Research Article

Cognitive Dissonance and the Perception of Natural Environments

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ABSTRACT—***Two studies demonstrated that the motivation to resolve cognitive dissonance affects the visual perception of physical environments. In Study 1, subjects crossed a campus quadrangle wearing a costume reminiscent of Carmen Miranda. In Study 2, subjects pushed themselves up a hill while kneeling on a skateboard. Subjects performed either task under a high-choice, low-choice, or control condition. Subjects in the high-choice conditions, presumably to resolve dissonance, perceived the environment to be less aversive than did subjects in the low-choice and control conditions, seeing a shorter distance to travel (Study 1) and a shallower slope to climb (Study 2). These studies suggest that the impact of motivational states extends from social judgment down into perceptual processes.***

People commonly assume that they perceive the external world the way it really is. However, considerable research challenges this intuition. A walker does not move as fast as a perceiver may think (Jacobs & Shiffrar, 2005), and objects fail to be as big (Wesp, Cichello, Gracia, & Davis, 2004) or as tall (Yang, Dixon, & Proffitt, 1999) as they seem.

In recent years, research has increasingly demonstrated that an individual's internal states can influence his or her perception of the external world. Thirsty people find their attention drawn to thirst-quenching objects in the environment (Aarts, Dijksterhuis, & De Vries, 2001), and people see greater transparency (a property characteristic of water) in objects when they are thirsty than when they are not (Changizi & Hall, 2001). Spider phobics misperceive the direction of a moving spider, seeing the creature as approaching themselves rather than approaching others who are equally close to the spider (Riskind, Moore, & Bowley, 1995).

In two studies, we explored whether another internal state, cognitive dissonance, could influence the perception of natural environments. Cognitive dissonance theory assumes a drivelike motivation to maintain consistency among relevant thoughts and actions (Festinger, 1957). When attitudes and actions contradict one another, psychological discomfort results (Elliot & Devine, 1994), leading to a drivelike motivation to restore harmony by shifting beliefs to realign them with behavior. This motivation maintains a widespread influence, changing attitudes (Festinger & Carlsmith, 1959), likelihood estimates (Knox & Inkster, 1968), social judgments (Kernahan & Bettencourt, 2002), and perceptions of self (Sherman & Gorkin, 1980).

In the present research, we asked if the impact of cognitive dissonance could extend to visual perception. In two studies, subjects performed an aversive task. In Study 1, they walked across a campus quad while wearing a costume inspired by Carmen Miranda, the Brazilian singer, dancer, and actress of the 1940s and 1950s who was usually clad in a large fruit-basket headdress. In Study 2, subjects knelt on an all-terrain skateboard and pushed themselves up a grassy hill. In each study, we manipulated the degree to which subjects felt they had freely chosen to complete the task, a classic manipulation often used to vary the level of dissonance people feel about the circumstance in which they find themselves. Under high choice, people must resolve the dissonance caused by their voluntary agreement to perform an aversive action. Under low choice, this dissonance is easily resolved because subjects can attribute their agreement to their lack of choice (Linder, Cooper, & Jones, 1967).

This classic choice paradigm has been shown to produce dissonance, as defined by psychological discomfort and arousal (see Elliot & Devine, 1994, for a comprehensive review). In addition, this free-choice paradigm has long been found to produce downstream consequences associated with dissonance. These effects include changed likelihood estimates (Knox &

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Inkster, 1968), social judgments (Kernahan & Bettencourt, 2002), and attitudes (Greenbaum & Zemach, 1972), to name only a few. Thus, we predicted that subjects in high-choice conditions would resolve their dissonance by altering their perception of the environment to make the task seem less aversive. Specifically, we expected that high-choice subjects in Study 1 would see the distance they had to walk as shorter, and high-choice subjects in Study 2 would see the hill as less steep, compared with low-choice and control subjects.

