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Bending perception to desire: Effects of task demands, motivation, and cognitive resources

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Abstract Determinants of motivated judgments were examined in this research. Three experiments investigated how dominant motivation, biasing difficulty and mental resources combine to produce motivationally congruent judgments. Studies 1 and 2 showed that where a biasing motivation is dominant the presence of resources can augment a motivational bias in judgment. Study 3 replicated that result and showed that resources contribute to the formation of biased judgments only where biasing is difficult to accomplish, but not where it is relatively easy to accomplish. In addition, Study 3 showed that where the accuracy motivation is dominant and biasing is the easy default, unbiased judgments will occur only in the presence (vs. absence) of resources. In contrast, where unbiased judgments are easy to come by, such judgments occur irrespective of resources.

Keywords Cognitive energetics theory · Goals · Cognitive resources · Decision making

Introduction

Most human beliefs are motivated; they are constructed for a purpose. That purpose may vary across instances. The "default" purpose is the arrival at a *truth* on a given matter (Petty and Cacioppo 1986). By definition, to believe something is to hold it to be true; the notion of a *belief* that one knows to be *false* is logically incoherent. Avowedly, the desire for truth is the sole motivation driving judgment formation. Common knowledge and ample research findings suggest otherwise, however. Specifically, the (illicit) desire for specific conclusions often biases judgment in the motivationally pleasing direction. The desire to view oneself in a positive light, to believe in one's future health and good fortune, to judge that one's favored team has bested its rival, or that one's economic woes are temporary—may surreptitiously color our judgments, while we assume them to be guided by "nothing but the truth." Thus, in addition to the *motivation for accuracy*, human judgments are subject to various *biasing motivations* bending the contents of our beliefs to our desires (Dunning 1999; Festinger 1957; Freud 1920; Kelley 1967, 1972; Kunda 1990; Kunda and Sinclair 1999; Pareto 1916).

To say that belief formation is motivated does not necessarily mean that the goals in question will be reached. Whether or not they will should depend on three major factors: (1) the strength of the underlying motivation, or *goal magnitude*, (2) the difficulty of attaining the goal involved or *task demands*, and (3) the pool of *mental resources* available to the individual at the moment. In the pages that follow, we explicate these claims and present novel experimental evidence bearing on their validity.

The conceptual framework for this research is the Cognitive Energetics Theory (CET, Kruglanski et al. 2012). According to the CET, attainment of any cognitive goal is enabled where the individual's *potential driving force* defined as a product of *cognitive resources* available to the person, and magnitude of her or his *focal goal*, is at least equal to the *restraining force* comprising *task difficulty*, the individual's degree of "*cognitive miserliness*,"

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and the magnitude of currently active *competing goals*. Much like Motivation Intensity Theory (Brehm and Self 1989; Wright 1998), the CET assumes that the individual will not put out more energy than is (perceived as) required to complete the cognitive task at hand. In other words, the *effective driving force* (the energy or effort actually expended) can be less and is at the most equal to the individual's *potential driving force*. In what follows, we apply this analysis to the ubiquitous phenomenon of motivated biases discussed earlier.

Determinants of motivated biases

A major CET parameter relevant to motivational biases is *magnitude* of the goal to form desirable judgments. Another such parameter is *difficulty* of so doing: At times, "spinning" the information given in a pleasing direction may be relatively easy; on other occasions, it may be relatively difficult. The third relevant parameter is the *energetic resources* available to the perceiver. According to the CET, if the potential driving force is of sufficient magnitude—enough so to match the restraining force—the perceiver's goal could be accomplished despite the task's difficulty. As concerns motivated biases, a pleasing reinterpretation of contrary evidence that may seem nearly impossible for energy-depleted perceivers, might be accomplished by highly energized ones with plentiful cognitive resources. In line with this logic, we present now two studies testing the same general hypothesis, namely that where a strong directional motivation is present, formation of a judgment would depend on a match between biasing difficulty and the perceivers' resources. Where biasing is difficult to accomplish, it will occur only in the presence of sufficient resources. However, where it is easy to accomplish—it will occur irrespectively of resources.

Study 1

In our first study we investigated how cognitive resources combine with a specific motivation, namely to cope with feelings of rejection, in shaping individuals' perceptual response to the Mona Lisa painting. In an influential review of work on the need to belong, Baumeister and Leary (1995) obtained evidence that forming and maintaining social bonds constitutes a fundamental human motivation. In line with this proposition, several authors have demonstrated that individuals can be sensitive to cues indicating potential rejection (Pickett and Gardner 2005) and engage in affiliation efforts (e.g., imitating others) in response to social exclusion (Lakin and Chartrand 2005). Based on this reasoning, we hypothesized that priming individuals' feelings of rejection might induce a directional motivation

to regain a sense of belonging which would translate into perceiving warmth and acceptance in others.

To investigate these notions, in one condition, participants were subliminally primed with rejection words to enhance their motivation to belong, whereas in another condition, participants' accuracy motivation was manipulated through subliminal presentation of words related to the concept of accuracy. In order to manipulate cognitive resources, we employed a digit retention manipulation. Participants in the high resource depletion condition were asked to retain a 9-digit number throughout the experiment, whereas participants in the low resource depletion condition were not presented with such a request.

Participants were asked to rate a representation of the Mona Lisa painting on several dimensions relevant to the motivation to belong; these dimensions included agreeableness, friendliness, and the extent to which the Mona Lisa appears to be smiling, and welcoming. We hypothesized that given the rejection prime (vs. the accuracy prime) individuals would perceive the Mona Lisa as warmer and friendlier when under low (vs. high) resource depletion.

Method

Participants

Sixty-four University of Maryland undergraduate psychology students, (37 women, $M_{age} = 19.36$ years, $SD_{age} = 1.47$) were recruited for a study on "Artistic Judgment." Participants were given partial course credit for their involvement and were randomly assigned to a 2 (accurate vs. rejection) × 2 (high vs. low resource depletion) between-subjects design. Partial course credit was awarded to students for taking part in this study. Gender did not yield any effects on our dependent variables; hence it will be omitted from further consideration.

