

Prone to Bias: Development of a Bias Taxonomy From an Individual Differences Perspective

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We adopt an individual-differences perspective and introduce a model that links types of biases and types of people. We propose that biases are created in the course of people's attempts to satisfy basic motivations, and that 3 such motivation categories underlie many of the biases discussed in the literature. Accordingly, our organizing framework integrates findings from previous research and classifies biases into verification biases, simplification biases, and regulation biases. Individual differences in core self-evaluations, in approach/avoidance temperament, and in cognitive ability and style help explain how biases come about and why some people are more likely than others to exhibit particular biases.

Keywords: personality, cognitive biases, individual differences

With reference to the above-average effect, by which people tend to exaggerate their skills, traits, and abilities, Kruger (1999) referred to “the most widely cited demonstration of the above-average effect, a national survey conducted by the College Board (1976–1977), [that] questions the ubiquity of the above-average effect” (p. 222). The survey, of a nonclinical population, ($N = 828,516$) lists a variety of domains and the percentage of individuals who rated themselves as “above average” in each. Despite general references to the ubiquity of the above-average effect, in 8 of the 14 domains listed, more than 40% of individuals did not rate themselves as above average. In 5 of these, only 50% or less rated themselves as above average. Even in the domain with the highest percentage of above-average self ratings (the “ability to get along with others”) there were still 11% who did not rate themselves as above average. Whereas social–cognitive theory and behavioral decision theory present a dim view of human beings as succumbing to a variety of biases and irrational thought processes in judgment and decision making (e.g., Gilovich, Griffin, & Kahneman, 2002; Nisbett & Ross, 1980), in this article we question the ubiquity of these biases and adopt an individual differences framework for explaining a broad range of biases.

Biases are often defined as erroneous responses that constitute a departure from normative rules or standards (e.g., Evans & Over, 1996; Gilovich et al., 2002). Another definition relaxes the assumption of error and employs a subjective criterion, focusing on responses that result from processes that are independent of, and interfere with, honest attempts to be accurate (Wilson & Brekke, 1994). Wilson and Brekke defined biases as a consequence of a mental contamination process “whereby a

person has an unwanted response because of mental processing that is unconscious or uncontrollable” (p. 117). Although most of the biases we review involve some form of error, we focus in this article on the latter, more inclusive, definition.

In the vast majority of bias studies, the biased response is considered ubiquitous. Individual differences in bias manifestations are largely ignored and treated as noise. However, neglect of the potential role of individual differences in bias manifestation leaves out a meaningful factor that can contribute to our understanding of the biased response. Indeed, accumulating evidence suggests that a substantial amount of systematic variability in individuals' judgments and choices is not accounted for and can be explained by considering stable individual differences (e.g., Budescu, Wallsten, & Au, 1997; Levin, Gaeth, Schreiber, & Lauriola, 2002). In addition, meta-analyses of studies on particular biases (e.g., framing bias; Kuhberger, 1998) have also demonstrated substantial variability in the manifestation of biases, which has thus far not been accounted for.

Several studies have demonstrated relationships between dispositional variables, such as self-esteem or the need for cognitive closure and bias phenomena such as the self-serving bias or regret avoidance (e.g., Josephs, Larrick, Steele, & Nisbett, 1992; Stanovich & West, 1998c). However, such works are sporadic and lack an overarching theory that incorporates a broader spectrum of biases. In this article we go beyond the case of a single individual difference variable and a single kind of bias, and (a) offer a tripartite typology that incorporates a variety of biases and (b) suggest a model that links individual differences with types of biases.

We believe that the framework we propose offers a number of key contributions. First, by cutting across a variety of biases, previously examined in isolation, we provide a more parsimonious account of the relationships among them. Second, by focusing on individual differences in bias manifestation, our framework promotes the theoretical unity of personality and experimental psychology (cf., Eysenck, 1997). Third, our framework informs future research on biases about theoretically relevant individual difference variables that can increase the predictive validity of studies.

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End-States, Individual Differences, and Bias

The bias literature has described various ways in which individuals' responses deviate from some normative standard. Literally hundreds of studies on biases have been conducted, most of which have considered a single type of bias. Although there have been some attempts to organize this literature, these have fallen short of providing a systematic explanation of biased responses. For example, in their article in *Science*, Tversky and Kahneman (1974) categorized biases on the basis of the cognitive short-cut (i.e., heuristic) from which they emanate: representativeness, availability, and adjustment and anchoring. Several years later, in their Prospect Theory (Kahneman & Tversky, 1979), they categorized biases by the judgment process phase in which the bias occurs (i.e., editing and evaluation phases). However, in both cases the spectrum of biases considered was relatively narrow. Furthermore, many additional biases that do not fit their proposed categorizations have been described and studied since.

Other categorizations appear in several books that cluster in distinct chapters biases similar in function (e.g., cognitive vs. motivational) or form (e.g., probability related; Gilovich et al., 2002; Kahneman, Slovic, & Tversky, 1982; Stanovich, 1999). These clusterings, although helpful in providing structure to a large variety of studies, have not been based on an overarching theoretical model. Other typologies exist (e.g., Arkes, 1991; Haselton & Nettle, 2006; Wilson & Brekke, 1994), yet these tend to be narrow in scope and exclude many of the common biases that have been frequently discussed in the bias literature. Furthermore, none of the frameworks mentioned above account for individual differences in bias manifestation. Considering that several dozens of biases have been described over the years (e.g., Wikipedia lists more than 60 types of cognitive biases, at http://en.wikipedia.org/wiki/List_of_cognitive_biases), an all-inclusive categorization of biases would hardly be viable. Nevertheless, in the present paper we use an individual-differences perspective to integrate a relatively broad range of commonly researched biases.

Lacking an existing overarching theory to integrate biases we adopted an inductive approach and began our investigations with a thorough review of the bias literature. Papers were gathered by using key terms such as *cognitive bias* and *social bias* in a search of the PsychInfo database, and from a review of extant reviews and typologies. In trying to find differences and commonalities among the various biases, it became apparent that a focus on motivational end states would be useful for explaining a relatively large variety of biases. As we aim to establish below, we believe that most biases can be categorized into one of three interrelated types. Each type involves a distortion that occurs in the process of trying to satisfy one of three motivational end states.

Some biases involve distortions in people's perceptions of themselves and of the world around them. These biases have been frequently termed *positive illusions*, or *self-enhancement biases* (e.g., self-serving bias). We call them *verification biases* and argue that they occur in the course of trying to achieve consistency and coherence. Other biases involve cognitive distortions and inaccuracies in the way people process information and analyze problems. These are the biases typically referred to

in the heuristics and biases literature (e.g., base-rate neglect). These simplification biases will occur in the process of trying to comprehend reality. A third category involves nonnormative choices and behaviors, many of which have been examined in the risky-choice and decision-making literature (e.g., framing effect). We term these *regulation biases* and argue that they occur when trying to approach pleasure and avoid pain. Although these end states are frequently referred to as among the most basic of human motivations and are presumed to underlie a broad range of human responses (e.g., Festinger, 1957; Freud, 1950; Piaget, 1954), we argue that individual differences in how people aim at achieving them will result in variations in bias manifestation across individuals.

Our argument is not that these basic motivations cause bias. Nor do we adopt a functional perspective, whereby biases promote the achievement of motivational goals (e.g., Tesser, 2000). Rather, we suggest that biases are consequences, or side effects, of individuals' attempts to satisfy basic motivations. Given the existence of guiding motivational forces, certain dispositions can ultimately lead to biased perceptions, judgments, and responses. Accordingly, we classify biases within the same category if they arise in the process of aiming for the same motivational goal. The use of basic motivations offers an organizing platform for better understanding the processes that underlie biases and the relationships among them.

We view these basic motivations as universal (i.e., relevant to all individuals). We define *dispositions* as "stylistic or habitual patterns of cognition, affect and behavior" (Emmons, 1989, p. 32) that vary across individuals. As we explain below, guided by motivational end states, or "auto-motives" (Bargh, 1990), individuals' responses are predominantly shaped through stable dispositions. Biases are manifested when dispositions automatically distort responses, aimed toward activated desired end states. In other words, the means to achieve desired ends differ according to one's personality.¹

Consistent with previous theory on the relationship between motives and dispositions, we assume that dispositions channel motivations (Cattell, 1946; Winter, John, Stewart, Klohnen, & Duncan, 1998). Through their underlying psycho-physiological mechanisms we assume that dispositions "affect the availability, accessibility, and intrinsic pleasure associated with behavioral options or channels" (Winter et al., 1998, p. 233). In other words, dispositions act as lenses that people use when perceiving, interpreting, and adapting to the world. In the course of striving toward desired end states, the different lenses that are used make some people more prone than others to manifest certain types of biases. These lenses portray the typical set of schemas, or mental representations that an individual automatically uses when interpreting one's social world (Bargh, 1982).

