Research Article

Visceral Drives in Retrospect

Explanations About the Inaccessible Past

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ABSTRACT—*The present research demonstrates that the extent to which people appreciate the influence past visceral states have had on behavior (e.g., the influence hunger has had on food choice) depends largely on their current visceral state. Specifically, we found that when people were in a hot state (e.g., fatigued), they attributed behavior primarily to visceral influences, whereas when people were in a cold state (e.g., nonfatigued), they underestimated the influence of visceral drives and instead attributed behavior primarily to other, nonvisceral factors. This hot-cold empathy gap was observed when people made attributions about the past behavior of another person or themselves, and proved difficult to overcome, as participants could not correct for the biasing influence of their current visceral state when instructed to do so. These different attribution patterns also had consequences for people's satisfaction with their performance. Those who attributed their poor performance to visceral factors were more satisfied than those who made dispositional attributions.*

The human body has a well-developed system that provides information about the body's well-being and directs behavior toward satisfying bodily needs. For example, people experience hunger when they require nourishment, thirst when they are dehydrated, and fatigue when they are sleep deprived. These visceral drives are a feature of daily experience and exert a substantial influence on behavior. This influence is acknowledged, for example, in the familiar wisdom that one should not buy groceries on an empty stomach.

Yet despite their familiarity with visceral drives, people tend to underestimate the influence of these drives on behavior. Much anecdotal evidence reflects this point. People engage in unplanned, risky sexual decisions when caught in "the heat of the moment"; women in labor are known to request anesthesia, though they had previously planned on having a natural birth; and cigarette smokers who insist they can quit smoking any time often later find that they have significantly underestimated the discomfort of nicotine cravings.

Empirical studies in a number of domains confirm the tendency to underestimate the effect of visceral drives. Nisbett and Kanouse (1969) asked grocery shoppers to indicate when they last ate and to predict how much food they intended to purchase. Results showed that hungry shoppers (i.e., those who had not eaten for some time) were more likely than nonhungry shoppers to purchase more food than they had anticipated. Read and Van Leeuwen (1998) found that people who were hungry predicted future food choices more accurately than people who were satiated. In another study, people were asked how they would feel if they were lost in the forest without food or water (Van Boven & Loewenstein, 2003). They reported their reactions immediately before or after vigorous exercise. Those who had yet to exercise reported that they would wish they had brought additional food, whereas those who had exercised, and thus were presumably dehydrated, reported that they would wish they had brought additional water.

In a study designed to test the impact of sexual drive, men were shown pornography and then were asked to estimate the likelihood that they would engage in sexually aggressive behavior (Loewenstein, Nagin, & Paternoster, 1997). Results were in line with those of the previous studies: Men who were sexually aroused predicted that they would be more likely to engage in sexually aggressive behavior than did men who were not aroused.

In each of these studies, people exhibited what Loewenstein (1996) termed a "cold-to-hot empathy gap." People in a cold state (i.e., not hungry, not thirsty, or not sexually aroused) underestimate the influence of a future hot state (i.e., feeling hungry, thirsty, or sexually aroused). Loewenstein argued that this underestimation of future visceral drives is due to constrained memory for visceral experiences. That is, though people can recall the circumstances that led to a visceral drive (e.g., "I was hungry because I didn't eat all day") and can recall the relative strength of a visceral drive (e.g., "that was the most

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hungry I have ever been"), they cannot freely bring forth the sensation of that drive itself.[1]

To date, the cold-to-hot empathy gap has been studied exclusively in the context of predicting future behavior, and it remains to be seen whether this effect extends to people's interpretation of the past. This inattention to past behavior is surprising for a number of reasons. Examining this effect in the context of past behavior would provide a more rigorous test of the notion that the hot-cold empathy gap is due to the inability to freely recall visceral states. When people predict future behavior, they have not yet experienced the event; in contrast, when they make attributions about the influence of a past visceral drive, they have actually experienced the event, and thus make their attributions with the benefit of a concrete memory of the event and a clear retrieval cue (in the form of the behavior that accompanied the visceral drive).

Moreover, whereas the cold-to-hot empathy gap leads to inaccurate predictions in the context of future behavior, it would lead to inaccurate attributions in the context of past behavior. The attributions people make about past behavior are crucial to how they evaluate those past actions and are instrumental in shaping subsequent behavior (Buchanan & Seligman, 1995). Thus, a hot-cold empathy gap for past behavior could offer considerable insight into how people come to explain the wide range of behaviors and decisions they make under visceral influence.