Materials and procedure

Participants were invited to partake in two unrelated studies. In the first study, they were told that the researchers were investigating people's speed of word recognition. Participants engaged in a lexical decision task in which they were either subliminally primed with eight words relating to accuracy (e.g., accurate, correct, true), or with eight words related to rejection (e.g., rejected, isolated, castaway). Participants were instructed to indicate whether a string of letters was a meaningful word or not. The letter strings consisted of either neutral words (e.g., lamp), or pronounceable non-words (e.g., gipow). Prior to each letter string, subliminal primes were presented for a period of 17 ms using backward masking. It was expected

that the rejection primes would create a directional motivation to regain a sense of belonging, whereas accuracy related words were expected to enhance participants' accuracy motivation.

The alleged second study conducted in a different room was presented as investigating artistic judgment. Participants were told that they would form an opinion about a painting after viewing it on a computer screen for 20 s. At that point, participants in the high resource depletion condition were told that the researchers were interested in how people perceive art when thinking of something else; to that end participants would have to memorize a 9-digit number and retain it until the end of the experiment. Participants in the high resource depletion condition were given 20 s to retain this number. No comparable instructions were given to participants in the low resource depletion condition. Subsequently, all participants were presented with the Mona Lisa painting for 20 s. Immediately thereafter, participants were asked to rate the extent to which the Mona Lisa seemed agreeable, friendly, welcoming, and smiling. Responses to these items were recorded on a 7 point Likert-type scale ranging from -3 (e.g., *Not agreeable at all*) to $+3$ (e.g., *Very agreeable*). At the end of the experiment, participants in the high resource depletion condition were asked to type in the 9-digit number they were asked to retain throughout the experiment.
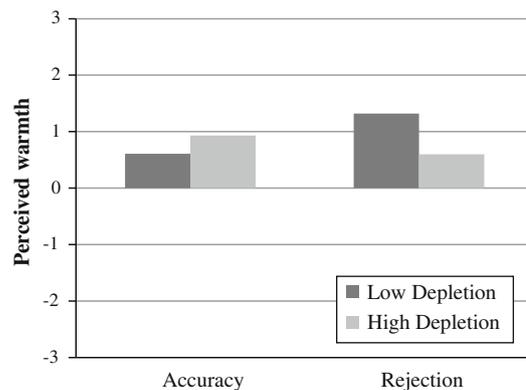
Results

Manipulation check

To ensure that participants in the high resource depletion condition were under processing capacity constraints, we examined whether they remembered the 9-digit given them at the start of the experiment. Only three individuals failed to recall that number. Consequently, these participants were dropped from future consideration, leaving 61 participants for further analyses.

Perception of warmth

In our first analysis, we subjected the agreeable, friendly, welcoming, and smiling items to a principal-components analysis (PCA). This analysis produced a one-component solution that accounted for 64 % of the total variance. The scree test and Kaiser's rule all indicated the extraction of one component. The eigenvalue for this component was 2.54. In light of these results, the four items pertaining to the Mona Lisa were averaged into a single score of perceived warmth.

A 2 (Motivation: accuracy vs. rejection) × 2 (resource depletion: high vs. low) ANOVA was performed on the

Fig. 1 Perceived warmth as a function of motivation and resource depletion

perceived warmth measure. Results from the ANOVA did not reveal a main effect of motivation, $F (1, 57) = 0.73$, $p = .39$, or resource depletion, $F (1, 57) = .87$, $p = .35$. However, as hypothesized, the two-way interaction was significant, $F (1, 57) = 5.79$, $p = .01$. Simple-effect analyses revealed that in the rejection condition, warmth was perceived to be more pronounced for participants in the low resource depletion condition ($M = 1.32$, $SD = .81$) than in the high resource depletion condition ($M = .60$, $SD = .65$), $t (57) = 2.51$, $p = .01$. Under accuracy motivation, no significant difference was found between the high resource depletion ($M = .93$, $SD = .60$) and the low resource depletion manipulations ($M = .61$, $SD = 1.14$), $t (57) = .93$, $p = .35$. Figure 1 displays the results.

Discussion

The results of our first experiment support the notion that in the presence (vs. absence) of a biasing motivation that privileges a given judgmental content over others, the availability of cognitive resources may enable the formation of the desired judgment. Specifically, in the rejection prime condition, where participants were presumably motivated to perceive others as warm and friendly, such perception was obtained only where participants' cognitive resources were relatively intact and not where these were depleted by rehearsal of the 9-digit number. In contrast, no effect of resource availability on perception of warmth was manifest in the accuracy prime condition where such perception was of lesser motivational relevance. Whereas Study 1 used an *approach* goal to examine motivated biases Study 2 examines the same phenomenon using an *avoidance goal*, namely the avoidance of guilt following transgression. In addition, Study 2 seeks to extend our understanding of motivated biases by looking at both emotional experience and behavioral decision making.

Study 2

Findings of Study 1 support the notion that extensive cognitive work may be required for motivational biases to operate. Study 2 addressed whether this principle would also extend to emotional self-regulation. In that regard, prior research has established that individuals are able to exert influence over their emotions (Morris and Reilly 1987). For instance, it is not unusual for individuals to regulate their emotions either preemptively by appraising potentially future stressful situations, or by responding to them as they occur (Gross 1998; Richards and Gross 2000). Thus conceivably, in response to negative emotions, individuals may engage in biased information processing in order to alleviate their painful phenomenological experience.

In this study, we focused on guilt and the effortful informational elaboration necessary to alleviate culpability. Given that guilt represents an aversive emotional state, escaping or avoiding it may constitute a goal served by biased information processing. Such processing may be less likely to occur without adequate cognitive resources. The notion that emotion regulation requires cognitive resources is suggested by the work of Wegner et al. (1993). In their research, it was shown that in the absence of resources, participants instructed to suppress their emotions were unable to regulate them effectively (and even experienced a shift in the opposite direction). In line with these findings, Study 2 investigated how individuals respond to induced feelings of guilt as a function of cognitive resources. Specifically we predicted that in culpability inducing situations, individuals who lack the necessary cognitive resources to regulate their emotions would report higher levels of guilt than participants with sufficient cognitive resources. Moreover, as guilt has often been associated with reparative actions (Tangney et al. 1998), we predicted that individuals who lack cognitive resources and, therefore, experience guilt would exhibit greater readiness to engage in reparative behaviors.

