectations. If most college students assume that they are healthy, then they are more likely to expect a test result suggesting health rather than problems. Hence, the fact that participants reported lower likelihoods when TAA negativity was described as unfavorable rather than favorable could be due to participants' prior expectancies about the future of their health (which are likely positive), rather than due to a biasing influence of desire.[15]

Desirability manipulations that systematically vary the social implications of outcomes might be especially promising ways of achieving a high degree of motivational impact while avoiding confounds such as the preexisting expectancies just discussed. Investigations described earlier (i.e., Krizan & Windschitl, in press; Price, 2000) have already used these types of manipulations. Participants in those studies made judgments about the performances of their teammate (who they would like to see win) or their teammate's competitor (who they would like to see lose). We believe that this use of groups or team allegiances is only one of many potentially effective nonmonetary ways of manipulating desire. For example, participants could be led to believe that they will become a member of a desired or undesired group (about to do desired or undesired activities) depending on the outcome of an event. This manipulation might cause more desire than a typical monetary incentive could elicit. Again, a critical issue for these and other nonmonetary manipulations of desire is whether the desirability manipulation is confounded with some other factor such as prior expectations or mood. In sum, in the future researchers should (a) explore nonmonetary manipulations of outcome desirability and (b) eliminate or assess potential confounding factors associated with respective manipulations.

The Importance of the Dependent Variable

Our literature review also revealed systematic differences in how different dependent measures responded to desirability manipulations. These differences should alert researchers to the importance of psychological processes involved in the transformation of internal representations of likelihood onto response scales. Although we have speculated about reasons why outcome predictions and subjective probabilities might respond differently to desirability manipulations (at least within contexts involving games of chance), it is also important to contrast these measures with other types of measures, particularly nonnumeric ones.

In everyday life, people often prefer and use verbal labels (e.g., "*very likely*"), rather than numeric values, to communicate uncer-

tainty (e.g., Brun & Teigen, 1988; Budescu & Wallsten, 1987; Wallsten, Budescu, Zwick, & Kemp, 1993). There is also evidence indicating that although people might be aware that probabilities for two events are equal, their gut feelings of uncertainty and their verbal descriptions of the uncertainty can differ between the two events (e.g., Kirkpatrick & Epstein, 1992; Windschitl, Martin, & Flugstad, 2002; Windschitl & Wells, 1998; see also G. Cohen & Wallsten, 1992; Teigen & Brun, 1999, 2000). Moreover, these intuitive perceptions of uncertainty are sometimes more influential in shaping decisions and behaviors than are beliefs in objective probability (e.g., Denes-Raj & Epstein, 1994; Teigen & Brun, 1999; Windschitl et al., 2002).

If numeric and nonnumeric expressions of certainty are differentially sensitive to a variety of phenomena, then they might also be differentially sensitive to desirability effects. Kunda (1990) noted the possibility that "people might interpret their belief that an event has a 60% probability of happening to mean that the event is either slightly likely or somewhat likely to happen, depending on whether they want to view it as likely" (p. 488). Whereas Kunda (1990) has mentioned the possibility that nonnumeric expressions of likelihood allow a person to interpret a numeric probability in an optimistic way, they might also allow people to interpret a numeric probability in a pessimistic way. Participants in a study by Windschitl & Wells (1996) read a scenario in which they were about to roll a die (Scenario 4, Study 1). They read that a roll of "6" had either positive or negative monetary consequences for them, and they were asked to provide likelihood estimates about rolling a "6" on either a numeric or verbal scale. Although the numeric responses showed no sensitivity to the desirability manipulation, responses on the verbal scale indicated a significantly lower likelihood of rolling a 6 when it meant winning rather than losing money. Perhaps this finding reflects that when people have low control, they use pessimistic interpretations of objective probabilities as a way of bracing for a negative outcome. This is merely speculation, but the larger point behind this result is that understanding of desirability bias is likely to improve if consideration is given to expressions of uncertainty above and beyond numeric subjective probability estimates and outcome predictions.