A consideration of the way in which personality factors shape people's attempts to satisfy basic motivational goals complements extant explanations of the process through which biases come about. Because the motivational goals we address have already been discussed at great depths elsewhere (e.g., Abelson et al.,

¹ This argument is consistent with the equifinality property of motivational strivings (i.e., goals can be achieved through multiple means and regardless of the initial state; Emmons, 1989).

1968; Gray, 1982; Kelly, 1955), we introduce each only briefly, and then propose how certain personality dispositions can create biased perceptions, judgments, or decisions in the course of striving for these end states. Finally, we discuss ways in which the three bias types relate to one another (see Figure 1).

Achieving Consistency—Biases in Perceptions of the Self

Numerous psychologists have pointed out people's basic need to achieve consistency in their cognitions (for a review, see Abelson et al., 1968). Some explanations of this need rely on the premise that inconsistency, or dissonance, between cognitions involves unpleasant tension that individuals try to eliminate by creating consistency (Festinger, 1957; Heider, 1958). Such consistency is sought both with respect to what people think about themselves as well as what they think about issues external to themselves.

Other explanations of the search for consistency, in particular with regard to the self, suggest that people seek consistency because it provides them with a sense of predictability and control (Swann & Read, 1981; Swann, Stein-Seroussi, & Giesler, 1992). It provides meaning and a sense of coherence (Swann, Rentfrow, & Guinn, 2002). Early in life people form their self-concepts by constantly evaluating how others perceive them and by incorporating these evaluations into their self-concept. Once the self-concept has stabilized—commonly believed to occur sometime in early adulthood—people tend to seek out information that will confirm their self-views.²

To achieve consistency, people adopt a variety of behavioral and cognitive strategies (Swann et al., 2002). At the behavioral level, people try to create social environments that reinforce their self-views and avoid situations that present potential risks to their self-views. At the cognitive level, people distort reality by paying closer attention to information that confirms, rather than disconfirms, their self-view; by preferring self-view-confirming interpretations of new information, and by tending to better remember such interpretations. According to Swann et al. (2002)

People's self-views represent the lens through which they perceive reality, lending meaning to all experience. Should people's self-views flounder, they will no longer have a secure basis for understanding and responding to the world because they will have been stripped of their fundamental means of knowing the world. (p. 368)

The motivation to self-verify is so strong that people will often prefer to maintain negative self-views than to adopt a positive, yet incongruent, view of the self (Swann et al., 1992). Discovering that one has not known oneself may be even more painful than maintaining a negative, yet confirming, self-view (Swann et al., 1992). Furthermore, a negative and accurate self-view can often serve to protect the individual from engaging in activities in which that individual is likely to fail.

We suggest that the dispositional lenses with which people strive for consistency can determine the extent to which their self-verifying strategies will entail accurate versus biased perceptions. More specifically we argue that individuals' core self evaluations contribute to the manifestation of verification biases.

The Impact of Core Self Evaluations on the Manifestation of Verification Biases

Core evaluations are fundamental implicit beliefs that people hold, which influence all of their appraisals (Judge, Locke, & Durham, 1997). They are conceptualized as all-encompassing beliefs that influence all situation-specific evaluations that people make about themselves or about reality (Packer, 1985). Particular attention has been devoted to core evaluations of the self, which are represented in at least four specific personality traits: self-esteem, generalized self-efficacy, neuroticism, and locus of control, all of which involve some form of self-perception (Judge et al., 1997).

Self-esteem involves the extent to which a person believes he or she has worth (Rosenberg, 1965) and refers to "self-acceptance, self-liking, and self-respect" (Judge et al., 1997, p. 160). Similarly, generalized self-efficacy involves beliefs about being able to cope with demands set by the environment (Chen, Gully, & Eden, 2001). Neuroticism—a dimension from the five-factor model of personality (Digman, 1990)—involves a lack of emotional stability and has been found to negatively correlate with self-esteem (Judge et al., 1997, p. 163). Last, the locus of control continuum (Rotter, 1966)—internal versus external—involves the extent to which an individual believes that he or she has control over events (i.e., internals) versus the belief that forces external to the individual are in control (i.e., externals). Although the four traits are distinct from one another, they share a common core, involving an overarching evaluation of one's worth and general ability to cope. This common, higher order, core is what comprises the core self-evaluations construct (Judge et al., 1997).³

In the search for consistency, people seek to confirm their core evaluations in the day-to-day events that they encounter. One way to aim for this is by manipulating one's environment, and one's maneuvers within the environment, to accommodate self perceptions (Swann et al., 2002). Yet in reality, despite such attempts, events do not always correspond with people's beliefs about themselves. In such cases, consistency can only be achieved if nonconfirming evidence is somehow distorted to be more closely aligned with one's self evaluations. Because these distortions come about in the course of trying to verify one's beliefs, we term them here verification biases.

Verification biases involve distortions in people's perceptions of self and reality and, as we argue, include biases such as self-serving (Miller & Ross, 1975) and self-diminishing biases, unrealistic positive (Greenwald, 1980) and negative (Giesler, Josephs, & Swann, 1996) self-views, over- (Fischhoff, Slovic, & Lichtenstein, 1977) and underconfidence, illusions of control (Langer, 1975) and learned helplessness (Seligman, 1972), and unrealistic

² We deal with the consistency-enhancement debate later in the article.

³ As in conceptualizations of most dispositions, individual differences in core self-evaluations are continuous in nature. Nevertheless, to maximize and highlight effects, most of the studies on individual differences in bias manifestation have used a dichotomous operationalization of traits (e.g., high versus low self-esteem). Accordingly, this is how we discuss the differences found across individuals in bias manifestation. This does not suggest that there is any particular "cut-off" point that distinguishes between high- and low- evaluation individuals, and is merely intended to provide a clear description of the expected effect of the individual differences constructs.

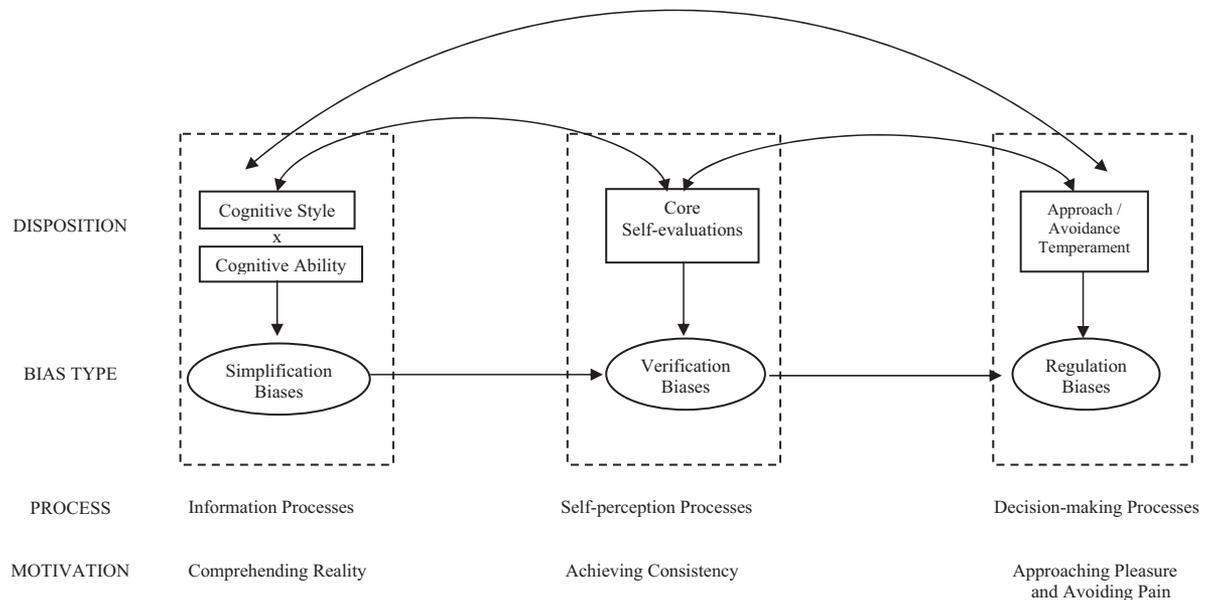


Figure 1. Relationships among bias categories.

optimism (Weinstein, 1980) and pessimism (see Figure 2). Research on these biases predominantly has addressed the positive, or enhancing, biases in this group, each involving an egocentric and inflated positive image of the self and of reality. Both motivational and cognitive explanations have been offered for the emergence of these biases. The most prevalent explanations focus on people's motivation to self-enhance (Baumeister, 1998; Kunda, 1987).