Method

Participants

Seventy-seven University of Maryland undergraduate psychology students, (44 women; $M_{age} = 19.77$ years, $SD_{age} = 3.06$) were recruited for a study on "Color Perception." Participants were given partial course credit for their involvement and were randomly assigned to a 2 (high vs. low blameworthiness) × 2 (high vs. low resource depletion) between-subjects design. Gender did not yield any effects on our dependent variables; hence it will be omitted from further consideration.

Materials and procedure

Cognitive resource depletion The experiment took place in a private laboratory room to ensure the confidentiality of participants' responses. The experimenter informed participants that the goal of the study was to investigate individual differences in color recognition. Participants were given a computerized Stroop task (Stroop 1935) to complete. On each trial, participants were shown the name of a color (e.g., green). The color of the text either coincided (e.g., green) or not (e.g., yellow) with the corresponding color name. Four different colors were used (i.e., blue, green, yellow, red). Participants were asked to state aloud (into a microphone placed in front of them) the color in which the color names were written. Cognitive resource depletion was manipulated by creating two different versions of the Stroop task. In the high depletion condition, 90 % of the trials were incongruent (i.e., the color and color name were different), whereas in the low depletion condition, 90 % of the trials were congruent (i.e., color and color name were the same). The Stroop task consisted of 500 trials and took approximately 15 min to complete.

Manipulation check After completing the Stroop task, participants rated its difficulty and their current level of concentration. These ratings were recorded on a 7-point Likert scale ranging from 1 (*Not at all*) to 7 (*Extremely*).

Blameworthiness Participants were instructed to access the second part of the study by clicking on the "Continue" button on the computer screen. At that point, the computer screen suddenly became inoperative and displayed an error message which read: "You will lose any unsaved information in all open applications." The experimenter waited for the participant to leave the room and ask for assistance. In the high blame condition, the experimenter (blind to all hypotheses) expressed discouragement by blaming the participant for erasing all the data and damaging the computer. In the low blame condition, the experimenter stated that this type of incident is rather common and that s/he should not be concerned about it.

Experienced guilt The experimenter then left the room and told the participants that because the computer was broken, they would take part in a different study, using paper and pencil, which would be of equivalent length to the study for which they had signed up originally. When the experimenter returned he gave the participant a measure of positive and negative affect (PANAS; Watson et al. 1988) to fill out. Positive affective states included items such as *active, attentive, alert, determined, inspired*), whereas negative affective states included items such as *afraid, ashamed, hostile, nervous, upset*. Participants rated the extent to which they were currently experiencing each of these 10 affective states, using a 5-point scale ranging from 1 (*Not at All*) to 5 (*Extremely*). Reliability of the

positive and negative affect measures yielded internal consistency indices of .81 and .77, respectively.

Reparative behavior After collecting the questionnaire, the experimenter told the participant that she/he could voluntarily sign up on a roster sheet to participate in future studies. Participants were explicitly informed that no monetary compensation or course credits could be gained from that participation. Two roster sheets and a pen were placed on a table outside of the lab, and participants were told that they could either sign up for a study on "altruism" or a study on "cognition and judgment."

Results

Manipulation check

ANOVAs were conducted on the self-report measures administered to participants after the Stroop task was completed. These analyses revealed that participants given an easy Stroop task ($M = 4.61$, $SD = 1.42$) perceived it as easier to accomplish than participants given the difficult Stroop task ($M = 3.89$, $SD = 1.57$), $F (1, 75) = 4.44$, $p = .03$. Moreover, after a difficult Stroop task ($M = 5.02$, $SD = 1.70$) participants reported greater difficulty concentrating than after an easy Stroop task ($M = 5.74$, $SD = 1.01$), $F (1, 75) = 5.07$, $p = 0.02$. These findings suggest that, as intended, the difficult Stroop task depleted participants' resources to a greater extent than the easy task.

Experienced guilt

A 2 (Resource depletion: high vs. low) × 2 (blameworthiness: high vs. low) between subjects ANOVA was conducted to examine possible differences on the guilt measure. Three items from the PANAS, namely, *guilt*, *blameworthiness*, and *dissatisfaction with self*, were averaged to create an index of guilt ($\alpha = 0.74$). An ANOVA performed on this measure yielded a significant main effect of blameworthiness, demonstrating that participants in the high blame condition, who were led to believe that they had erased the experimenter's data and were not "forgiven" for so doing ($M = 1.61$ $SD = .83$), experienced more guilt than participants in the low blame condition, who were led to believe that the computer crash was accidental and common ($M = 1.22$ $SD = .36$), $F (1, 73) = 8.20$, $p = .005$. A second main effect was found for resource depletion, $F (1, 73) = 3.99$, $p < .05$. Participants in the high resource depletion condition ($M = 1.57$ $SD = .84$) experienced significantly more guilt than participants in the low resource depletion condition ($M = 1.29$ $SD = .42$). In line with our predictions, these main effects were qualified by a significant two-way interaction, $F (1, 73) = 4.89$, $p < .05$.
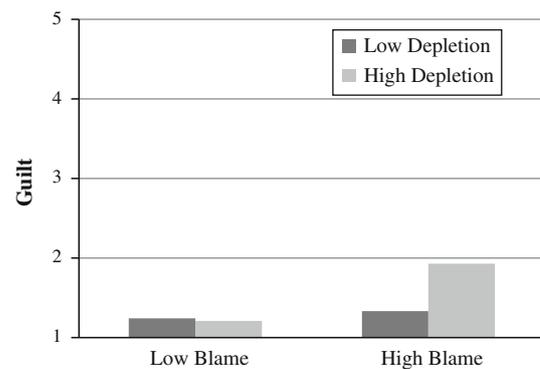
Fig. 2 Guilt as a function of motivation and resource depletion

As shown in Fig. 2, simple effects analyses revealed that when participants were led to think that they were personally responsible for the computer crash, they experienced more guilt under *high resource depletion* ($M = 1.92$ $SD = 1.04$) than under *low resource depletion* ($M = 1.33$ $SD = .43$), $t (73) = 3.03$, $p < 0.01$. No differences due to resource depletion were found in the low blame condition ($p > .8$).