The Role of Affect

Although this review focuses on how preferences can influence predictions, it is also important to consider the role of affective processes. It is already firmly established that positive and nega-

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[15] Ditto et al. (2003) argued that the motivational explanation is ultimately more compelling than the expectancy explanation for their findings. This argument was based on their finding that observer-participants in their Study 3, who made judgments about a hypothetical participant's likelihood of having TAA-negativity, did not show a significant effect for whether TAA-negativity was said to have favorable or unfavorable consequences. However, we do not believe that this finding distinguished between the motivation and expectancy explanations. People have personal expectancies about their own health that are probably much stronger than expectancies for a hypothetical student. Consequently, the differences in the results from participants judging their own TAA-negativity status and from the results of participants judging a hypothetical student's status could readily be explained by a differential influence of expectancies (strong in the former case but weak in the latter case).

tive affective states can influence predictions in optimistic and pessimistic directions, respectively (see, e.g., Johnson & Tversky, 1983; W. F. Wright & Bower, 1992). Much less is known, however, about the interplay of people's desires and moods in shaping predictions. The possibility that preferences for certain outcomes co-occur with particular affective states has important consequences for how best to interpret effects of desirability manipulations on predictions. For example, whenever researchers use motivational explanations to account for self-serving data patterns, it is important to rule out global mood effects as an alternative explanation (see e.g., Dunning, 1999).

Research on bracing for loss (e.g., Shepperd et al., 1996, 2000), for example, has already shown how the possibility of a negative outcome can lead to anxiety and rumination that, in turn, can lead to pessimistic predictions in order to "brace" for potential loss. Besides these *anticipated* emotions, which seem to be central to strategic pessimism (see e.g., Shepperd et al., 2000), it is also important to consider the influence of *anticipatory* emotions (e.g., Loewenstein, Weber, Hsee, & Welch, 2001), namely, immediate emotional reactions to potential risks (or rewards). Given that research on the desirability bias almost always involves contemplation of positive or negative future outcomes, it is worth considering whether desirability manipulations used in studies might also have subtle mood effects that could influence resultant predictions. For example, knowing that one could win $5 if a particular card is selected from a deck of cards might, across several trials, induce positive mood, whereas knowing that one could lose $5 if a particular card is selected might conversely induce negative mood. Therefore, researchers using such manipulations should be mindful of potential mood effects and assess or control them.

If desirability manipulations were found to influence moods, questions about the nature of this influence would also need to be addressed. The distinction between mood-congruent memory (e.g., Bower & Forgas, 2001) and mood as information processes (e.g., Schwarz & Clore, 1983) seems particularly relevant. It would also be important to address the role of emotion specificity, as particular moods can have different consequences on judgments even if the former have the same valence (e.g., DeSteno, Petty, Wegener, & Rucker, 2000; Lerner & Gonzalez, 2005; Lerner & Keltner, 2001). For example, although fear and anger are both negative emotions, they have opposite effects on judgments of personal risk; fearful individuals overestimate their risk for negative outcomes, whereas angry individuals underestimate their risk of negative outcomes (see Lerner & Keltner, 2001). To the extent that desirability manipulations lead to specific emotional states, researchers need to be aware of the idiosyncratic consequences these states can have on likelihood judgments.

Relevance for Understanding Individual Differences in Optimism and Pessimism

Although our discussion has focused mainly on nomothetic psychological processes involved in the desirability bias, understanding how preferences impact expectations can also broaden our understanding of individual differences in optimism and pessimism. Although optimism and pessimism have been construed in multiple ways (see Chang, 2001), we limit our discussion to one conceptualization that has received wide attention. This conceptualization defines optimism as a trait reflecting generalized positive outcome expectancies and is commonly measured by the Life Orientation Test (see Scheier, Carver, & Bridges, 1994).