Consider, for example, the circumstance of a dieter who, hungry from restricted portion sizes and low-fat meals, impulsively seeks out two of his favorite candy bars and eats them in quick succession. How might the now-satiated dieter come to understand his actions? Does he conclude that his cravings are difficult to resist (particularly when candy bars are in reach) and realize that he will be more successful in the future if he tries to prevent his cravings (e.g., by increasing the number of meals per day and making chocolate less accessible)? Or does he instead conclude that he failed because he lacks the willpower to maintain a successful diet?

This example is at the heart of the present research question: How does one's current visceral state affect the attributions one makes about the consequences of past visceral states? We predicted that when people are in a hot state (e.g., hungry), they will attribute behavior primarily to visceral influences, whereas when people are in a cold state (e.g., satiated), they will underestimate the influence of visceral drives and instead attribute behavior primarily to other, nonvisceral factors.

We investigated these predictions in three studies. In the first two studies, the same basic paradigm was used. Participants completed a fatiguing memory task. Then, after reading a vignette about a student who attributes his poor academic performance to fatigue, they indicated what factors they felt contributed to the student's poor performance. In Study 3, participants estimated the influence of a past hot state on their own behavior.

[1]This is one important way in which visceral drives differ from moods. Simply recalling a sad event can reproduce the feeling of sadness, whereas the sensory experience of visceral drives cannot be freely recalled.

STUDY 1

Method

Participants in Study 1 were 78 undergraduates at the University of Amsterdam, The Netherlands. They were assigned to three between-subjects conditions: nonfatigue, moderate fatigue, and severe fatigue. To induce fatigue, we asked participants to complete a strenuous memory task that lasted for 10 min in the moderate-fatigue condition and 20 min in the severe-fatigue condition (participants in the nonfatigue condition did not perform the memory task). In this task, participants were asked to memorize nine-digit number strings. Each number string appeared for 11 s, after which participants were asked to "hold the numbers in your head" for 7 s before finally being asked to type the number string to the best of their ability. In the moderate-fatigue condition, participants completed 20 memory trials, and in the severe-fatigue condition, they completed 40 memory trials.

Afterward, participants read a vignette about a student who studied for a test for less time than he had anticipated. (He intended to study for 12 hr, but after 8 hr of studying he stopped.) He later attributes his behavior to fatigue, but his parents offer other explanations (e.g., lack of motivation). Participants were then asked to decide for themselves the extent to which fatigue and three dispositional factors (discipline, motivation, and willpower) influenced the student's performance. For each of these four factors, responses were made on a 7-point scale from 1, *not at all influential*, to 7, *extremely influential*.

Results and Discussion

The three dispositional attributions were combined into one scale (Cronbach's $\alpha = .84$). Participants' attributions followed the expected linear trend. Fatigue was rated most influential in the severe-fatigue condition ($M = 5.54$, $SD = 1.20$), less influential in the moderate-fatigue condition ($M = 4.82$, $SD = 1.33$), and least influential in the nonfatigue condition ($M = 4.00$, $SD = 1.06$), $F(2, 77) = 10.02$, $p_{rep} = .98$, $\eta^2 = .21$ (see Fig. 1). It is interesting to note that this effect remained significant when only the severe-fatigue and the moderate-fatigue conditions were compared, $F(1, 53) = 4.62$, $p_{rep} = .87$, $\eta^2 = .07$. This finding suggests that the influence of current visceral state on perceptions of another person's past behavior is sensitive to the extremity of the current visceral state.

We next tested our prediction that compared with fatigued participants, nonfatigued participants would to a greater extent explain the student's poor performance as due to dispositional influences. Results supported the prediction: Nonfatigued participants gave higher ratings to dispositional influences ($M = 4.78$, $SD = 1.03$) than did moderately fatigued participants ($M = 4.44$, $SD = 1.12$) and severely fatigued participants ($M = 3.56$, $SD = 1.58$), $F(2, 77) = 6.30$, $p_{rep} = .98$, $\eta^2 = .14$.