Reparative actions

Logistic regression analyses were conducted in order to examine whether the experimental conditions had any impact on participants' likelihood of signing up for a future study. Participants were given a score of 1 or 0 if they had signed up or not, respectively, for volunteering for further experimental studies. The resource depletion (coded $0 = $ low load; $1 = $ high load) and blame manipulations (coded $0 = $ low blame; $1 = $ high blame) were predictors of participants' decision to sign up on one of the roster sheets. These two independent variables did not yield any significant main effects. However, the interaction term was significant, $\beta = 1.58$, *Exp* (B) $= 4.89$, $p < .05$. Further analyses revealed that under high blame, participants were more likely to sign up for a future study in the high resource depletion condition than in the low resource depletion condition, $\beta = 2.56$, *Exp* (B) $= 13.00$, $p = .001$. In the low blame condition, no difference between the high resource depletion and low resource depletion conditions were found, $\beta = 0.46$, *Exp* (B) $= 1.586$, $p > 0.5$.

Discussion

The results of Study 2 extend our analysis of the role of cognitive resources in motivated biases to the realm of emotion regulation. Our results support the prediction that cognitive resources are necessary to regulate one's feelings of guilt. In the absence of sufficient processing capacity,

one is unable to down-regulate feelings of culpability. These results are consistent with those of Wegner et al. (1993) who demonstrated that cognitive resources are pivotal for effective emotional self-regulation.

Moreover, in line with previous work on guilt (Tangney et al. 1998), we found support for the idea that guilt may encourage reparative actions. Specifically, participants who were blamed for the computer failure under high resource depletion (vs. low resource depletion) condition not only experienced greater guilt, but were also more likely to repair their wrongdoing by signing up for a future study on a voluntary basis. In this sense, current results support the notion that the role of cognitive resources in motivated biases pertains not only to differential judgments and emotions, but also translates into actual behavior.

A major assumption of the CET is that cognitive resources serve to facilitate goal attainment, and are particularly useful where attainment is difficult to accomplish. In other words, resources are viewed as an all-purpose reserve capable of facilitating, when required, the advancement toward *any objective*. Accordingly in the present study we explored the implications of our theoretical analysis in reference to two contrasting goals: The goal of forming an unbiased opinion, that as discussed earlier constitutes the "default" objective of judgment formation, and a biasing goal of reaching a particular, motivationally desirable judgment. Furthermore, note that Studies 1 and 2 did not manipulate task difficulty, but rather created a situation where biasing was assumed to be difficult to begin with. Therefore, in the present study, we addressed this issue by manipulating biasing difficulty.

Consistent with prior research (e.g., Hsee 1996; Kunda 1990; Kunda and Sanitioso 1989; Tesser 1976), we posit that "reality constraints" limit the extent of informational "spin" in a direction of one's wishes. Specifically, where the informational stimulus is unambiguous (reflecting high reality constraints), it may be easier to reach an unbiased (vs. biased) judgment than when it is ambiguous. To the contrary, when the information given is ambiguous and open to multiple interpretations (i.e., low reality constraints), it may be easier to reach a biased, comforting judgment and forming an unbiased (vs. directionally biased) judgment may require effort afforded by available cognitive resources (Ditto et al. 1998). In other words, where the stimulus information is ambiguous, it may be all too easy to arrive at a pleasing judgment congruent with one's desires, and resisting the temptation to do so may require considerable resources.

Based on this rationale, we hypothesized that where the individual's focal goal is to form a motivationally pleasing (and hence, biased) judgment *and* biasing is difficult to accomplish, the availability of ample cognitive resources would increase the likelihood of bias, and where biasing is easy to accomplish it will occur regardless of resources. Similarly, where the focal goal is to form an unbiased judgment and forming such judgment is difficult to accomplish because the information given readily lends itself to "spinning" in a desired direction, the presence of resources would attenuate bias. In contrast, where rendering an unbiased judgment is easy, such judgment will be made relatively independently of resources.

Study 3

Study 3 examined the occurrence of a self-serving bias manifest in the notorious "above average" effect, defined as people's propensity to assess their own capacities as above average when comparing themselves to their peers (Baumhart 1968; Larwood 1978; Svenson 1981; Weinstein 1980). In a series of studies, Dunning et al. (1989) demonstrated that ambiguously-defined traits were subjected to the *above average effect* to a greater extent than clearly-defined traits. However, as Dunning et al. (1989) underscored, their research did not provide insights regarding additional factors that may prompt self-serving judgments. In search of such insights we revisited, therefore, Dunning's et al. (1989) paradigm and incorporated within it the present variables in order to examine their effects on the *above average bias*. Accordingly, the design of the present experiment included the factors of (1) motivation (accuracy vs. self-enhancement) manipulated via (supraliminal) priming, (2) ampleness of cognitive resources manipulated via participants' circadian matches and mismatches (e.g., Bodenhausen 1990; Kruglanski and Pierro 2008), and (3) biasing ease represented by stimulus ambiguity (Dunning et al. 1989). Description of our specific methods and procedures is given below.

Method

Participants and design

One hundred and fifty University of Maryland undergraduates (89 women, 61 men, $M_{age} = 19.41$ years, $SD_{age} = 1.26$) participated in the study for course credits. The study proceeded in two phases. During the first phase, participants filled out a "morningness" scale (Smith et al. 1989). In the second phase, 2 days later, participants performed a writing task and compared themselves to their peers on multiple personality dimensions. In that latter phase, participants were randomly assigned to a 2 (motivation: accuracy vs. biasing) × 2 (cognitive resources: circadian match vs. mismatch) × 2 (biasing ease: ambiguous vs. clear-cut personality traits) × 2 (trait valence: positive vs. negative) mixed-design.