Optimism, viewed as a disposition reflecting generalized outcome expectancies (Scheier & Carver, 1985), has been found to predict many psychological characteristics and behaviors, particularly positive outcomes related to active coping and efficient problem solving (e.g., Aspinwall & Richter, 1999; Aspinwall & Taylor, 1992; McFarland & Miller, 1994; Scheier & Carver, 1985; Scheier et al., 1994). Although these widely documented positive effects associated with dispositional optimism have been understood mainly through Carver and Scheier's model of self-regulation (e.g., Carver & Scheier, 1998), we wish to suggest that psychologists' understanding of optimism can be further enriched by considering the cognitive and motivational processes involved in formation and operation of more specific expectancies, relative to their generalized counterparts. One of the central issues involves the relation between generalized expectancies (as measured by the Life Orientation Test) and more specific expectancies. It is not yet clear, for example, whether optimists actually make more optimistic predictions than pessimists on a case-by-case basis. The general finding is that dispositional optimism is, at best, only weakly related to specific outcome expectations (e.g., Fitzgerald, Tennen, Affleck, & Pransky, 1993; Lipkus, Martz, Panter, Drigotas, & Feaganes, 1993; S. E. Taylor et al., 1992). These findings have led some (e.g., Armor & Taylor, 1998) to question the claim that generalized outcome expectancies operate in a manner similar to more specific outcome expectancies (see Scheier & Carver, 1988). These findings are important because the desirability bias concerns the impact of preferences on specific outcome expectancies. Perhaps the most interesting question from our perspective is whether optimists' (relative to pessimists') specific expectancies are more easily influenced by their preferences and, if so, whether that is the case for both controllable outcomes (usually examined in the context of dispositional optimism) and the uncontrollable outcomes we have focused on (cf. Price & Marquez, 2005).

Questions posed above emphasize the need for a more comprehensive examination of optimistic orientations and their relation to the psychological processes involved in prediction of specific outcomes. Although researchers tend to aggressively explore correlates and consequences of optimistic orientations (see Chang, 2001), there is a relative paucity of research examining relevant cognitive and motivational processes involved in predicting the future. Research on the desirability bias, we argue, could be especially pertinent to our understanding of optimism and pessimism in general.

Limitations of the Present Analysis

As mentioned earlier, our description of possible mediators focused on the possible immediate impacts of bias on information processing. This focus on immediate impacts is partially a reflection of the available empirical research; almost all experiments on the desirability bias (those in which outcome desirability was manipulated) have examined the influence of desires in the short run (for partial exceptions, see Bar-Hillel & Budescu, 1995, Study 4; Klein, 1999; Slovic, 1966). However, this focus also reflects the fact that the question of how outcome desirability might have an immediate influence on the information processing that feeds optimism is critical for both basic and applied reasons. Nonethe-

less, we must note that the formation of the desire and the making of a prediction might sometimes be separated by hours, weeks, or years. In these long-run cases, there is a potential for outcome desirability to have substantial effects on various behavior patterns that influence information acquisition as well as on information storage and recall. These influences might then impact optimism. For example, political preferences can influence selections of newspaper subscriptions, which can influence information exposure, which can influence optimism about elections and wars. Another possibility is that outcome desirability might differentially influence long-term memory losses (for desire-consistent versus desire-inconsistent knowledge).[16] Our analysis does not address these and perhaps other possible long-term mediators, and there is a lack of research with experimental designs to specifically test them. Hence, this is an important limitation of our analysis and the available research.

A second limitation of our analysis involves the fact that we excluded studies in which people were asked to make predictions regarding outcomes that were under their partial or full control. The question of how desires and motivations influence predictions in these cases are quite different from the same question applied to cases in which people have no control. In the former case, exaggerated perceptions of control can produce overoptimism effects, but it is unclear whether such instances should be considered cases of the desirability bias (i.e., a case of desire causing overoptimism). If a desire for the outcome caused exaggerated perceptions of control, then this would be a case of the desirability bias. However, if exaggerated perceptions of control existed for other reasons, then the desirability bias would not be implicated. Consider an example in which an observer overestimates Person A's control over an outcome (e.g., being selected for a job), and the observer is asked to estimate the likelihood that Person A will attain an outcome that is desired by Person A (but is of no interest to the observer). This observer would presumably overestimate Person A's chances of attaining the outcome, but this overestimation would not constitute evidence of the desirability bias on the part of the observer.