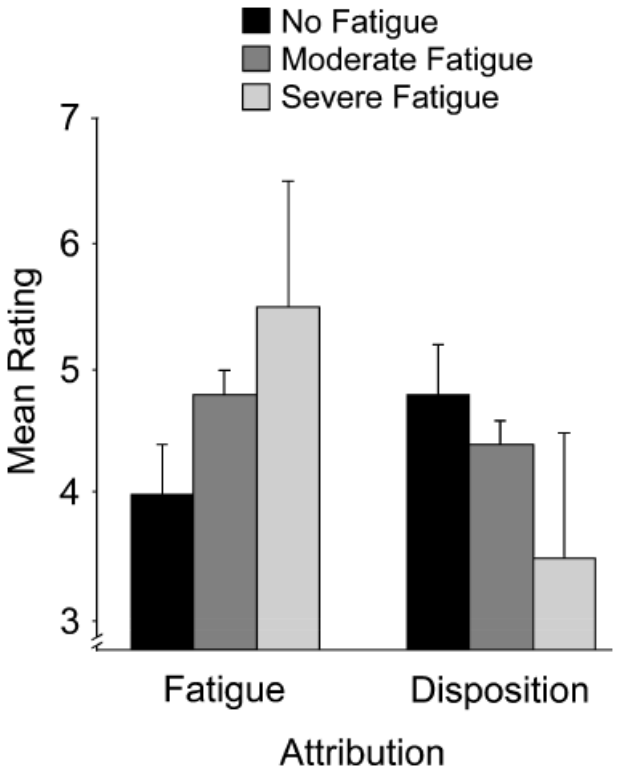

Fig. 1. Results from Experiment 1: mean rating of the influence of fatigue and dispositional factors by condition (no fatigue, moderate fatigue, or severe fatigue).

As with the ratings of fatigue, this effect remained significant when we compared only the severe-fatigue and the moderate-fatigue conditions, $F(1, 53) = 5.72$, $p_{rep} = .93$, $\eta^2 = .09$, confirming the role of extremity of the current visceral state.

Taken together, these findings suggest that the extent to which people appreciate the influence of past visceral states depends largely on their current visceral state. One potential criticism of this interpretation is that the results can also be interpreted as an accessibility effect; that is, in the two fatigue conditions, the concept of fatigue was made salient, and this salience may have increased the likelihood of attributing the behavior to fatigue. However, this explanation cannot account for the differences between the severe-fatigue and moderate-fatigue conditions. If the accessibility of the concept of fatigue, rather than the sensation of fatigue itself, drove the effects obtained, then no differences should have been observed between participants in the moderate- and severe-fatigue conditions (the concept of fatigue was accessible in both conditions).

STUDY 2

In Study 1, participants exhibited a hot-cold empathy gap. In Study 2, we tested the strength of this gap. We examined whether people could in fact become more empathic of another person's visceral state if they were instructed to do so. To do this, we replicated Study 1 but this time made the link between the memory task and the vignette explicit and encouraged participants to make judgments as if they were in a different visceral state. Thus, people in a cold state were asked to rate the vignette as if they were in a hot state, and vice versa.

Although past research has shown that people can often adjust their attributions when motivated to do so (Regan & Totten, 1975; Schwarz, 2001), this adjustment generally requires that people become aware of the relevant situational influences (Gilbert & Malone, 1995). For example, if people realize that their judgments are being affected by the bad weather, they can correct for this influence (Schwarz & Clore, 1983). Visceral drives have two features that might make their past influence difficult to appreciate. As noted earlier, people have little to no ability to recall visceral sensations, and these sensations are extremely transient: Considerable pain, hunger, or thirst can be relieved entirely within a few moments. With this in mind, we predicted that motivating participants to empathize with another person's past visceral state would not change the attribution pattern observed in Study 1.

Method

The participants in Study 2 were 148 undergraduates at the University of Amsterdam. This study followed the same basic paradigm of Study 1. Participants were assigned to four conditions: nonfatigue, fatigue, nonfatigue-empathic, and fatigue-empathic. The first two conditions were identical to the nonfatigue and severe-fatigue conditions in Study 1. In the latter two conditions, participants were asked to make attributions as if they were in a different visceral state. In the nonfatigue-empathic condition, participants were reminded that the student in the vignette had attributed his performance to fatigue and were asked to make attributions about the student's performance as if they were themselves fatigued. In the fatigue-empathic condition, participants were reminded that they had just completed a fatiguing memory task and were asked to not allow their own fatigue to affect their attribution ratings.