Materials and procedure

Phase 1 The Morningness Scale (Smith et al. 1989) was administered to participants at the onset of phase 1. This scale is a 13-item instrument assessing people's preferences for morning and evening activities. A sample item is "During the first half hour after having awakened in the morning, how tired do you feel". Responses to this and other similar items are made on the following scale: 1 = *Very tired,* 2 = *Fairly tired,* 3 = *Fairly refreshed,* and 4 = *Very refreshed.* A composite morningness score is then computed by summing across participants' responses to the items. Scores range from 13 (representing an *extreme evening type*) to 55 (representing an *extreme morning type*). Based on their score, participants were classified as evening or morning-types according to a median split procedure.

Phase 2 Participants categorized as morning or evening types were randomly assigned to a morning or an evening lab session during Phase 2. Participants tested during their circadian match, that is, morning-type participants tested in the morning and evening-type participants tested in the evening (circadian-match conditions), were expected to possess ample cognitive resources. In contrast, participants tested during their circadian mismatch were assumed to have relatively meager cognitive resources. The morning and evening lab sessions were held at 8–9 a.m. and 7–8 p.m., respectively. As a manipulation check of resource depletion, participants were asked to indicate the extent to which they felt "energized" on a 5-point Likert scale ranging from 1 (*Not at all*) to 5 (*Extremely*) during the lab session in Phase 2.

Participants were then randomly assigned to one of 2 writing tasks. Those assigned to the biasing motivation condition were asked to:

> "Write about a time in which you felt intense failure in an intellectual domain, a time that you felt as if you were not very smart. This failure can be academic in nature (e.g. a time in which you failed a class or an exam) or can be a failure outside of school (e.g. a time in which you tried but failed to understand something important)."

Similar reliving tasks have proven effective in producing experiences of intellectual failure (Knowles and Gardner 2008). In their meta-analyses, Campbell and Sedikides's (1999) have demonstrated a robust self-serving bias in response to self-esteem threats. Consequently, we expected that our manipulation of intellectual failure would instigate a strong motivation for individuals to regain a positive self-image through self-serving judgments.

Participants assigned to the accuracy motivation condition were given a writing task on a neutral topic. This task was intended to parallel the writing task of participants in the biasing motivation condition, though the accuracy motivation was induced differently, via subsequent instructions as described below. Specifically, participants' writing task was to:

> Write about the food that you had yesterday at lunchtime. For example, describe the texture, the temperature, and the type of cuisine that you had. You can also include where you were and the period of the day during which this event occurred.

Following the writing task, participants responded to a personality questionnaire and assessed their standing among other UMD students on 28 different personality traits. Participants in the *accuracy* condition were advised about the importance of ''accurate self-perception'', and were informed that they would discuss their answers with the experimenter at the end of the experiment. This procedure has been previously found to be successful in manipulating accuracy motivation (Freund et al. 1985; Kruglanski and Freund 1983; Tetlock 1983, 1985). Additionally, to further strengthen the accuracy manipulation, participants pledged on their honor that they would try to be as accurate as possible.

Participants were then presented with a personality questionnaire. The 28 personality traits were exactly the same as those employed by Dunning et al. (1989); they are clustered into 4 categories: *ambiguous positive* (i.e., sensitive, sophisticated, idealistic, disciplined, sensible, ingenious, quick), *ambiguous negative* (i.e., neurotic, inconsistent, impractical, naive, submissive, compulsive, insecure), *unambiguous positive* (i.e., neat, well read, mathematical, thrifty, athletic, studious, punctual), and *unambiguous negative* (i.e., sarcastic, wordy, sloppy, clumsy, gullible, gossipy, bragging). These personality traits appeared on the questionnaire in no particular order. Participants indicated their standing on each trait among UMD students using a 7-point scale ranging from −3 (*I exhibit this trait much less than other UMD students*) to 0 (*I exhibit this trait to about the same degree as other UMD students*) to +3 (*I exhibit this trait much more than other UMD students*). This procedure replicates Dunning et al. (1989) methodology.

We expected that under a dominant accuracy motivation, self-serving judgments would be more likely when personality traits are ambiguous (and thus easy to bias) and individuals lack sufficient cognitive resources (in the circadian mismatch condition). We also predicted that when the personality traits are unambiguous participants under accuracy motivation would render unbiased judgments whether or not they possessed ample or limited resources. We predicted this pattern of results independently of the valence of the personality traits being assessed.

In contrast, we predicted that under *biasing motivation* individuals would demonstrate self-serving biases when judging easy to bias traits (ambiguous) irrespective of the presence or absence of cognitive resources. We also predicted that when judging difficult to bias traits (unambiguous) individuals under biasing motivation would self-serve only in the presence of resources (i.e. under circadian matches) but not in their absence (i.e., under circadian mismatches).

Results

Fourteen participants did not show up for the second phase of the study, leaving one hundred and thirty-six participants for the statistical analyses.

Manipulation check

An ANOVA was conducted on the self-report measures administered at the onset of Phase 2 to assess participants' felt level of energy. This analysis revealed that participants in the circadian mismatch condition ($M = 2.91$, $SD = 1.19$) felt they had less energy than participants in the circadian match condition ($M = 3.37$, $SD = 1.20$), $F (1, 134) = 4.96$, $p = .02$. Consequently, our manipulation of resource-depletion via circadian rhythm mismatches appears to have been effective.

Main analyses[1]

Accuracy motivation: Positive traits A 2 (cognitive resources: circadian match vs. mismatch) × 2 (biasing