Our tasks and perceptual measures were modeled after those used by Proffitt and his colleagues (e.g., Bhalla & Proffitt, 1999), who argued that visual perception serves to regulate physical behaviors. When people must expend more effort to complete some action, the perceptual system portrays the environment as more challenging so as to guide them toward what actions to take (or to avoid), as well as how to execute those actions successfully. Thus, distances to walk seem longer after one straps on a heavy backpack (Proffitt, Stefanucci, Banton, & Epstein, 2003), and hills appear steeper when one wears a backpack, is fatigued after a long run, is out of shape, or is not in good health (Bhalla & Proffitt, 1999). In the two studies reported here, we examined whether similar changes in the perception of natural environments would serve a different sort of regulation, one associated with dissonance reduction.

STUDY 1: PERCEPTIONS OF DISTANCE

Method

In exchange for course credit, subjects ($N = 44$) in Study 1 were taken outside to a highly trafficked, grassy quad at the center of campus and were randomly assigned to the high-choice, low-choice, and control conditions. In both choice conditions, the experimenter explained that emotional reactions are difficult to predict. As a result, subjects would report their reactions to a real emotion—in this case, their emotional reaction to an embarrassing experience. At this point, the experimenter handed subjects a bag containing a Carmen Miranda costume, including a grass skirt, coconut bra, hat adorned in plastic fruit, and flower lei. Subjects were told that they would put on the costume, walk the width of the quad alone, and return before answering questions about their emotions and their experience.

Subjects in the high-choice condition ($n = 22$) were told that they could perform other tasks in lieu of the emotion test (although no tasks were ever listed for subjects to choose from). However, the experimenter said that it would be preferable if subjects chose to perform the emotion test. The experimenter ended by asking if the subjects would choose to do the emotion task. After agreeing, subjects completed a waiver labeled "freedom of choice." They signed their name, indicating that they had freely chosen to perform the task.

Subjects assigned to the low-choice condition ($n = 12$) learned that other tasks were available, but that a supervisor had selected the emotion task for them. These subjects completed a similar waiver, this time labeled "experimenter choice." They signed their name to indicate that they had not chosen the task.

Subjects in the two choice conditions then walked across the width of the quad from one statue to another and back (365 ft, or 111.2 m, each way) and completed a survey asking them to estimate the one-way distance from one statue to the other. Before they provided a response, the experimenter showed them a ruler and explained that it showed the length of 1 ft (0.3 m). Subjects then wrote down a number that represented their estimate of the distance in feet between the statues. Additionally, subjects indicated on a 9-point Likert scale the degree to which they felt that they had chosen to perform the emotion task.

The subjects in the control condition ($n = 10$) were not informed about the task involving the Carmen Miranda costume or about alternatives to it. Instead, they accompanied the experimenter to the quad to complete the measurement estimate, ostensibly as a part of a survey of natural object perception. No cover story was needed to explain the survey.

Results and Discussion

Gender Differences

There was no effect of gender in any of the analyses in this study, $F < 1$; thus, we collapsed across this variable.

Perceptions of Choice

Subjects in the high-choice condition felt they had more choice ($M = 7.1$) than did those in the low-choice condition ($M = 5.5$), $t(32) = 2.09$, $p = .05$, $p_{rep} = .92$, $d = 0.75$.

Distance Estimates

Across the three conditions, subjects tended to underestimate the distance between the statues ($M = 142.0$ ft, or 43.3 m), one-sample $t(43) = -16.86$, $p < .001$, $p_{rep} = .99$, $d = 2.54$. More important, this underestimation was moderated by the choice manipulation, $F(2, 41) = 3.18$, $p = .05$, $\eta_p^2 = .13$ (see Table 1). We predicted that subjects in the high-choice condition would estimate a shorter distance than subjects in either the low-choice or the control condition. To test this specific prediction,

TABLE 1

Subjects' Estimates of Distance in Study 1 and Slope in Study 2

	Condition					
	Low-choice		Control		High-choice	
Estimate	*M*	*SD*	*M*	*SD*	*M*	*SD*
Study 1: distance (in feet)	182.5_a	90.3	161.5_{ab}	112.9	111.1_b	62.5
Study 2: slope (in degrees)	31.0_a	5.6	30.8_a	9.2	23.9_b	4.8