Results and Discussion

We examined the effects of fatigue state (fatigue, no fatigue) and attribution perspective (empathy, nonempathy) on the attribution ratings. There was a main effect of fatigue state on participants' fatigue attributions, $F(1, 147) = 29.02$, $p_{rep} < .001$, $\eta^2 = .16$, and dispositional attributions, $F(1, 147) = 38.43$, $p_{rep} = .98$, $\eta^2 = .21$, replicating the findings from Study 1. As predicted, there was no main effect of attribution perspective, and the interaction between fatigue state and attribution perspective was not significant (Fs < 1). Even when instructed to take the biasing influence of their current visceral state into account, fatigued participants continued to attribute the student's performance to fatigue ($M = 5.08$, $SD = 1.32$) more than nonfatigued participants did ($M = 4.05$, $SD = 1.28$), $F(1, 72) = 11.29$, $p_{rep} = .98$, $\eta^2 = .13$.

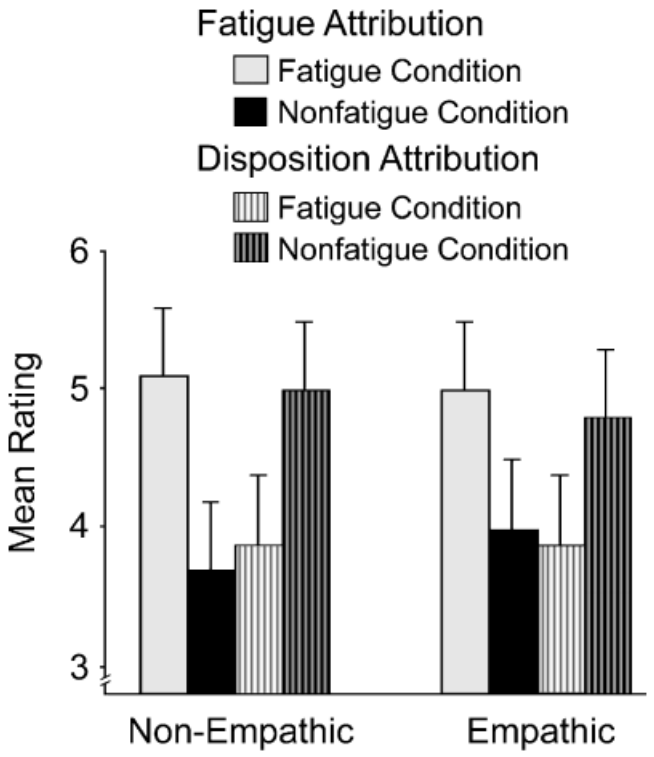

Fig. 2. Results from Experiment 2: mean rating of the influence of fatigue and dispositional factors by visceral state (fatigued or nonfatigued) and attribution perspective (empathy or nonempathy).

Likewise, nonfatigued participants continued to attribute the student's performance to dispositional factors ($M = 4.83$, $SD = 0.81$) more than fatigued participants did ($M = 3.88$, $SD = 1.27$), $F(1, 72) = 15.23$, $p_{rep} = .98$, $\eta^2 = .18$ (see Fig. 2).

These results reveal that hot-cold empathy gaps are strong: Participants could not correct for the biasing influence of their current visceral state even when instructed to do so. These findings have applied significance, as they suggest that efforts designed to help people overcome empathy gaps are likely to be unsuccessful. For example, warning a colleague who is tempted to engage in risky sexual behavior (say, by starting a relationship with a coworker) that she will regret it in the morning will have very little impact on her judgment.

In addition, these findings further rule out the possibility that accessibility or demand effects drive the hot-cold empathy gap. In this study, nonfatigued participants who were asked to make attributions as if they were fatigued still differed from fatigued participants in their attribution ratings, even though the potential influence of fatigue was made highly salient by the instructions they were given.

STUDY 3

The first two studies investigated how people perceive the influence of a past visceral state on another person's behavior. In Study 3, we examined how people perceive the influence of a past visceral state on their own behavior. As noted earlier, examining the hot-cold empathy gap in the context of people's own past behavior provides a more rigorous test of this effect, as participants make attributions about an event they have actually experienced, and thus make their attributions with the benefit of a concrete memory of the event and a clear retrieval cue. On the basis of the previous studies, we expected participants would attribute their own past behavior primarily to visceral drives when they were in a hot state, but primarily to other, nonvisceral factors when they were in a cold state.