Indeed, a vast amount of research has established the existence of a universal upward drive that stands at the basis of enhancement biases. However, there is also evidence to suggest individual differences in the strength and prevalence of these biases (e.g., Baumeister, Smart, & Boden, 1996; Gilovich, Epley, & Hanks, 2005). For example, Taylor and Brown (1988) suggested that enhancement biases such as illusions of control, unrealistic positive self-views, and unrealistic optimism are less likely to arise among depressed individuals.⁴ More recently, as described in the example opening this paper, Kruger (1999) provided information from an extraordinarily large sample demonstrating the substantial variance that exists in the manifestation of the above-average effect. Although the majority of respondents tended to rate themselves as "above average," a substantial percentage of individuals, in each of the domains surveyed, did not.

Such evidence of individual differences in the existence of self-enhancing biases has led some researchers to question the appropriateness of motivation-based explanations for these biases (Chambers & Windschitl, 2004). Contrarily, we suggest that instead of discounting motivational accounts, a better route is to consider an additional motivation, such as the motivation to self-verify (Swann et al., 2002), which acts alongside the motivation to self-enhance and will sometimes attenuate, or even reverse, the ultimate response. We argue that stable individual differences in core self-evaluations can explain the extent to which a bias in the interpretation of reality will occur and whether its direction will be to distort upward (i.e., to hold an overly positive view) or downward (i.e., to hold an overly negative view).

As noted above, the motivation to self-enhance is well established and is based on the notion that people generally enjoy and seek out positive feedback (e.g., Tesser, 2000). At the same time, it has also been noted that the tendency to self-enhance operates within the bounds of what appears to be realistic to the individual (e.g., Alicke & Govorun, 2005). For some individuals an enhanced and overly positive interpretation will appear to be more realistic than for others. Indeed, numerous studies have shown that some individuals tend to be unrealistically negative when evaluating their own abilities, value, or prospects (e.g., John & Robins, 1994).

This is because the motivation to self-enhance exists alongside the motivation to maintain a consistent and coherent self-view. Yet the satisfaction of the former motivation will sometimes conflict with the satisfaction of the latter. For people with positive self-views, both motivations should lead to the same kinds of enhanced, positive, interpretations (Baumeister, 1998). These individuals approach situations generally believing that they are able to cope with difficulties, that they are knowledgeable and right, and that their attributes lead to desirable ends. In their attempts to self-verify, they search for evidence that supports their positive evaluations. When confronted with negative information, they are subconsciously and automatically (Bargh, 1989) drawn to utilize biases that enable them to verify and consequently maintain their positive, enhanced, self-views. On the other hand, for individuals with negative self-evaluations,

⁴ Although the debate on the matter is far from resolved (e.g., Santor & Coyne, 2001), there is growing evidence for the continuity of depression across clinical and nonclinical samples. The differences between clinically depressed individuals and nonclinical individual with negative self-evaluations appear to be quantitative rather than qualitative (Flett, Vredenburg, & Krames, 1997). Therefore, throughout this section we draw on studies with both populations as evidence for the role of core self-evaluations in the manifestation of verification biases.

		Individual Differences (Disposition) Category	Positioning on Disposition	Biases
Bias Category	Verification Biases - Achieving Consistency	Core Self-evaluations (self-esteem, generalized self-efficacy, locus of control, neuroticism)	Positive Evaluations	Self-serving bias Unrealistic positive self-views False consensus Illusions of Control over positive outcomes Unrealistic Optimism Overconfidence
			Negative Evaluations	Self-diminishment Unrealistic negative self-views Learned Helplessness Illusions of control over negative outcomes Unrealistic pessimism Underconfidence
	Simplification Biases – Comprehending Reality	Cognitive Style and Ability	Restrictive cognitive style and low cognitive ability	Reasoning errors Insensitivity to base rates Selection task errors Illusory correlation Conjunction fallacy Belief bias in syllogistic reasoning Probability matching errors Denominator neglect
	Regulation Biases – Approaching Pleasure & Avoiding Pain	Approach/Avoidance Temperament	Approach Temperament	Reversed Framing bias Reversed Endowment effect Inaction regret avoidance
			Avoidance Temperament	Framing bias Endowment effect Category response bias Action regret avoidance

Figure 2. Bias categorization by pursued end-state and corresponding individual difference categories.

self-verifying and self-enhancing lead to opposite interpretations. To achieve a coherent self-view, these individuals often need to apply downward, rather than upward, distorting strategies that downplay their achievements in the face of positive information (e.g., successes).

Studies that pit the two motivations against one another tend to conclude that self-enhancement is the stronger of the two (e.g., Sedikides, 1993). However, these studies tested what respondents *liked* better, rather than what types of interpretations they are more likely to adopt. People may indeed prefer an enhancing interpretation over a verifying one, yet will act on this preference primarily when they can do so without feeling that they are deceiving themselves (e.g., Alicke & Govorun, 2005).

Swann, Pelham, and Krull (1989) found that both high- and low-esteem individuals solicited positive feedback over their positive self-conceptions and negative feedback over their negative self-conceptions. Thus they concluded that both self-verification and self-enhancing motivations exist for both high- and low-esteem individuals. However, their findings also indicate that high self-esteem individuals tend to hold many

more positive self-conceptions and many fewer negative ones, when compared with low self-esteem individuals. Therefore, individuals with positive self-evaluations have many more conceptions on which they seek positive feedback and many fewer over which they seek negative feedback. Consequently, much more of their time will be spent on seeking positive, rather than negative, feedback.

The opposite would be true for individuals with negative self-evaluations. As Swann et al. (1989) suggested, contrary to individuals with positive self-evaluations,

people with low self-esteem are at least sometimes caught in a crossfire between their desire for self-enhancement and their desire for self-verification, a conflict they at least sometimes resolve in favor of self-verification. From this perspective, although our findings suggest that people with low self-esteem might look on their positive attributes as offering a ray of hope, the realities of everyday life may prevent such attributes from offering much more than that. (p. 789)

Accordingly, much of the evidence for individual differences in biases suggests that for individuals with negative self-evaluations,

self-depreciation may often be just as prevalent as self-enhancement (e.g., Blaine & Crocker, 1993). As we review next, numerous studies of specific biases have supported such a formulation. Although different studies employed different individual differences constructs, they all appeared to relate, in one way or another, to individuals' self-views. As Table 1 demonstrates, in all of these studies positive self-views were correlated with self-enhancing bias manifestations, whereas negative self-views were correlated with self-depreciating biases. We now discuss these findings.

Empirical Findings in Support of the Link Between Core Self Evaluations and Verification Biases

Several biases have been discussed in the context of self-enhancing and self-depreciating biases. These include the self-serving bias (Miller & Ross, 1975), unrealistic self-views (Greenwald, 1980), confidence biases (Fischhoff et al., 1977; Griffin & Tversky, 1992), illusions of control (Langer, 1975), learned helplessness (Seligman, 1972), and unrealistic optimism and pessimism (Blanton, Axsom, McClive, & Price, 2001; Weinstein, 1980). For each of these biases there is empirical evidence that suggests either a positive relationship between positive self-views and the degree of self-enhancement or a positive relationship between negative self-views and the degree of self-depreciation (see Table 1).

Most of the studies considering individual differences have considered the role of self-esteem and found that the higher an individual's self-esteem, the more likely he or she is to exhibit self-serving biases (e.g., Beaugregard & Dunning, 2001), unrealistic positive self-views (e.g., Suls, Lemos, & Stewart, 2002), overconfidence (e.g., Kramer, Newton, & Pommerenke, 1993), and unrealistic optimism (e.g., Boney McCoy, Gibbons, & Gerrard, 1999). A number of works considered other self-evaluation traits and yielded comparable findings. For example, an internal locus of control was positively associated with individuals' illusions of control (Hong & Chiu, 1988), unrealistic optimism (Hoorens & Buunk, 1993), and neuroticism was negatively associated with overconfidence (Hancock, Moffoot, & O'Carroll, 1996).

Although not among the four dispositions typically associated with core self-evaluations, several studies explored the role of depression in explaining verification biases. Most of these studies used nonclinical samples (primarily undergraduates) and measured depression with self-report questionnaires, many of which comprise items that pertain to individuals self-views (e.g., the Beck Depression Inventory [BDI]; Beck, Steer, & Garbin, 1988). The pattern of relationships found with bias manifestation parallels that found with self-esteem. For example, depression has been found to correlate negatively with illusions of control (e.g., Alloy & Abramson, 1979) and unrealistic optimism (e.g., Alloy & Ahrens, 1987).

Beyond these findings, which indicate a relationship between positive self-evaluations and self-enhancing biases, there is also evidence for a relationship between negative self-evaluations and the manifestation of self-depreciating biases. For example, low self-esteem individuals were more likely to dampen, rather than savor, positive moods (Wood, Heimpel, & Michela, 2003), to seek out negative over positive feedback (e.g., Giesler et al., 1996), to hold unrealistically negative self-views (J. D. Campbell & Fehr, 1990), to exhibit a lack of confidence in their knowledge (Hancock et al., 1996), and to exhibit pessimistic

views (Heinonen, Raikkonen, & Keltikangas Jarvinen, 2005). Similarly, low self-esteem (Orbach & Hadas, 1982) and neuroticism (Hill & Kemp Wheeler, 1986) have been linked with learned helplessness.