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[1] Although we hypothesized two different result patterns between accuracy and biasing motivation conditions, the expected patterns were not expected to be necessarily detected by a four-way interaction. This is so because several of the predicted effects were expected to be in the same direction in both the accuracy and the biasing motivation condition, and in the match versus mismatch conditions. Specifically, some directional tendency toward biased judgments (claiming the ownership for positive traits and disowning negative ones) was assumed to be present in both the biasing motivation and the accuracy motivation condition, though it was expected to be more pronounced in the former versus the latter condition. Similarly, the same direction of bias (toward self enhancement) should be expected for the ambiguous and the unambiguous traits, even though the latter should be more amenable to bias [as Dunning et al. (1989) demonstrated]. The only expected differences between conditions were that in the biasing motivation condition the biasing tendency should have been enhanced in the match-unambiguous traits, whereas in the accuracy condition, the biasing tendency should have been enhanced in the mismatch-ambiguous traits. These subtle differences may be readily swamped in the four way interaction by the omnibus tendencies to perceive the positive versus negative traits as more characteristic of self, and by the two way interaction that shows that difference to be more pronounced for ambiguous versus unambiguous traits.
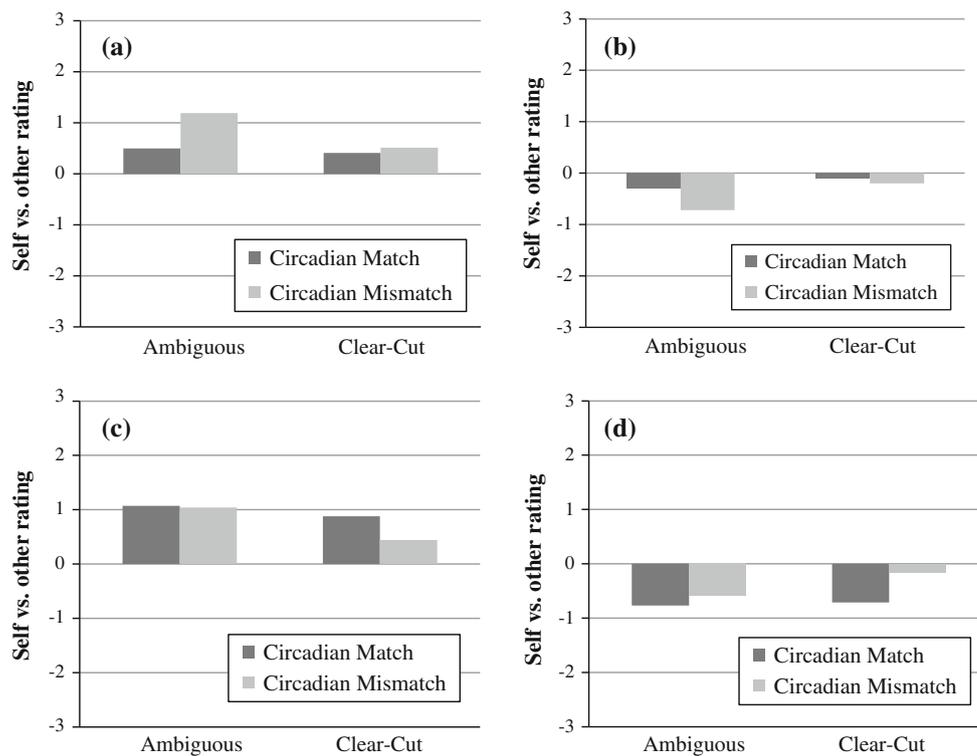
difficulty: ambiguous vs. clear-cut traits) × 2 (traits valence: positive vs. negative) mixed design ANOVA was conducted on participants' ratings of self versus others when under *accuracy motivation*. The three-way interaction yielded significant results $F (1, 69) = 15.71$, $p < .001$. Thus, we proceeded to examine our specific hypotheses by looking at the 2 two-way components of this interaction. Figure 3a, b display the results.

A 2 (cognitive resources: circadian match vs. mismatch) × 2 (biasing difficulty: ambiguous vs. clear-cut traits) mixed-design ANOVA was conducted on the *positive personality traits ratings*. Results revealed a main effect of stimulus ambiguity, which indicated that participants tended to rate themselves more highly on ambiguous traits ($M = .79$, $SD = .64$) than on clear-cut traits ($M = .45$, $SD = .62$), $F (1, 69) = 22.06$, $p < .001$, replicating Dunning et al. (1989) ambiguity effect. A main effect of cognitive resources was also significant showing that participants tended to rate themselves more highly on personality traits in the mismatch ($M = .85$, $SE = .08$) than in the match condition ($M = .45$, $SE = .07$), $F (1, 69) = 11.74$, $p = .001 = .14$. The two-way interaction was statistically significant, $F (1, 69) = 12.60$, $p = .001$. Simple effects revealed that when personality traits were clear-cut, personal ratings did not differ between the match ($M = .41$, $SD = .66$) and mismatch conditions ($M = .51$, $SD = .57$), $t (69) = -.71$, $p = .47$. However, as expected, when personality traits were ambiguous, participants in the mismatch ($M = 1.19$, $SD = .54$) condition rated themselves more highly on positive personality traits than in the match condition ($M = .50$, $SD = .55$), $t (69) = 5.19$, $p < .05$. Further analyses revealed that self-serving judgments were significantly more pronounced for participants in the mismatch condition rating themselves more highly on positive ambiguous traits than on positive clear-cut traits ($M = .51$, $SD = .57$), $t (29) = 6.30$, $p < .05$, and on positive clear-cut traits in the circadian match condition ($M = .41$, $SD = .66$), $t (69) = 5.26$, $p < .05$.

Accuracy motivation: Negative traits A 2 (cognitive resources: circadian match vs. mismatch) × 2 (biasing difficulty: ambiguous vs. clear-cut traits) repeated-measure ANOVA was further conducted on the *negative* personality traits ratings by participants under the *accuracy motivation*. Results indicated a main effect of trait ambiguity, with participants rating themselves less highly on negative ambiguous traits ($M = -.48$, $SD = .68$) than on negative clear-cut traits ($M = -.13$, $SD = .66$), $F (1, 69) = 17.91$, $p < .001$. A main effect of cognitive resources was also significant, showing that ratings were less positive in the mismatch ($M = -.46$, $SE = .10$) than in the match ($M = -.19$, $SE = .08$) condition, $F (1, 69) = 3.99$, $p < .05$. The two-way interaction was marginally significant, $F (1, 69) = 3.36$, $p = .07$. Simple effects revealed