This study also examined the consequences of these differential attribution ratings. The way people make attributions has enormous consequences for their well-being (Peterson, Seligman, & Vaillant, 1988), and making dispositional attributions for negative outcomes can have numerous psychologically and physically negative consequences (Buchanan & Seligman, 1995). With this in mind, we examined whether participants who attributed their poor performance to dispositional factors would report less satisfaction with their performance than participants who attributed their poor performance to visceral factors.

Method

Fifty-nine University of Amsterdam undergraduates completed the study individually. The study was divided into two parts. In the first part, participants performed a challenging memory test: On each trial, they had 10 s to memorize a 12-digit number string. The test took approximately 4 min to complete. Forty of the participants performed the memory test under mildly painful conditions, keeping their nondominant arm in a bucket of ice water ($\approx 5\,^{\circ}C$). This procedure is known as the cold-pressor task and is the most common and well-validated way of inducing pain in the laboratory (Kelly & Cooper, 1998). Participants in a control condition ($n = 19$) completed the memory test pain free, keeping their nondominant arm in room-temperature water. This condition enabled us to assess the objective effect of pain on performance on the memory test.

Participants in the control condition were not included in the remainder of the study. Thus, the second part of the study included only the 40 participants who performed the cold-pressor task. After completing the memory test, these participants dried and warmed their hands with a towel before completing a 10-min filler task. Then, they received false feedback indicating that they had performed poorly on the memory test (recalling only 30% of the digits correctly). Participants were then asked to indicate the extent to which the ice water and several dispositional factors had influenced their performance on the memory test and to indicate how satisfied they were with their performance on the test. Crucially, half of the participants ($n = 20$) made their attributions under mild pain (i.e., they put their arm back in the ice water), whereas the other participants ($n = 20$) made their attributions under no pain (i.e., they put their arm in room-temperature water).

The design of this experiment thus consisted of three conditions: a control condition in which participants completed only

the memory test and did so pain free; a pain attribution condition in which participants both completed the memory test and made their attributions about their performance while they were in pain; and a pain-free attribution condition in which participants performed the memory test while in pain but later made attributions about their performance while they were pain free.

Results and Discussion

We first examined our assumption that the pain from the cold-pressor task would hinder performance on the memory test. Our measure of performance was the mean number of digits participants remembered in the correct order. As predicted, participants who performed the memory test under pain scored significantly lower ($M = 5.54$, $SD = 1.03$) than participants who performed the test pain free ($M = 6.40$, $SD = 1.34$), $F(1, 58) = 10.14$, $p_{rep} = .98$, $\eta^2 = .15$.

We next examined whether participants would acknowledge the influence the pain had on their performance. As predicted, participants who made their attributions under pain attributed their poor performance to the cold water ($M = 5.40$, $SD = 1.18$) to a greater extent than did participants who made their attributions pain free ($M = 4.42$, $SD = 1.22$), $F(1, 38) = 5.02$, $p_{rep} = .84$, $\eta^2 = .12$. Moreover, participants who made their attributions pain free attributed their performance to dispositional factors ($M = 4.53$, $SD = 0.94$) to a greater extent than did participants who made their attributions under pain ($M = 3.81$, $SD = 1.16$), $F(1, 39) = 4.69$, $p_{rep} = .87$, $\eta^2 = .11$ (see Fig. 3). These findings demonstrate that visceral empathy gaps can occur even when people make attributions about their own behavior, and that these gaps can develop very soon after the visceral drive is extinguished.

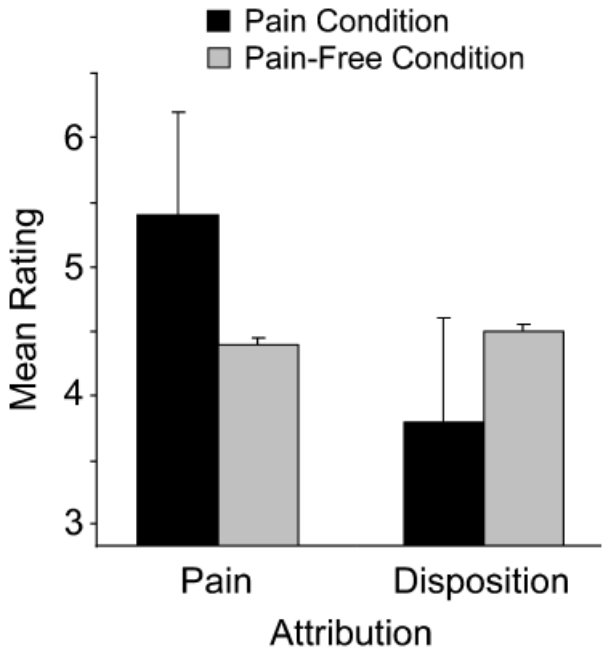

Fig. 3. Results from Experiment 3: mean rating of the influence of pain and dispositional factors by condition (pain or pain free).