Thus, alongside evidence for an overall inclination to self-enhance, there are at least 40 studies (see Table 1) in which individual differences have been found in the strength of such self-enhancing tendencies (e.g., Mezulis, Abramson, Hyde, & Hankin, 2004), with some evidence to suggest that there are those who do not self-enhance even when events provide objective and realistic opportunities to bolster one's self-image (e.g., Beaugregard & Dunning, 2001; Blaine & Crocker, 1993). Furthermore, some findings even demonstrate a self-depreciating, rather than self-enhancing, tendency among those who hold negative self evaluations. We therefore raise our first set of propositions:

Proposition 1a: Individuals with positive core evaluations of the self are more likely than others to exhibit upward-distorting verification biases such as the self-serving bias, overly positive self-views, overconfidence, illusions of control for desired outcomes, the false consensus effect and unrealistic optimism.

Proposition 1b: Individuals with negative core evaluations of the self are more likely than others to exhibit downward-distorting verification biases such as self-diminishment, overly negative self-views, underconfidence, learned helplessness, illusions of control for undesired outcomes, and unrealistic pessimism.

Comprehending the World Around Us—Cognitive Distortions in Problem Solving

The second desired end state in our theory involves the formation of an interpretable and comprehensible reality. One of the most basic needs people have is to be able to make sense of the world around them (Heider, 1944; Piaget, 1954). To predict how events will transpire and to accordingly adapt oneself to the situation, one must first be able to form a meaningful interpretation of reality.

Comprehending the world around us requires one to cognitively process stimuli by encoding, evaluating, and reaching a judgment. By now, it is well accepted that human cognitive processes follow a dual process model (e.g., Chaiken & Trope, 1999), including cognitive operations that are fast, automatic and intuitive (System 1 processing; Stanovich, 1999), versus operations that are slow, more controlled and reflective (System 2 processing; Stanovich, 1999). The former involve what Kahneman and Frederick (2002) called "natural assessments," which play the role of heuristics because of their fast and easy accessibility. These processes enable one to quickly make sense of the events one encounters. According to Kahneman and Frederick "judgment is mediated by a heuristic when an individual assesses a specified target attribute of a judgment object by substituting another property of that object—the heuristic attribute—which comes more readily to mind" (p. 53). Such "attribute substitution" is most likely when the target attribute is inaccessible and when a related attribute is routinely accessible. Hence, cognitive efficiency is achieved by substituting a related and highly accessible attribute with the target attribute. However, attribute substitution introduces systematic biases

when the substituted attribute is contaminated with irrelevant information.

On the other hand, when circumstances provide novel stimuli, when they call for extensive and careful evaluation of information, or when they require deliberate use of a rule or heuristic, the slower, controlled and reflective cognitive operations are likely to take control, thus avoiding bias. For System 2 to override System 1 processing, the presence of the following three conditions are necessary: First the individual has to have the “mindware” (the procedures and declarative knowledge to substitute an analytic response for a heuristic one) available; second, the individual has to be able to detect the necessity for override; and third, the individual has to have the capacity to sustain System 2 processing (Stanovich & West, 2008). These requirements decrease the likelihood that the conflict between a heuristically triggered response and a normative response generated by the analytical system will be resolved in favor of the normative response. Hence, cognitive operations predominantly follow an automatic subconscious mode (Bargh & Chartrand, 1999) and therefore tend to be driven by easily accessible heuristics (Kahneman & Frederick, 2002). In other words, simplification through heuristics commonly represents the process through which people try to achieve a comprehensible (even if not always accurate) image of the world. When misapplied, these heuristics often lead to faulty, inaccurate, and suboptimal interpretations of events—henceforth, simplification biases. As proposed in Figure 2, the extent and manner in which people present such faulty interpretations is influenced by individual differences in people’s cognitive functioning. In the course of trying to understand reality, cognitive ability and cognitive motivation jointly influence the extent to which people exhibit simplification biases.

The Impact of Cognitive Functioning on the Manifestation of Simplification Biases

Optimal cognitive performance requires both the ability and motivation to effectively process information. Cognitive ability (aka general intelligence; Spearman, 1904) involves the capacity to understand the world around us—the capacity to acquire and apply knowledge. It constitutes an important capacity for acquiring relevant mindware and for sustaining System 2 processing. In fact, it has been addressed as one of the strongest and most consistent predictors of performance, in a large variety of tasks and settings (e.g., Lubinski, 2004; Schmidt & Hunter, 2004), in particular in tasks that require complex information processing (e.g., Arvey, 1986).

Cognitive motivation, on the other hand, involves the extent to which individuals are inclined to apply their information processing abilities. It is assessed through variables such as the need for cognition (Cacioppo, Petty, Kao, & Rodriguez, 1986), the need for cognitive closure (Kruglanski, 1989), dogmatism (Rokeach, 1960), intolerance for ambiguity (Budner, 1962), and openness to experience (Digman, 1990). For example, the need for cognition has been defined as an individual’s tendency to engage in and enjoy effortful cognitive activity (Cacioppo et al., 1986). At the opposite end of the continuum are, dogmatism and the need for cognitive closure both involving a desire to quickly form an opinion from available evidence and a closed mindedness and unwillingness to consider new evidence once an opinion has been formed. Cognitive style constitutes an overarch-

ing term for these motivations. In one way or another, they involve the extent to which people are motivated to prolong and enjoy thinking and intellectually processing information and direct individuals’ attention to detecting the need for System 2 processing.

To accurately comprehend the world around us, people require both the ability and motivation to process information. Those with a low capacity or motivation to process information deal with novel and complex stimuli by simplifying their information environment through the use of heuristics; that is, they pay attention to information that is readily available or is most representative of target stimuli. The indiscriminant use of simplifying heuristics often leads to the classic cognitive biases originally discussed by Tversky and Kahneman (1974), which involve systematic mental errors caused by the inappropriate use of heuristics. They include biases such as insensitivity to base rates, insensitivity to sample size, and illusory correlation (Tversky & Kahneman, 1974). As we review next, several studies of specific biases support our formulation concerning the link between cognitive ability and motivation and the manifestation of these cognitive biases. Although different studies employed different individual differences constructs, they all appear to relate, in one way or another, to individuals’ cognitive ability or motivation. We review these studies next (see Table 2).

Empirical Findings in Support of the Link Between Cognitive Ability and Motivation and Simplification Biases

Among the classical cognitive biases indicated early on are the insensitivity to causal base rates and the insensitivity to sample size. Insensitivity to causal base rates occurs when people use the representativeness heuristic for determining the likelihood that a specimen belongs to particular category. What many people do in this situation is try to imagine the extent to which the specimen is representative of their image of the typical group member. In doing so, people ignore relevant information about probabilities (e.g., the statistical distribution of category members) because of irrelevant, but easily accessible, descriptive information about the specimen that is made available. Similarly, insensitivity to sample size takes place because people disregard the size of the sample when making estimates about various sample statistics (e.g., the mean of a certain attribute in the sample). When asked to evaluate a sample’s feature many people respond based on how the “typical” and representative sample would be characterized, disregarding information about the sample’s size. Additional biases that have been argued as stemming from the misuse of heuristics include conjunction fallacy, selection tasks, denominator neglect, probability matching, insensitivity to causal base rates, belief bias in syllogistic reasoning, and deviations in Bayesian reasoning.

What creates these biases is not the use of a heuristic, but rather the application of the heuristic to solve a problem for which it is not relevant. Ultimately, misapplying the heuristic leads people to either not take into consideration relevant information and rules or to take into consideration information that is not relevant for understanding the problem at hand. These types of problems represent the types of evaluations people make when trying to understand the daily events in their lives. To accurately comprehend them, people need to determine when the use of a particular heuristic is appropriate and when it is not. Such determinations require both the ability and the desire to process complex infor-

Table 1
Empirical Findings in Support of Link Between Core Self Evaluations and Verification Biases