Fig. 3 a Self versus other rating of positive personality traits under accuracy motivation as a function of cognitive resources and trait ambiguity. **b** Self versus other rating of negative personality traits under accuracy motivation as a function of cognitive resources and trait ambiguity. **c** Self versus other rating of positive personality traits under directional motivation as a function of cognitive resources and trait ambiguity. **d** Self versus other rating of negative personality traits under directional motivation as a function of cognitive resources and trait ambiguity

that when personality traits were clear-cut no rating difference were found between the match ($M = -.09$, $SD = .71$) and mismatch conditions ($M = -.20$, $SD = .60$), $t(69) = -.65$, $p = .51$. However, as expected, participants in the mismatch ($M = -.72$, $SD = .59$) condition rated themselves lower on negative ambiguous traits than did participants in the match condition ($M = -.30$, $SD = .68$), $t(69) = 2.72$, $p < .05$. Further analyses revealed that for negative traits, ratings on ambiguous characteristics by participants in the mismatch condition were also significantly higher than ratings on clear-cut traits given by participants in the mismatch condition ($M = -.20$, $SD = .60$), $t(29) = -4.07$, $p < .05$, and clear-cut ratings given by participants in the match condition ($M = -.09$, $SD = .71$), $t(69) = 3.94$, $p < .05$.

Biasing motivation: Positive traits A 2 (cognitive resources: circadian match vs. mismatch) × 2 (biasing difficulty: ambiguous vs. clear-cut traits) × 2 (traits valence: positive vs. negative) mixed design ANOVA was conducted on participants' ratings of self versus others under the *biasing motivation*. The three-way interaction yielded significant results $F(1, 63) = 9.81$, $p < .05$. Thus, we investigated this interaction by looking at the 2 two-way interactions composing it. Figure 3c, d display the results.

A 2 (cognitive resources: circadian match vs. mismatch) × 2 (biasing difficulty: ambiguous vs. clear-cut traits) mixed-design ANOVA was performed on the

positive personality traits ratings in the biasing motivation condition. Results yielded a main effect of stimulus ambiguity with ambiguous traits ($M = 1.06$, $SD = .49$) being rated more positively than clear-cut traits ($M = .66$, $SD = .60$), $F(1, 63) = 25.13$, $p < .001$. The main effect of cognitive resources was also significant with ratings in the match condition ($M = .98$, $SE = .07$) being more positive than ratings in the mismatch condition ($M = .74$, $SE = .07$), $F(1, 63) = 5.05$, $p = .02$. The two-way interaction was also statistically significant, $F(1, 63) = 6.57$, $p < .05$. Simple effects revealed that when positive personality traits were *clear-cut* participants gave higher ratings in the match ($M = .88$, $SD = .60$) than in the mismatch condition ($M = .44$, $SD = .51$), $t(63) = 3.15$, $p < .05$. In line with our predictions, *ambiguous* positive personality traits were not rated differently in the match ($M = 1.07$, $SD = .52$) than in the mismatch condition ($M = 1.04$, $SD = .47$), $t(63) = .26$, $p = .78$. Further analyses revealed that self-ratings on positive clear-cut traits by participants in the mismatch condition ($M = .44$, $SD = .51$) were also significantly lower than self-ratings given on positive ambiguous traits given by participants in the match condition, $t(63) = -4.92$, $p < .05$, and ambiguous ratings in mismatch condition, $t(31) = -5.86$, $p < .05$.

Biasing motivation: Negative traits A 2 (cognitive resources: circadian match vs. mismatch) × 2 (biasing difficulty: ambiguous vs. clear-cut traits) mixed-design

ANOVA was conducted on the negative personality traits ratings given by participants under the biasing motivation. Results indicated a main effect of biasing ease, with ambiguous traits ($M = -.68$, $SD = .69$) being rated more negatively than clear-cut traits ($M = -.42$, $SD = .76$), $F (1, 63) = 7.15$, $p = .01$. A main effect of cognitive resources was also significant, showing that ratings were more negative in the match ($M = -.74$, $SE = .10$) than in the mismatch ($M = -.36$, $SE = .10$) condition, $F (1, 63) = 7.04$, $p < .05$. The two-way interaction was statistically significant, $F (1, 63) = 4.24$, $p = .04$. Simple effects revealed that when personality traits were clear-cut, participants in the match condition ($M = -.71$, $SD = .74$) gave lower ratings than those in the mismatch condition ($M = -.12$, $SD = .66$), $t (63) = 3.33$, $p < .05$. However, as expected, no ratings differences were found on the negative ambiguous traits as between the match ($M = -.77$, $SD = .59$) and the mismatch conditions ($M = -.59$, $SD = .79$), $t (63) = 1.03$, $p = .30$. Further analyses revealed that ratings on clear negative traits by participants in the mismatch condition ($M = -.12$, $SD = .66$) were also significantly higher than ratings given on negative ambiguous traits given by participants in the match condition ($M = -.77$, $SD = .59$), $t (63) = 4.13$, $p < .05$, and ambiguous ratings in the mismatch condition ($M = -.59$, $SD = .79$), $t (31) = 3.69$, $p < .05$.

Self-serving biases Self-rating means of every experimental condition were analyzed to assess whether they were significantly different from zero, which in this cases indicates an "I'm average" response. Results indicated that all cells means were different from zero, showing that people stated that they are anything but average. Only two cells did not conform to this effect: As predicted, under accuracy motivation, participants' self-ratings in the match condition did not succumb to the "more than average effect" when assessing negative clear-cut traits, $t (40) = .83$, $p = .40$. Similarly, participants under biasing motivation in the mismatch condition did not manifest self-serving biases when rating negative clear-cut traits, $t (31) = 1.10$, $p = .27$. However, contrary to our hypotheses, participants under both accuracy motivation and biasing motivation rendered self-serving judgments when rating positive clear-cut personality traits. Possibly, because of generally positive self-perceptions on part of our participants the ease of identifying with such traits was too considerable to be affected by our manipulation of cognitive resources.

Discussion

Results of Study 3 lend support to our hypotheses. We find that under accuracy motivation, avoidance of self-serving biases is impaired when processing resources are limited

and biasing happens easily, as motivationally desired judgments readily suggest themselves. This suggests that the absence of cognitive resources increases one's penchant to succumb to a stimulus bias even though one is basically motivated to attain accuracy. In contrast, where processing resources are plentiful, the magnitude of self-serving biases diminishes, even when the stimuli are ambiguous, hence easy to interpret in a motivationally desirable direction. These results suggest that under accuracy motivation cognitive resources may be utilized towards reducing the magnitude of motivated biases by overriding the self-serving conclusions that readily come to mind.