Note. Within a row, means with different subscripts differ significantly at $p <$ .05 or less. Cell *n*s ranged from 10 to 24.

we performed a linear contrast. Given that subjects in the low-choice and control conditions did not differ in their estimates, $t(20) < 1$, $d = 0.21$, we assigned weights of +1 to the estimates of these groups and −2 to the estimates made by the high-choice group. The contrast was significant, $t(41) = 2.15$, $p < .04$, $p_{rep} = .93$, $d = 0.67$, and in fact accounted for more than 91% of the total between-groups variance in subjects' estimates.[1]

Data from two supplemental studies bolster a dissonance-based interpretation of the results of Study 1 and rule out alternative explanations based on arousal. In one of these studies ($n = 10$), subjects who imagined performing the task in Study 1 stated that performing it strongly contradicted their natural or most likely choice, $M = 6.3$ on a 7-point Likert scale, one-sample $t(9) = 10.78$, $p < .001$, $p_{rep} > .99$, $d = 7.18$ (tested against the scale's midpoint of 4, *uncertain*). Such a contradiction is a precondition for dissonance effects.

The second supplemental study ($n = 47$) provides evidence against the notion that high-choice subjects felt more positive arousal than low-choice subjects, and that their higher arousal led them to see the environment as more benign. We replicated the initial steps in the design of Study 1, but also asked subjects how they felt before they walked the distance. Specifically, subjects rated the degree to which a number of adjectives described their current feelings. Subjects in the high- and low-choice conditions reported feeling more psychological discomfort (i.e., *uncomfortable*, *uneasy*, and *bothered*; *M*s = 3.9 and 4.3, respectively) than subjects in the control condition ($M = 2.4$), $F(2, 44) = 6.27$, $p = .004$, $p_{rep} = .99$, $\eta_p^2 = .44$. Such discomfort is a definitional component of dissonance (Elliot & Devine, 1994). The three groups failed to differ on the composite measure of positive arousal (i.e., *joyful*, *delighted*, *cheerful*, *excited*, *lively*, and *energetic*), $F(2, 44) = 1.24$, $p = .30$, $p_{rep} = .76$, $\eta_p^2 = .49$. Subjects in the high-choice condition did not feel more positive arousal than their low-choice counterparts (*M*s = 2.7 and 2.3, respectively), $t(32) = 1.47$, $p = .15$, $p_{rep} = .84$, $d = 0.52$. In sum, our manipulations appeared to increase the psychological discomfort associated with dissonance, but not to increase positive arousal.

In addition, data from Study 1 itself are inconsistent with the notion that it was physiological arousal, with its possible energizing effects, and not the psychological motivation to reduce dissonance that biased perception of the environment (Zanna & Cooper, 1974). If dissonance arousal in the high-choice condition enhanced energy, then high-choice subjects should have walked faster than subjects in the other conditions (Ozel, Larue, & Dosseville, 2004). Walking speed did vary across conditions, $F(2, 40) = 3.19$, $p = .05$, $p_{rep} = .92$, $\eta_p^2 = .14$, but high-choice subjects took more time ($M = 61.2$ s), not less, to walk than low-choice subjects did ($M = 55.0$ s), $t(31) = -2.34$, $p = .03$, $p_{rep} = .94$, $d = 0.94$. Subjects in the high-choice and control ($M = 60.0$ s) conditions took the same amount of time to complete the walk, $t(30) = -0.42$, $p = .68$, $p_{rep} = .60$, $d = 0.18$. Given these patterns of data, we argue that positive arousal is an unlikely source of the biased perceptual estimates.

In sum, Study 1 provided initial evidence that the motivation to reduce cognitive dissonance can lead subjects to see their environment in a less extreme way—to see distances as shorter than if they had not been experiencing dissonance.