Because participants received negative feedback on the test, those who attributed their performance to the pain can be viewed as "self-serving," whereas those who attributed their performance to dispositional factors can be viewed as "self-disserving." We next examined whether participants who attributed their performance to the cold water reported greater satisfaction with their performance than those who attributed their performance to dispositional factors. As predicted, the more participants attributed their performance on the memory test to the pain, the more satisfied they were with their performance, $r(40) = .39$, $p_{rep} = .95$. In addition, participants who made their attributions pain free (and thus explained their poor performance in terms of dispositional attributions) reported less satisfaction with their performance ($M = 3.05$, $SD = 1.01$) than participants who made their attributions under pain ($M = 3.75$, $SD = 1.14$), $F(1, 38) = 3.53$, $p_{rep} = .86$, $\eta^2 = .09$.

GENERAL DISCUSSION

Visceral drives impose an enormous influence on daily life. Yet as the present research demonstrates, people often have very little insight into the impact of past visceral drives. In fact, the extent to which people appreciate the influence of past visceral states depends largely on their current visceral state. We found that when people were in a hot state, they attributed behavior primarily to visceral influences, whereas when people were in a cold state, they underestimated the influence of visceral drives and instead attributed behavior primarily to other, nonvisceral factors.

This effect was sensitive to the extremity of the visceral state, such that people in a moderately hot state (i.e., moderate fatigue) had difficulty appreciating the past influence of a more severe hot state (i.e., severe fatigue). This extremity effect has implications for how people evaluate behavior that is carried out during extreme visceral states. Even when one is experiencing mild-to-moderate visceral sensations—a moderate amount of anger, for instance—it may be nearly impossible to fully appreciate the influence of a more extreme form of this state (in this case, full-blown rage). Given that most of the time people are not in strong visceral states, it seems likely that their estimates of the influence of past visceral states are very often inaccurate. These biased attribution patterns are of considerable consequence, as they can shape understanding of the past and affect people's sense of well-being. Consider, for example, that in Study 3, participants who attributed their poor performance to visceral factors were more satisfied than participants who made dispositional attributions.

Loewenstein (1996) argued that this hot-cold empathy gap is due to people's constrained memory for visceral experiences: Because the sensory experience of a visceral drive cannot be freely recalled, the influence a visceral drive might have exerted remains highly inaccessible. The present studies provide more direct evidence for this notion. We found that participants could not correct for the biasing influence of their current visceral

state when instructed to do so or when making attributions about their own past behavior. These results demonstrate that the hot-cold empathy gap is indeed difficult to overcome. In contrast, the bulk of research on the stability of misattribution effects shows a greater degree of lability. Regan and Totten (1975) found that asking people to identify with someone else's situation resulted in more empathic attributions for that person. Likewise, simply making people aware of the incidental effects of mood on their attributions is enough for them to correct for mood's biasing influence (Schwarz & Clore, 1983). One avenue for future research is to investigate what aspects of mood and visceral states account for these differences in the stability of attributions.

A limitation of this study is that, although it clearly demonstrates that people's current visceral state largely shapes the attributions they make about the past, the objective accuracy of these attributions remains unclear. Research has demonstrated that people in a hot state tend to be more accurate than people in a cold state in predicting the influence of future hot states. Although these findings might lend tentative support to the notion that people in a hot state also make more accurate attributions about the influence of past hot states, it could well be the case that people in a hot state in fact overestimate the influence of past hot states. This possibility would be more in line with research on the focusing illusion (Schkade & Kahneman, 1998), which has found that people tend to overweigh the salient affective features of an event.

Imagine again the example of the satiated dieter who tries to make sense of his candy-bar binge. The present research suggests that although only moments earlier he could think of nothing else but satisfying his craving, he is likely now to underestimate the influence hunger had on his behavior and instead to explain his binge in terms of other factors, such as his insufficient motivation or inadequate social support. The dieter's mistaken attributions not only will hinder his ability to learn the right lesson from the experience (i.e., that controlling hunger cravings is a key to dieting success), but also will darken his assessment of his weight-loss efforts and perhaps reduce his hope for weight loss in the future.

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