Bias	Article	Findings
Self-serving and self-diminishing bias	Swann, Pelham, & Krull (1989)	High-esteem individuals hold greater positive and lesser negative, self-conceptions than low-esteem individuals
	Beauregard & Dunning (2001)	High-, but not low-, self-esteem individuals emphasize one's own attributes when defining positive traits and to de-emphasize self attributes when defining negative traits
	Kobayashi & Brown (2003)	High self-esteem individuals were more likely to display evidence of the self-serving bias than those who were low on self-esteem
	J. D. Campbell & Fairey (1985)	After describing failure situations, low-esteem subjects exhibited lower expectancies and lower performance than high-esteem subjects
	Baumeister (1982)	High-, but not low-, esteem individuals used compensatory self-enhancement in their self-descriptions and behaviors after receiving negative feedback
	Gibbons & McCoy (1991)	High-esteem individuals more likely than low-esteem individuals to derogate a downward comparison target when threatened
	Baumgardner, Kaufman, & Levy (1989)	High-esteem individuals more likely to derogate sources of negative feedback and compliment sources of positive feedback
	Suls, Lemos, & Stewart (2002)	Low self-esteem individuals were found less likely than high self-esteem individuals to discount ambiguous negative feedback about their traits
	Wheeler & Miyake (1992)	High-, compared with low-, self-esteem individuals engaged in more self-enhancing comparison
	Wood, Heimpel, & Michela (2003)	Low self-esteem more likely to dampen, rather than savor, positive moods
Unrealistically positive and negative self-views	K. Campbell, Rudich, & Sedikides (2002)	High self-esteem individuals perceive themselves as better than average both on agentic and communal traits
	Suls et al. (2002)	High self-esteem individuals take advantage of ambiguity more consistently to present favorable self-views
	Paulhus, Harms, Bruce, & Lysy (2003)	Self-esteem was positively related to a self-serving overclaiming bias
	Giesler, Josephs, & Swann (1996)	Low self-esteem individuals more likely than high self-esteem individuals to choose unfavorable over favorable feedback
	Ruehlman, West, & Pasahow (1985)	Depressed individuals more likely to hold negative self-schemata than nondepressed individuals
	Swann, Stein-Seroussi, & Giesler (1992)	People with negative self-views chose partners who appraised them unfavorably
	J. D. Campbell & Fehr (1990)	High self-esteem individuals overestimated observers' evaluations of them
	Gotlib & Meltzer (1987)	Depressed subjects rated themselves as less socially competent than did nondepressed subjects
	John & Robins (1994)	Individuals high in Narcissism were more likely than to exhibit exaggerated self-evaluations; those low on Narcissism more likely to exhibit negative self-views
	Over- and underconfidence	Kramer, Newton, & Pommerenke (1993)
Wolfe & Grosch (1990)		Self-esteem positively related to individuals' confidence in performing a problem-solving task
Hancock, Moffoot, & O'Carroll (1996)		Neuroticism was negatively associated with confidence ratings in responses to general knowledge questions
Illusions of control versus learned helplessness	Alloy & Abramson (1979)	Nondepressed individuals were more likely to exhibit illusions of control than nonclinical depressed individuals
	Golin, Terrell, & Johnson (1977)	Depression scores were negatively associated with illusions of control in a dice-throwing experiment
	Martin, Abramson, & Alloy (1984)	Nondepressed, but not depressed, undergraduates overestimated their control over an experimental outcome
	Vazquez (1987)	Nondepressed, but not depressed, subjects showed illusions of control in four experimental tasks
	Mikulincer, Gerber, & Weisenberg (1990)	Nondepressives estimated more control over uncontrollable events than depressives and in some conditions depressives underestimated control over controllable events
Hong & Chiu (1988)	Internal locus of control was associated with a greater likelihood of exhibiting illusions of control in gambling	

(table continues)

Table 1 (continued)

Bias	Article	Findings
Unrealistic optimism/pessimism	Hill & Kemp Wheeler (1986)	Neuroticism was positively associated with a learned helplessness attribution style
	Orbach & Hadas (1982)	Induced self-esteem reduced deficits caused by learned helplessness
	Ruehlman, West, & Pasahow (1985)	Nondepressives, but not mildly depressed individuals exhibit unrealistic optimism; severely depressed individuals exhibit unrealistic pessimism
	Boney McCoy, Gibbons, & Gerrard (1999)	Self-esteem negatively correlated with perceived vulnerability to sexually transmitted diseases
	Gerrard, Gibbons, Reis Bergan, & Russell (2000)	Self-esteem positively correlated with minimizations of personal risk estimates
	Hoorens & Buunk (1993)	Individuals with an internal locus of control more likely to exhibit unrealistic optimism compared with those with an external locus of control
	Heinonen, Raikonen, & Keltikangas Jarvinen (2005)	Positive correlation between self-esteem and dispositional optimism and negative correlations with dispositional pessimism
	Makikangas, Kinnunen, & Feldt (2004)	Positive correlation between self-esteem and dispositional optimism
	Alloy & Ahrens (1987)	Nondepressives showed unrealistic assessments of high likelihood for positive events and low likelihood for negative events; depressives showed the reverse pattern
	Anderson (1990)	Among undergraduates, depression was associated with unrealistic pessimism
	Pyszczynski, Holt, & Greenberg (1987)	Depression associated with increased pessimism and decreased optimism
	Andersen, Spielman, & Bargh (1992)	Depressives predicted more negative events and fewer positive events than did mild depressives or nondepressives

mation. In line with the main theme of our paper we suggest that some people are more able and willing to process such information than others.

Because simplification biases reflect people's failure to acquire and apply the right kinds of information, it is almost by definition that cognitive ability influences the manifestation of such biases. In fact, one of the most prevalent explanation for the occurrence of these biases is limited cognitive resources (e.g., Simon, 1957). All else being equal, differences in cognitive ability reflect differences in the amount and type of cognitive resources available to the individual. Cognitive resources are required for acquiring and applying the appropriate types of rules and procedures required for solving the problem at hand, and therefore allowing extensive and careful evaluation of information (Kunda, 1999; Stanovich & West, 2008). Thus, individuals who typically have more cognitive resources at their disposal, will be more likely to select and apply the appropriate rule (e.g., conjunction rule of probability) for any given problem, and therefore will be less likely to manifest such biases. Accordingly, cognitive ability is expected to correlate with the manifestation of simplification biases.

Most of the empirical work supporting such claims was conducted by Stanovich, West and their colleagues (Kokis, Macpherson, Toplak, West, & Stanovich, 2002; Stanovich & West, 1998a, 1998b, 1998c, 1998d; West & Stanovich, 2003). Using tests such as the Raven Matrices test (Raven, 1978) and the Scholastic Aptitude Test (SAT; Donlon, 1985) to assess cognitive ability, Stanovich and West found performance on cognitive tasks of the type involved in simplification biases (e.g., insensitivity to causal base rates, denominator neglect, probability matching) to correlate with cognitive ability (Stanovich & West, 1998b, 1998c).

Beyond the effects of cognitive ability, Stanovich and his colleagues (Kokis et al., 2002; Stanovich, 1999) introduced

studies in which differences in cognitive *style* (referred to as *thinking dispositions*) were also associated with the manifestation of biases (i.e., denominator neglect). In several experiments, individuals' scores on measures such as the Dogmatism scale (Rokeach, 1960) and Need for Cognition (Cacioppo et al., 1986) were associated with performance on simplification-bias-type tasks that required an override of heuristic processing with analytical processing. Although Stanovich (1999) linked cognitive style to his computational-limitations argument, we suggest that cognitive style relates to simplification biases not because it involves the inability to process information, but because it involves the lack of motivation to do so.

We suggest that in addition to cognitive ability, to avoid simplification biases, people are also required to possess an open-minded and inquisitive cognitive style. To appropriately simplify reality with minimal distortions, individuals need not only possess the ability to handle complex information, they should also possess the desire to apply this ability. Such an interaction between ability and motivation has been suggested with respect to people's performance in a variety of contexts (e.g., Heider, 1958). An able person who lacks the desire to perform, and an enthusiastic one who lacks ability, will both perform poorly. Indeed, several studies have empirically demonstrated the multiplicative effect of ability and motivation in the context of job performance (e.g., O'Reilly & Chatman, 1994).

We therefore suggest the following equation for describing the manifestation of simplification biases:

$$\text{Unbiased response} \propto \text{Cognitive ability} \times \text{Cognitive style}$$

Contrary to verification biases, the relationship between dispositions and the manifestation of simplification biases appears

Table 2
Empirical Findings in Support of Link Between Cognitive Functioning and Simplification Biases