STUDY 2: PERCEPTION OF SLOPE

Study 2 was designed to replicate the finding that motivation to resolve cognitive dissonance can influence perception of environments, in this case examining perceptions of a hill's slope. Study 2 also addressed alternative possible explanations of the effect obtained in Study 1. First, to eliminate concerns that the cover story used in Study 1 led subjects to attribute their feelings of discomfort to our supposed investigation of emotions, rather than to their choice to engage in an aversive activity, we designed Study 2 so that emotions were not mentioned; instead, the study was framed as focused on perceptions of nature. Second, to eliminate the concern that the findings in Study 1 were a result of biases in memory or feedback from proprioceptive cues subjects received while walking the length of the target distance, we asked subjects in Study 2 to estimate the slope of the hill while looking at it before they performed the task.

Finally, to eliminate concerns that our measurement of perception measured not perceptual processes per se, but rather the production of a label, statement, or explicit judgment to describe perceptual experience, we used measures that were more visual than in Study 1. Instead of asking subjects to write down a number representing how steep they perceived the hill to be, we asked them to directly indicate their perception of slope by drawing it, as well as by matching the incline using a movable arm on a protractor (two visual angle-matching tasks modeled after those used by Bhalla & Proffitt, 1999).

Method

In exchange for course credit, subjects ($N = 51$) individually accompanied an experimenter outside to the foot of a hill (47 ft, or 14.3 m, in length; 19° incline). They were randomly assigned

[1]Because of the sometimes inopportune nature of random assignment, the numbers of subjects in different conditions were unequal in Study 1. This inequality was neither intentional nor the by-product of varying attrition rates among conditions. However, in the end, some of our cells had low *n*s. Thus, the results could have been influenced unduly by outliers or skewed distributions. We are happy to report that our data are well behaved. No outliers were found, as all data points fell within 2.5 standard deviations of the mean. We also tested the normality of the distribution of our data. In Study 1, the skew statistic associated with the distance estimates was 1.04. The standard error of the skew was 0.37. Multiplying this value by 2 produced a value less than the skew statistic, suggesting relative asymmetry around the mean. The test statistic associated with kurtosis was 0.18, a value close to zero, indicating normality along that property. To investigate the impact of this level of skew on our results, we ran analyses based on the rank order of the distance estimates. These analyses led to the same statistical conclusions reported in the main text.

to the high-choice ($n = 12$), low-choice ($n = 15$), and control ($n = 24$) conditions.

Choice was manipulated in the same manner as in Study 1, although there was no mention of emotions. Instead, the study was framed as a test of physical strength and perceptions of nature. Specifically, the experimenter told subjects in the choice conditions that they would complete a test of strength, kneeling on an all-terrain skateboard and pushing themselves up the hill using their hands. The subjects completed a survey in which they estimated the incline of the hill in two ways, the order of which was counterbalanced. In the drawing measurement, subjects saw a 4-in. line labeled on one end with an "X." They drew a diagonal line emanating from the "X" to represent the slope of the hill. In the protractor measurement, subjects were handed a protractor with an attached arm. They moved the arm until the angle formed by the arm and the bottom of the protractor was equal to the slope of the hill. Additionally, subjects indicated on a 9-point Likert scale the degree to which they felt they had chosen the strength test. They then completed the test (or attempted it for 3 min if it was too difficult to complete) by pushing themselves up the hill while kneeling.[2] Although the dependent measures had already been obtained, we asked subjects to complete the test so as to avoid inducing suspicion in our subject pool.

As was the case in Study 1, a separate group of subjects ($n = 10$) who imagined performing this task stated that performing it would strongly contradict their natural or most likely choice, $M = 6.4$, one-sample $t(9) = 7.06$, $p < .001$, $p_{\text{rep}} > .99$, $d = 4.71$ (tested against the midpoint of the response scale). Such a contradiction is a precondition for dissonance effects.

Subjects in the control condition were not informed about the strength test. Instead, they accompanied the experimenter outside to the hill to complete the two measurement estimates, ostensibly as a survey of natural object perception. No cover story was needed to explain the survey.

Results and Discussion

Gender Differences

There was no effect of gender in any of the analyses in this study, $F\text{s} < 1$; thus, we collapsed across this variable.

Perceptions of Choice

The choice manipulation left subjects in the high-choice condition feeling that they had had more choice ($M = 4.8$) than the low-choice subjects ($M = 3.4$), $t(25) = 2.22$, $p = .04$, $p_{\text{rep}} = .93$, $d = 0.95$.