Differences in beliefs about control can also be a contributing cause for why people sometimes report that they are less likely than others to experience negative life events and more likely than others to experience positive ones (e.g., Chambers et al., 2003; Weinstein, 1980). If people generally believe they have more personal control than others, then it stands to reason that people would be comparatively optimistic about avoiding negative events and securing positive ones (e.g., Klein & Kunda, 1994; McKenna, 1993; Zakay, 1984). McKenna (1993) found that although people were comparatively optimistic about a risk that they had control over (i.e., being in a car accident as a driver), they were not comparatively optimistic about a risk over which they had much less control (being in an accident as a passenger; see also Chambers et al., 2003, Study 3; Zakay, 1984).

Although we excluded from our review all studies in which people were asked to make predictions regarding outcomes that were under their partial or full control, we believe that there is a great deal to be learned about how perceptions of control, desires for an outcome, and other factors (e.g., egocentrism) combine to influence optimism and pessimism. Perhaps most interesting in the present context is the possibility that a desire for an outcome can cause a person to assume that he or she has more control than he

or she does in actuality—which would be a form of desirability bias mediated by perceived control.[17]

Conclusions

Although our review indicates that research findings on the desirability bias are mixed, we are not suggesting that this bias does not exist or that desires do not influence predictions. In fact, in our attempt to address "second-generation" questions (Zanna & Fazio, 1982), we outlined nine possible accounts for how desires might influence predictions because we believe that they specify quite plausible mediating mechanisms for desirability biases. We are, however, chagrined that the field of psychology does not have more to say from an empirical and theoretical standpoint regarding these possible mechanisms. The field also says little in the way of definitive information about important moderator questions such as: When will the desirability bias be at its strongest? When will bracing for disappointment or other causes of pessimism dominate over preference-induced overoptimism? Who is most prone to exhibiting biased predictions about the future? Adequately answering such questions requires that empirical and theoretical work address the potential for desires to have both optimism-enhancing and optimism-dampening influences.

The general topic of how desires influence expectations is surely worthy of more intensive study. The practical and theoretical importance of the topic seems to be on par with that of a variety of well-known judgment and social phenomena (e.g., fundamental attribution error, cognitive dissonance, availability heuristic, and anchoring). However, in comparison with such other phenomena, desirability biases have been the specific focus of relatively few research studies, and there are no well-established theories of how motivations influence expectations. The more general notion of motivated reasoning seems to have been accepted as an elementary idea in psychology (see, e.g., Kunda, 1990), but as we argue in this review, the desirability bias is a subtype of motivated reasoning that requires separate consideration from other forms of motivated reasoning. We are wishful and cautiously optimistic that researchers will address our call for more intensive and targeted work on how desires influence expectations.

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[16] This might be similar to the processes by which a stored schema can have a robust influence on the encoding and storage of schema-relevant information (see, e.g., Anderson & Pichert, 1978; Fiske & Taylor, 1991).

[17] Biner, Angle, Park, Mellinger, and Barber (1995) presented intriguing data on the relationship between need state, illusion of control, and confidence judgments. Like the Biner, Huffman, Curran, and Long (1998) study, they asked hungry and nonhungry people about their confidence in winning a hamburger in a card-selection game and about how much skill the game involved. Although the authors argued that mediation analyses showed that perceptions of skill mediated greater levels of confidence among hungry participants, the presence of an intervening task in the experiment complicates the interpretation of those results. Participants were only allowed to play the card game if they completed a challenging trigram memorization task. Therefore, although participants were asked to assume that they would be successful at the trigram task, their answer to the confidence and skill questions might have been influenced by the contingency of completing the task, which presumably would have been different for hungry and nonhungry participants (see Waller & Mitchell, 1991).

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