Bias	Article	Findings
Conjunction fallacy	Stanovich & West (1998b)	Individuals with higher cognitive ability (measured via SAT scores) were substantially less likely to exhibit the conjunction fallacy (using the "Linda problem" scenario)
Selection tasks	Stanovich & West (1998c)	Performance on the Wason's selection task (Wason, 1968) was better for students with high-cognitive ability, as measured with SAT scores and the Raven Matrices test
Denominator neglect	Newstead, Handley, Harley, Wright, & Farelly (2004, Experiment 3)	Cognitive ability (measured with the AH5 intelligence test) was positively associated with performance on an abstract selection task
	Kokis, Macpherson, Toplak, West, & Stanovich (2002)	In a sample of children, a significant correlation was found between cognitive ability and the tendency to choose the normatively correct small tray in a probabilistic reasoning task
Probability matching	Stanovich & West (2008, Experiment 8)	The mean SAT score of the participants (i.e., university students) choosing the normatively correct small tray was significantly higher than the mean score of those choosing the large tray in a probabilistic reasoning task
	West & Stanovich (2003)	In two versions of a probabilistic choice task, participants preferring the utility-maximizing response were significantly higher in cognitive ability than were those showing a probability-matching tendency
Insensitivity to causal base rates	Stanovich & West (2008, Experiment 8)	In two probabilistic reasoning tasks measuring predictive accuracy, participants' SAT scores were positively correlated with their choice of a normative (MAX) versus nonnormatively (MATCH or OTHER) response
	Stanovich & West (1998c)	Participants providing the statistical response (using the causal base rate) scored significantly higher on measures of cognitive ability and thinking dispositions (e.g., dogmatism, actively open-minded thinking scale, paranormal beliefs scale)
Belief bias in syllogistic reasoning	Stanovich & West (1998d)	In two experiments, individuals with higher SAT scores consistently gave more weight to causal base-rate information, as opposed to personal experience, when making an inductive inference in a task consisting of 6 problems simulating real-life situations (the Volvo problem)
	Stanovich & West (1998c)	Participants higher in cognitive ability (SAT scores and Raven Matrices test) and thinking dispositions were better at identifying the logical validity in eight syllogisms where logic was in conflict with believability
Deviations from Bayesian reasoning	Stanovich & West (2008, Experiment 8)	Cognitive ability (measured via SAT scores) was significantly correlated with the magnitude of belief bias (number of consistent items correct minus number of inconsistent items correct) displayed by each participant ($r = .28, p < .001$)
	Sternberg & Weil (1980)	The effectiveness of a given strategy for solving linear syllogistic reasoning problems depended on one's pattern of verbal and spatial cognitive abilities
	Stanovich & West (1998d)	Participants higher in math and verbal ability were more likely to appropriately include the denominator of the likelihood ratio ($P(D/\sim H)$) in a Bayesian reasoning task
	Stanovich (1999)	Subjects ignoring Bayesian reasoning had significantly lower SAT scores than those responding normatively. Subjects' need for cognition levels did not differ across the two groups; the authors did not consider the possibility of an interaction effect

Note. SAT = Standard Achievement Test; AH5 = Alice Heim 5 test (Heim, 1968).

to be monotonic. Whereas in the case of verification biases, both high and low rankings on the relevant dispositions are argued to correlate with bias manifestation, the higher an individual is on cognitive ability and style (where high scores reflect an inquisitive style), the less likely is that individual to manifest simplification biases.

Proposition 2: The interaction between cognitive ability and cognitive style is negatively associated with the manifestation of simplification biases.

Approaching Pleasure and Avoiding Pain—Biases in People's Choices and Behaviors

Among the most basic of human motivations are to approach pleasure and avoid pain. These motivations hold center stage in the most seminal theories in psychology. Freud's (1950) discussion of the pleasure principle, Thorndike's (1935) law of effect, Gray's (1982) concepts of inhibition and activation, and Atkinson's (1964) discussion of the achievement motivation, to

name a few, all addressed the notion that people want to experience positive, pleasurable, emotions and try to avoid unpleasant and painful ones.

Approach and avoidance motivations are argued to differ as a function of valence such that the approach (or appetitive) motivation signifies behavior toward (positive) stimuli whereas the avoidance (or aversive) motivation signifies behavior away from (negative) stimuli. Gray (1982, 1990) argued that approach- and avoidance-related motivation and affect are mediated by two distinct neurological subsystems: the behavioral activation system (BAS) and the behavioral inhibition system (BIS). BAS is believed to control an approach motivation and is said to be sensitive to rewards and nonpunishments and is responsible for the experience of positive emotions such as hope, elation, and happiness (Gray, 1990). BIS is believed to control an avoidance motivation and is suggested to inhibit approach behavior that may lead to negative or painful outcomes by producing anxiety (Gray, 1982). Research on achievement motivation (e.g., Elliot & Covington, 2001) and on self-regulation (e.g., Carver & Scheier, 1990; Higgins, 1998) corroborates Gray's work by clearly distinguishing between approach- and avoidance-oriented goals and strategies.

Carver and Scheier (1990) suggested two separate self-regulatory feedback loops: one that reduces the discrepancy between incoming information and an internal reference by approaching positive goals (i.e., discrepancy reducing), and the other that increases the discrepancy between incoming information and an internal reference by avoiding negative goals (discrepancy enlarging). Similarly, Higgins (1998) distinguished between promotion and prevention regulatory foci, two self-regulatory strategies that are differentially involved in approach and avoidance. A promotion regulatory focus indicates a concern with positive change and with reaching one's personal aspirations and ideals. It is conceptualized as a long-term perspective that involves an increased sensitivity to intrinsic needs. The prevention focus reflects a concern for stability, protection, and maintenance of the status quo. It involves a short-term perspective taking, and sensitivity to social norms and pressures (e.g., duties, obligations, responsibilities). Despite differences across these various conceptualizations, they all address the two basic approach and avoidance motivations. A prevention orientation, BIS, the discrepancy-reducing mode, and fear of failure, all involve the avoidance motivation, and a promotion orientation, BAS, the discrepancy-enlarging mode, and achievement strivings all involve the approach motivation.

We suggest that the dispositional lenses with which people strive to approach pleasure and avoid pain can determine the extent to which their approach and avoidance strategies will entail accurate versus biased choices and decisions. More specifically, we argue that individuals' approach and avoidance temperaments contribute to the manifestation of regulation biases.

Approach and Avoidance Temperaments and the Manifestation of Regulation Biases

Attempts to tie approach- and avoidance-oriented physiological and regulatory systems to basic personality dimensions have been ongoing since the 1960s. Eysenck's (1967) personality dimensions of extraversion (E) and neuroticism (N),⁵ Gray's (1982) work on impulsivity and trait anxiety, Carver and White's (1994) BIS/BAS dimensions, positive versus negative emotionality/temperament

(e.g., Tellegen, 1985), and Higgins' (1998) chronic promotion and prevention regulatory foci, all indicate the existence of two broad traits that tap the approach and avoidance orientations (Carver, Sutton, & Scheier, 2000). Indeed, these traits have been shown to share common variance and to load on to two distinct latent factors (Elliot & Thrash, 2002). Extraversion, positive emotionality, and BAS load on an approach temperament factor, whereas neuroticism, negative emotionality, and BIS scores load on an avoidance temperament factor. Elliot and Thrash (2002) also showed that these factors are independent of response biases, and are systematically linked to achievement goals.

The notion of a chronic component of approach and avoidance means that although all people strive to approach pleasure and avoid pain, there are stable individual differences in sensitivities to pleasure and pain and in the means of achieving them. Whereas some people focus on positive outcomes, tend to experience positive emotions, and are inclined to adopt an eagerness strategy in an effort to fulfill their desires, others focus on negative outcomes, tend to experience negative emotions, and are inclined to adopt vigilance strategies in their effort to fulfill their responsibilities. Accordingly, individuals with an approach temperament are more likely to focus on opportunities for learning and growth, whereas those with an avoidance temperament will tend to focus on attaining stability and security.

Approach and avoidance temperaments have been shown to influence the type of goals (mastery vs. performance-avoidance goals) that individuals tend to pursue (Kahneman & Tversky, 1979) as well as the choices that they make (Thaler, 1980). Because individuals with an approach orientation focus on positive outcomes, they are more sensitive to the presence or absence of such outcomes (i.e., rewards) and aim to maximize hits (i.e., successfully obtaining a positive outcome) and minimize errors of omission (i.e., failing to obtain a potential positive outcome). On the other hand, individuals with an avoidance orientation are much more sensitive to the presence or absence of *negative* outcomes (i.e., punishments) and aim to maximize correct rejections (i.e., successfully avoiding a negative outcome) and minimize errors of commission (i.e., failing to avoid a negative outcome; Kahneman & Tversky, 1984). These differences suggest that people with approach and avoidance temperaments will differ in the biases they exhibit, given the same decision situation involving risk or uncertainty. Because these biases come about in the course of regulating one's decisions and actions, we term them here *regulation biases*.

Regulation biases are subconscious and unwanted deviations from normative axioms in decision making that involves a choice between a risky or unknown option and an alternative option that represents certainty or a familiar situation (e.g., the status quo). These include biases such as framing bias (Kahneman & Tversky, 1979), the endowment effect (Thaler, 1980), category-response bias (Kahneman & Tversky, 1984), and regret avoidance (Bell, 1982; Loomes & Sugden, 1982).

⁵ As noted above, neuroticism also reflects individuals' core self-evaluations, which we link to the manifestation of verification biases. However, only the depressive aspects of neuroticism are included within measures of core self-evaluation, whereas the anxiety component in neuroticism has been linked to the avoidance temperament. The relationship between verification and regulation biases is addressed in the next section.