Slope Estimates

The drawing and protractor measurements were significantly correlated, $r(51) = 0.45$, $p = .001$, $p_{\text{rep}} = .99$. Thus, we averaged the two estimates to form a composite measure. Overall, subjects overestimated the steepness of the hill ($M = 29.2°$), one-sample $t(50) = 9.30$, $p < .001$, $p_{\text{rep}} = .99$, $d = 1.30$, a result replicating previous findings. However, choice moderated this overestimation, $F(2, 48) = 4.10$, $p = .02$, $\eta_p^2 = .15$ (see Table 1). We tested whether subjects in the high-choice condition estimated that the slope of the hill was less steep than subjects in either the low-choice or the control condition. Given that subjects in the low-choice and control conditions did not differ in their estimates, $t(37) = 0.04$, $p = .97$, $p_{\text{rep}} = .09$, $d = 0.06$, we assigned weights of $+1$ to estimates of those groups and -2 to estimates of subjects in the high-choice condition. The predicted contrast was significant, $t(48) = 3.06$, $p = .003$, $p_{\text{rep}} = .98$, $d = 0.88$, and accounted for more than 99% of the total between-groups variance in subjects' estimates.

In sum, Study 2 provided convergent evidence that the motivation to reduce dissonance can result in changed perceptions of the physical environment. Subjects in the high-choice condition estimated that the slope of the hill was shallower than did subjects in both the low-choice and control conditions. Moreover, in this study, we took steps to avoid the possibility that biased estimates were the result of an emotion-based cover story, memory, or increased proprioceptive feedback. In addition, the visual-matching dependent measures we used were more perceptual than the dependent measure in Study 1 and also bore less resemblance to a deliberate and effortful judgment or decision.[3]

GENERAL DISCUSSION

In these two studies, the motivation to resolve cognitive dissonance influenced perception of natural environments. Taken together, these studies demonstrate that motivational pressures, including higher-order, intrapsychic motivations like cognitive-dissonance reduction, can have an influence on perceptual processes. In doing so, this work adds to an emerging body of literature in cognitive and social psychology demonstrating that internal states influence perception. For example, Proffitt and his colleagues have shown that the need to allocate stores of effort and energy distorts perceptions of distance and slope (Proffitt et al., 2003; Witt, Proffitt, & Epstein, 2004). They have argued that one role of biased perception is to dissuade the organism from taking action that would be costly or effortful—thus providing an important aid in the effective regulation of physical behavior.

We propose that other psychological motivations, including the drive to reduce dissonance, prompt similar regulatory efforts that work through perception. In our studies, biased perception may have occurred to regulate away the aversive intrapsychic

[2]All but 1 subject in the high-choice condition performed the strength test.

[3]Although the distribution of participants across the three conditions in Study 2 was unequal, all data points fell within 2.5 standard deviations of the mean; the statistics for both kurtosis and skew were within the range expected of a normal distribution, and are thus not reported or adjusted for.

state of dissonance. When experiencing dissonance, perceivers may take advantage of an opportunity to "push" around perceptual experiences to return to a preferred baseline of cognitive consonance. Thus, our work expands upon previous research efforts to explore how other higher-order goals, beyond the efficient harnessing of effort and energy (Proffitt et al., 2003), may enlist perception in their cause.

CONCLUSION

In a sense, the studies reported here constitute a revisiting of new-look theorists' classic proposal that values and needs influence perception (e.g., Bruner & Goodman, 1947), a proposal that ultimately sank into a morass of theoretical and empirical controversies (e.g., Eriksen, 1958). Since the collapse of the new-look approach, such hypotheses have largely been avoided, but the time might be ripe to explore these hypotheses with theories and methods that are more nuanced and sophisticated than what was available 50 years ago. The present findings, combined with the recent observation that wishful thinking influences how people perceive ambiguous stimuli (Balcetis & Dunning, 2006), suggest that intrapsychic motives may, indeed, have a significant impact on what people perceive in the physical world around them.

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