Equally informative are our findings in the biasing motivation condition. Our results demonstrate that the magnitude of self-serving biases under biasing motivation is reduced when cognitive resources are limited and the informational stimuli are unambiguous, and hence are resistant to bias. This echoes the importance of "reality constraints" in judgments, discussed by social cognition theorists (e.g., Kunda 1990; Tesser 1976). Ostensibly, when "reality constraints" are substantial, the lack of sufficient cognitive resources impedes the "spinning" of the information in a desirable direction. Of special interest, replicating our previous results, the "reality constraints" aren't *absolute* and can be overcome given sufficient cognitive resources: Granting such resources, individuals with biasing motivation seem quite able to reach motivationally pleasing judgments despite unambiguous informational stimuli.

Finally, the present results identify conditions under which the presence of cognitive resources matters less as far as the formation of wishful judgments is concerned: They matter less when individuals are under high accuracy motivation and the biasing difficulty is high (under low stimulus ambiguity condition), or when individuals are under biasing motivation and the biasing difficulty is low (under high stimulus ambiguity condition).

General discussion

The three studies described above provide consistent support for the hypothesized role of cognitive resources in motivated biases. In Study 1, individuals endowed with relatively ample cognitive resources exhibited significantly greater motivated bias in their perceptual judgments than their counterparts who possessed fewer resources. Study 2 conceptually replicated these findings in the realm of emotion (i.e., guilt) and emotionally-driven behaviors. Lastly, Study 3 further extended our analysis to the goal of *accuracy* and showed that where the rendition of unbiased judgments is difficult to accomplish this process is

facilitated by the availability of cognitive resources. In the same judgmental domain, where a *biasing goal* was activated and biasing was difficult to carry out ("reality constraints" were high), biasing occurred in the presence of cognitive resources, but not in their absence.

Collectively, this research supports a three-factor model of human judgments suggested by Cognitive Energetics Theory (Kruglanski et al. 2012). According to this model, judgment formation is carried out in the service of various motivations. From this perspective, judgments are *means* to specific *ends*. Whether the means are adequate and the intended ends are reached, however, depends on the conjunctive effect of *dominant motivation*, *biasing difficulty,* and the *availability of resources*. Where the dominant motivation favors a specific conclusion and biasing the judgmental process toward that conclusion is easy, the desired conclusion will be reached relatively independently of resources. In contrast, where biasing is difficult to carry out, resources are critical and the desired conclusion will occur only in their presence (Studies 1 and 2). Intriguingly, the role of cognitive resources *reverses* where the dominant motivation is for accuracy (Study 3). Here, where biasing is difficult to accomplish (that is, where unbiased judgments are the easy default) unbiased judgments occur independently of resources. But where biased responses are the default, and hence are difficult to override, unbiased judgments occur only in the presence of adequate resources.

It thus seems that cognitive resources (1) are impactful only when needed, that is where attainment of one's cognitive objective is difficult to accomplish, (2) are utilized in the service of whatever motivation is currently dominant. Ultimately then, cognitive resources do not have a "mind of their own," and their impact is contingent upon and constrained by the dominant motivation and task difficulty. That is likely why prior research has obtained evidence both that the presence of resources can *reduce* bias (Klauer et al. 2010) and that, to the contrary, it can promote or augment bias (e.g. Moreno and Bodenhausen 1999; Yzerbyt et al. 1999). Thus, our findings are consistent with Petty and Cacioppo's (1986) notion that "central route" processing that requires considerable, resource-intensive, elaboration can, nonetheless, be systematically biased. Finally, the present research demonstrates that under some conditions, mental resources have little consequence for bias, namely where the cognitive task as defined by the dominant motivation (whether geared toward accuracy or bias) is easy to carry out and for that reason is relatively independent of resources.

The presently suggested interplay of motivation and cognitive resources suggests that under some conditions either of these may not suffice to reach a motivationally congruent judgment, especially if the available information was hard to spin in a desired way, defining task difficulty. According to motivation intensity theory (e.g., Brehm and Self 1989; Wright 2008), such a scenario involving insufficient importance of reaching a desirable judgment (motivation) or insufficient resources would promote task disengagement and explain why some individuals would not reach congruent judgments compared to those that possessed the resources and/or were facing information that made it easy to achieve one's cognitive goal (accuracy or bias).

Our CET framework (Kruglanski et al. 2012) suggests that individuals with low resources may exert compensatory effort to achieve similar judgments to those with ample cognitive resources. Such effort could be mobilized via increased level of goal importance (Brehm and Self 1989; Wright 2008). Indeed, a small body of research suggests that depletion effects can be overcomed and that this might be obtained by increasing the subjective importance of the task at hand (Muraven and Slessareva 2003; DeWall et al. 2010). Effects of such intervention on motivated reasoning have yet to be examined.

Further research directions

The present studies advance our understanding of motivated biases and the conditions for their occurrence. Admittedly, however, they stop short of delineating the *specific mechanisms* whereby motivationally biased or unbiased judgments are rendered. Useful lists of such mechanisms including suppression, transcendence, denial, bolstering and counter-arguing, have been provided by several authors (cf. Abelson et al. 1968; Krizan and Windschitl 2007; Kunda 1990). The question for the next generation of research could, therefore, concern the specific conditions under which each of the different mechanisms would be operative, and the factors which determine their modes of utilization. One approach to this problem, implied by the present analysis, might be to consider the various possible mechanisms as *means* to currently active goals, and frame the issue in terms of general conditions for means choice (Kruglanski et al. 2002). For instance, a given mechanism could be utilized (1) to the extent that it is highly accessible to individuals, (2) to the extent that it is perceived as effective or equal to the task, and/or (3) to the extent that it is serving other goals as well, thus being "multifinal" (Kruglanski et al. 2013). Such investigation could build on the present findings and refine them toward a comprehensive view of wishful judgments that so pervasively affect how we think, decide and form many of our attitudes and opinions.

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