As with verification and simplification biases, regulation biases too have been treated as ubiquitous human tendencies. Biases in decision making under risky or uncertain situations have been predominantly studied with reference to prospect theory (Kahneman & Tversky, 1979). Prospect theory describes an S-shaped value function and an inverse S-shaped probability weighting function. According to the value function, people give more weight to potential losses than to potential gains (i.e., loss aversion). That is, the displeasure associated with loss is greater than the pleasure that is associated with an equivalent gain. Therefore, individuals are expected to respond differently to situations with potential gains versus those with potential losses. Similarly, individuals have been shown to exhibit a tendency to overweigh low probabilities and underweigh moderate to high probabilities, thus implying a diminishing sensitivity to changes in probabilities (Kahneman & Tversky, 1979, 1984).

However, this trend of responses is not necessarily uniform across individuals. We argue that the degree to which individuals are oriented toward approach versus avoidance ultimately contributes to the emergence, and direction of such biases. Those with an avoidance orientation will be more likely to make biased decisions as predicted by prospect theory, such as in the framing effect and category-response bias. That is, they are more likely to exhibit risk-averse behavior with respect to gains and will take on risks to avoid losses. On the other hand, those with an approach orientation will be more likely to make decisions that manifest opposite biases (e.g., reverse framing effect), involving risk seeking aimed at enhancing gains, and risk aversion when the aim is to circumvent losses. As we review next, several studies of specific biases support such a formulation (see Table 3). Although different studies employed different individual differences constructs, they all appear to relate, in one way or another, to individuals' approach and avoidance temperaments. We review these studies next.

Empirical Findings in Support of the Link Between Approach and Avoidance Temperaments and Regulation Biases

Only a small subset of studies on decision-making biases has considered individual differences. Most of them explore variations of the framing effect. As noted above, Prospect Theory predictions correspond particularly with the reactions of avoidance-oriented individuals. Because individuals with an avoidance temperament tend to focus on avoiding losses, they prefer the risk of a large loss over the certainty of a small one. On the other hand, when offered the choice between a certain small gain, and an uncertain larger gain, these same individuals will tend to be risk averse. Contrarily, individuals with a strong approach temperament, who focus on maximizing gains and opportunities, should be expected to exhibit the opposite choices. A number of studies provide preliminary support for this argument. For example, in one study, promotion (i.e., approach oriented) individuals were more likely to be risk seeking in a gain frame, yet risk averse in a loss frame (Kluger, Yaniv, & Kuhberger, 2001). In contrast, individuals high on neuroticism, which has been shown to load on an avoidance factor (Elliot & Thrash, 2002), exhibited more risk aversion under the gain frame and more risk seeking under a loss frame (Lauriola & Levin, 2001; Levin et al., 2002).

Similarly, research on the effects of mood on decision making under risk and uncertainty found that people high on positive affect (i.e., strong approach temperament, high promotion focus; Higgins, 1996) tend to be conservative in situations in which meaningful loss is likely (e.g., loss frame) because they have more to lose in the form of positive mood (see also Isen, Nygren, & Ashby, 1988; Isen & Patrick, 1983). On the other hand, positive affect may serve to promote risky behavior if the environment appears to offer previously unknown rewards (Moore & Chater, 2003). Consistent with this view, Mano (1994) showed that risk attitude reversal was contingent on frame formulation and affective state, with high negative affectivity (NA) leading to a greater willingness to pay for insurance (i.e., loss frame) and high calmness (inverse of NA) leading to a greater willingness to pay for lotteries (i.e., gain frame).

Thus, both approach and avoidance temperaments may lead to risky choices. However, the two temperaments differ in the outcomes for which risks are taken. Avoidance-oriented people make risky choices when they believe it is the only way to avoid losses, circumvent punishment, and maintain their security, and will therefore exhibit the framing bias. On the other hand, approach-oriented individuals make risky choices when they believe it will enable them to gain rewards and to approach their aspirations and will therefore exhibit a reversed-framing bias.

Related to the framing bias, Prospect Theory also addresses people's tendency to distort stated probabilities (Kahneman & Tversky, 1984), such that they have increased sensitivities to very high (i.e., certain or almost certain choices) and to very low probabilities (i.e., impossible or almost impossible choices). This overweighing of low and high probabilities, called the *category-response bias*, refers to the phenomenon in which a change from impossibility to possibility or from possibility to certainty has a greater impact than a comparable change in the center of the probability distribution. For example, an increase from 0% to 5% or from 95% to 100% appears to have a larger effect than an increase from 30% to 35%.

However, Kluger, Stephan, Ganzach, and Hershkovitz (2004) found that although the weighted probability function of individuals with a prevention focus resembled prospect theory's predictions, participants with an avoidance focus showed an opposite trend. These latter individuals exhibited an elevated sensitivity (overweighing) for moderate and moderate-high, rather than low, probabilities. This suggests that although most people do indeed distort probabilities, the direction (or extent) of the distortion is partly determined by their approach/avoidance temperament.

Another bias that shows a similar pattern is the endowment effect (Thaler, 1980), according to which once something is owned, its value increases. When asking people to sell an item, they often expect to receive an amount that is higher than the amount they had paid for it. This leads individuals to prefer a currently owned item over a different item of equal value.⁶ Consistent with our arguments above, whereas the endowment effect is observed for individuals with a prevention (i.e., avoidance) orientation, it is not exhibited among promotion-oriented (i.e., approach-oriented) individuals (Lieberman, Idson, Camacho, & Higgins, 1999).

⁶ This is similar to the status-quo bias, according to which people generally prefer the status-quo over change (Samuelson & Zeckhauser, 1988).

Table 3
Empirical Findings in Support of Link Between Avoidance/Approach Temperament and Regulation Biases

Bias	Article	Findings
Framing and reverse-framing effects	Isen, Nygren, & Ashby (1988)	Subjects with induced positive affect (i.e., approach orientation, Higgins, 1996) were more conservative than were controls in their decisions in situations in which meaningful losses were likely (e.g., loss frame)
	Isen & Patrick (1983)	Subjects with induced positive affect were more likely than controls to bet more on an option with a high probability of winning (83% chance of winning), but significantly less on an option with a high probability of losing (17% chance of winning)
	Kluger, Yaniv, Kuhberger (2001)	Promotion-focused (i.e., approach-oriented) individuals were more likely to be risk seeking in a gain frame, yet more likely to be risk averse in a loss frame
	Lauriola & Levin (2001)	When responding to 60 decision-making trials, individuals high on neuroticism (i.e., avoidance oriented), exhibited more risk aversion under the gain frame and more risk seeking under a loss frame
	Levin, Gaeth, Schreiber, & Lauriola (2002)	In response to a task involving food consumption preferences, individuals high on neuroticism and low on openness to experience (i.e., avoidance oriented) exhibited more risk aversion under the gain frame and more risk seeking under a loss frame
	Mann, Sherman, & Updegraff (2004)	When given a loss-framed message, avoidance oriented (measured with the BIS/BAS scales) people reported flossing more than approach-oriented people; the reverse was found when given a gain-framed message
	Mano (1994)	Risk attitude reversal was contingent on frame formulation and affective state, with high negative affectivity (NA) leading to higher willingness to pay for insurance (i.e., loss frame) and higher calmness (inverse of NA) led to greater willingness to pay for lotteries (i.e., gain frame)
	Moore & Chater (2003)	Individuals who report happiness (i.e., approach orientation) selected risky options more often in a gambling task and invested in the stock market more than relatively less happy individuals
	Sherman, Mann, & Updegraff (2006)	Health messages framed as congruent with individuals' approach/avoidance orientations (measured with BIS/BAS scales) were more effective in promoting health behaviors than incongruent health messages
Category-response bias	Brandstatter, Kuhberger, & Schneider (2002)	The inflection point in the probability-weighting function (in which overweighting becomes underweighting) declines among disappointment-sensitive individuals (i.e., avoidance oriented), and inclines among elation-sensitive individuals (i.e., approach oriented)
	Kluger, Stephan, Ganzach, & Hershkovitz (2004)	Prevention-focused individuals exhibited increased sensitivities to very high (i.e., certain or almost certain choices) and to very low probabilities (i.e., impossible or almost impossible choices), whereas promotion-focused individuals showed an elevated sensitivity (overweighting) for moderate probabilities
Endowment effect	Liberman, Idson, Camacho, & Higgins (1999)	When offered the option of retaining a previously awarded gift versus exchanging it with another, promotion-focused, but not prevention-focused individuals were more likely to prefer exchanging gifts
Regret avoidance bias	Crowe & Higgins (1997)	In a signal detection task individuals in a promotion focus exhibited a risky response bias, whereas those in a prevention focus exhibited a conservative response bias
	Friedman & Foerster (2001)	Promotion individuals were more likely to exhibit a risky-response bias than prevention individuals
	Leone, Perugini, & Bagozzi (2005)	Anticipated agitation, such as anxiety and anguish, induced more favorable attitudes towards maintaining a diet for prevention-focused individuals, whereas anticipated dejection or despair led to more favorable attitudes for promotion focused individuals

Note. BIS = behavioral inhibition system; BAS = behavioral activation system.

Finally, several studies have addressed the regret-avoidance bias. Theories of regret argue that people can anticipate the regret they would feel if they were to adopt a certain course of action, and will therefore make choices that minimize potential regrets (Bell, 1982; Loomes & Sugden, 1982). In line with the arguments made above, the distinction between approach and avoidance temperaments suggest that because of their focus on avoiding negative outcomes, regret avoidance would be manifested primarily among individuals with a strong avoidance orientation. On the other hand, approach-oriented individuals, who focus on learning goals and avoiding errors of omission, would not avoid such regret but rather, would seek out feedback on forgone alternatives. In the works above, regret has been depicted as the negative emotion that results from making a bad choice (i.e., errors of commission). However, regret can also result from not taking what would have been a beneficial course of action (i.e., error of omission). In other words, regretting action may take on a different form than regretting inaction (Gilovich & Medvec, 1995; Landman, 1993). According to Kahneman, Slovic, and Tversky (1982), greater regret is experienced when negative outcomes are the result of nonnormative actions rather than inactions. Accordingly, anticipated regret from actions is likely to induce adherence to the status quo or to routine behavior at the expense of innovation and change.

Some evidence exists to support the notion that anticipating action regrets is more likely among individuals with an avoidance temperament (Leone, Perugini, & Bagozzi, 2005). These individuals tend to anticipate, and therefore avoid, regret from choice alternatives that involve a risk of ending with failure, or a potential loss. However, because of their focus on avoiding errors of omission, those with an approach temperament will actually show greater regret for failures due to inaction. For them, the types of regret that are anticipated, and therefore avoided, are those indicating one's failure to capitalize on a potential gain. Although not explicitly addressing regret avoidance, a number of findings demonstrate that whereas prevention individuals tend to make conservative, status-quo, choices, promotion individuals opt for risky and innovative ones (Crowe & Higgins, 1997; Friedman & Foerster, 2001). Because of approach individuals' orientation toward trying out new possibilities, missing out on them is more likely to generate regret than trying them out and discovering that they have not proved fruitful.

In sum, whereas regulation biases have been treated as ubiquitous, we argue that they are contingent on people's approach/avoidance temperaments.

Proposition 3a: Individuals who are high in their avoidance temperament are more likely than others to exhibit biases such as the framing bias, the endowment effect, greater sensitivities to low and high probabilities, and avoidance of regrets due to actions that stray from the status quo.

Proposition 3b: Those who are high in approach temperament are more likely than others to exhibit biases such as reversed framing and endowment effects, greater sensitivities to midrange probabilities, and avoidance of regrets due to inaction.

Relationships Among Bias Categories

Although we suggest that the three bias categories are distinct from one another and stem from separate processes, we do not presume that the three are necessarily independent. Rather, we suggest that they relate to one another, both directly, and indirectly through relationships among their underlying dispositions (see Figure 1). First, relationships among bias categories may exist given that their underlying dispositions are not independent of one another. For example, the approach/avoidance temperaments and cognitive style appear to be related, in that both an approach temperament and an inquisitive cognitive style (e.g., high need for cognition and low need for closure) involve an open and inquisitive orientation. Conversely, both the avoidance temperament and the dogmatic cognitive style (i.e., low need for cognition and high need for closure), represent constrained cognitive functioning and a heightened concern with confirming expectations (Kruglanski, 1989). Indeed, several studies indicated relationships between cognitive style and framing bias in line with our propositions concerning approach/avoidance temperament and regulation biases (e.g., McElroy & Seta, 2003).

Relationships also exist between cognitive style and core self-evaluations. An inquisitive cognitive style is positively correlated with self-evaluation traits such as self-esteem (Osberg, 1987). Similarly, self-evaluations are related to approach/avoidance temperaments, such that individuals with negative self-evaluations are more likely to hold an avoidance temperament. Blaine and Crocker (1993) proposed that because high self-esteem individuals are quite certain about their positive attributes,

they are not particularly concerned about avoiding failure . . . but they seem very interested in enhancing themselves through success Low self-esteem people, on the other hand, are unsure of their self-concepts As a result, they approach and evaluate situations with an eye toward avoiding failure. (p. 80)

Such relationships among dispositions are likely to translate into relationships among the three bias categories. This could suggest that some higher order disposition, comprising components of all three personality categories, may be more directly responsible for the manifestation of bias, and could explain why some individuals are particularly likely to exhibit biases in general. Nevertheless, such a higher conceptualization is yet to be developed, through empirical work comparing the three personality sets. Moreover, the distinctions between the three personality categories on which we focused are still meaningful for tying each of the categories to a separate category of biases. For example, at the least, cognitive style and temperament are distinct in that the former focuses on cognitive processes, whereas the latter also incorporates, and often emphasizes, affective components. This alone would tie cognitive style more directly than temperament to biases that involve the cognitive simplification of events (i.e., simplification biases). Similarly, whereas temperament involves individuals' overarching approach to their environment, core-self-evaluations directly tap how individuals perceive *themselves*. It is therefore the latter that should be more directly related to biases that involve distortions in perceptions of the self (i.e., verification biases).

Beyond the existence of relationships among the three personality sets, which yield indirect links among the three bias categories, we also argue for a direct link between bias types. First, we propose that simplification biases can directly influence verification biases. That is, distortions in the processing of information may lead to increases in the likelihood of biases in perception. Evidence for such a relationship appears in studies that show an underweighing of event base rates among individuals who exhibit overconfidence in their predictions (Dunning, Griffin, Milojkovic, & Ross, 1990; Vallone, Griffin, Lin, & Ross, 1990). Similarly, in Chambers and Windschitl's (2004) nonmotivated account of biases, insensitivity to base rates as well as insensitivity to sample size were indicated as a possible explanation of unrealistic positive self-views (i.e., the above-average effect) and a form of unrealistic optimism.

There is also evidence that verification biases contribute to the creation of regulation biases. As discussed above, verification biases evolve from the core-self-evaluation lenses used when verifying self-perceptions. For individuals with either upward- or downward-distorting lenses, the outcome of the verification process is a biased interpretation of particular events in reality. For example, individuals with positive core self-evaluations will overestimate their control of the car on an icy road (i.e., illusion of control) and underestimate their chances of having a car accident (i.e., unrealistic optimism). Accordingly, even when not in a particular hurry, they will be more likely to view speeding as an opportunity (to gain time) rather than threat (on their lives) and are more likely to avoid future regret by choosing to speed (i.e., action). On the other hand, individuals with negative self-evaluations will have too little faith in their control on an icy road (i.e., learned helplessness) and will overestimate the likelihood that speeding is result in an accident (i.e., unrealistic pessimism). Accordingly, their focus will be on the potential harm that speeding entails (i.e., avoidance focus) and they will therefore avoid regret by driving more conservatively and cautiously or refrain from driving at all (i.e., inaction).

Some support for the link between verification and regulation biases comes from studies on unrealistic optimism (or pessimism) and risk-taking behaviors. In one study, unrealistic optimism was found to correlate with perceptions of lower risk of health-related problems and less concern about such risks (Radcliffe & Klein, 2002). Similarly, unrealistic optimists tended to downplay the amount of risk involved in their behavior (Klein, 1996) and were less likely to take precautions against health-related risks (Davidson & Prkachin, 1997). In other words, individuals' biased interpretations of their situation (i.e., verification biases) directly relates to their choices and actions with respect to how they approach pleasure and avoid pain (i.e., regulation biases). Thus, although we believe there is ample conceptual sense, and empirical evidence to suggest a distinction among the three types we identified, there is also evidence to suggest conceptually meaningful relationships among them.

Recommendations for Future Research

Our theory involves a shift from viewing biases as uniform across individuals, to viewing them as subject to individual differences. Although the interest in understanding biases is increasing, as evidenced by the number of published articles, handbooks,

and edited books on the topic, few works have systematically addressed the role of individual differences in bias manifestation. Works that have addressed individual differences in biases have generally focused on one individual difference in biases and one particular bias. By introducing our taxonomy and the proposed links among bias categories, we hope to energize discussions and instigate further research on the topic.

Our conceptualizations offer several venues for future research. As a start, studies should be conducted to test the validity of our classification scheme. One line of research can be devoted to demonstrating intraindividual consistency in the manifestation of biases within each bias category. Another line of research can focus on the propositions raised, by directly testing the relationships between the individual difference variables and bias categories. In particular, more research is needed to test individual differences in the manifestation of regulation biases. Previous works on regulation biases have employed constructs such as field dependence, need for cognition, Type A behavior, and neuroticism and have yielded inconsistent findings. As our theory suggests, individual differences in approach/avoidance temperaments should be more closely related to regulation biases and could potentially help reconcile such inconsistencies.

Beyond such works that would validate the theory, controlling for the individual difference variables outlined in our model is likely to improve the quality of research on biases by enhancing cross-situational effects and by explaining a greater amount of variance in the phenomena studied.

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