



Action-Based Model of Dissonance: A Review of Behavioral, Anterior Cingulate, and Prefrontal Cortical Mechanisms

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Abstract

Research and theoretical developments on the theory of cognitive dissonance are reviewed. After this critical review, we present the action-based model of dissonance, which accepts the original theory's proposal that a sufficient cognitive inconsistency causes dissonance and extends the original theory by proposing *why* cognitive inconsistency prompts dissonance. Finally, we present results from behavioral and physiological experiments examining predictions derived from the action-based model. In particular, this evidence converges with recent neuroscience evidence in suggesting that the anterior cingulate cortex and left prefrontal cortical region are involved in conflict detection and resolution, respectively.

Cognitive dissonance theory, first proposed by Festinger (1957), has generated hundreds of experiments and is considered one of the most influential theories in psychology (Jones, 1985). The theory and its research have led to increased understanding of attitude and behavior change processes as well as understanding relationships between cognition, perception, emotion, and motivation.

Overview of the Theory of Cognitive Dissonance

The theory predicts that when an individual holds two or more elements of knowledge that are relevant to each other but inconsistent with one another, a state of discomfort is created. This unpleasant state is referred to as 'dissonance'. According to the theory, the degree of dissonance in relation to a cognition equals $D/D + C$, where D is the sum of cognitions dissonant with a particular cognition and C is the sum of cognitions consonant with that same particular cognition, with each cognition weighted for importance (see Sakai, 1999; Shultz & Lepper, 1999, for precise mathematical models).

The unpleasant state of dissonance is predicted to motivate individuals to engage in psychological work so as to reduce the inconsistency. To

reduce dissonance, individuals could add consonant cognitions, subtract dissonant cognitions, increase the importance of consonant cognitions, or decrease the importance of dissonant cognitions. Researchers have most often measured dissonance reduction with attitude change. Attitude change in response to a state of dissonance is expected to be in the direction of the cognition that is most resistant to change. In experimental tests of the theory, knowledge about recent behavior is usually assumed to be the cognition most resistant to change. If one has recently performed a behavior, it is usually difficult to convince oneself that the behavior did not occur. Thus, attitude change is often consistent with the behavioral commitment.

Experimental Paradigms Used to Test the Theory

Free choice

According to the theory, after a decision, all of the cognitions that favor the chosen alternative are consonant with the decision, whereas all the cognitions that favor the rejected alternative are dissonant. The greater the number and importance of dissonant cognitions and the lesser the number and importance of consonant cognitions, the greater the degree of dissonance experienced by the individual. In a decision situation, dissonance is typically greater the closer the alternatives are in attractiveness (as long as each alternative has several distinguishing characteristics). Dissonance caused by a decision can be reduced by viewing the chosen alternative as more attractive and/or viewing the rejected alternative as less attractive. Brehm (1956) conducted the first free choice experiment. In it, participants made either an easy or a difficult decision between two alternatives. The difficult decision was one in which the alternatives were close in attractiveness, whereas the easy decision was one in which one alternative was much more attractive than the other. Participants were asked to evaluate the decision options before and after the decision. After an easy decision, participants did not change their attitudes. In contrast, after a difficult decision, participants changed their attitudes to become more negative toward the rejected alternative (and slightly more positive toward the chosen alternative). This effect has been referred to as 'spreading of alternatives'.

Induced compliance

Dissonance should be aroused when a person acts in a way that is contrary to his or her attitudes. In the first test of this prediction, Festinger and Carlsmith (1959) had participants perform a boring task. Then, participants were paid either \$1 or \$20 to tell 'another participant' that the task was interesting. According to dissonance theory, lying for a payment of \$20 should not arouse much dissonance because \$20 provides sufficient justification for the counter-attitudinal behavior (i.e., it adds 20 cognitions

consonant with the behavior). However, being paid \$1 for performing the same behavior should arouse much dissonance because \$1 was just enough justification for the behavior (i.e., it adds only one consonant cognition). As expected, participants in the \$1 (low justification) condition changed their attitudes to be more positive toward the task, whereas participants in the \$20 (high justification) condition did not change their attitudes.

The above paradigms continue to be used fruitfully in research (e.g., Beauvois & Joule, 1996; Cooper, 2007; Harmon-Jones & Mills, 1999; Olson & Stone, 2005). Other experimental paradigms have been used to test the theory, but they are used less frequently and because of space limitations are not described here (Wicklund & Brehm, 1976).

Alternative Theoretical Explanations

After these and other dissonance results appeared, some theorists began to question whether the results were due to dissonance motivation. However, subsequent research confirmed that dissonance is a motivated process (for reviews, see Harmon-Jones, 2000a, b). During the state of dissonance, individuals evidence heightened electrodermal activity (which is associated with activation of the sympathetic nervous system; Elkin & Leippe, 1986; Harmon-Jones, Brehm, Greenberg, Simon, & Nelson, 1996) and report increased negative affect (e.g., Elliot & Devine, 1994; Harmon-Jones, 2000d; Zanna & Cooper, 1974). After discrepancy is reduced (attitude change occurs), self-reported negative affect is reduced (Elliot & Devine, 1994; Harmon-Jones, 2000d). Moreover, research using a misattribution paradigm reveals that discrepancy reduction is motivated by the need to reduce negative affect (Zanna & Cooper, 1974).

Beginning in the late 1960s, researchers began to propose motivational explanations for dissonance effects that differed from Festinger's originally proposed theory. They are reviewed below.

Self-consistency

In self-consistency theory, Aronson (1969, 1999) proposed that dissonance only occurs when a person acts in a way that violates his or her self-concept (i.e., when a person performs a behavior inconsistent with his or her sense of self). Because most persons have a positive self-concept, dissonance is experienced when a person behaves in an incompetent, irrational, or immoral way. One of the primary predictions derived from this revision is that low self-esteem individuals should respond with less dissonance reduction than high self-esteem individuals because dissonance experiments induce individuals to act in ways discrepant from a positive self-view. Experiments testing this prediction have produced mixed results. In addition, Beauvois and Joule (1996, 1999) obtained results that are difficult to explain with this revision. For instance, in a fascinating experiment,

Joule and Girandola (1995) found that dissonance can be greater when individuals behave in a 'moral' compared with 'immoral' manner (space limitations prevent description of this complicated experiment; see Beauvois & Joule, 1996, 1999).

Self-affirmation

Steele (1988) proposed a different alternative to Festinger's dissonance theory. He proposed that persons possess a motive to maintain an overall self-image of moral and adaptive adequacy. He stated that dissonance-induced attitude change occurs because dissonance threatens this positive self-image. Although Festinger's dissonance theory posited that individuals are motivated to reconcile inconsistent cognitions, Steele proposed that, instead, individuals are merely motivated to affirm the integrity of the self. In support of this idea, Steele presented experiments, where, following a dissonance induction, participants either were, or were not, presented with an opportunity to affirm an important value. When participants were allowed to affirm an important value, dissonance-related attitude change did not occur.

However, Simon, Greenberg, and Brehm (1995) presented evidence supporting an alternative explanation for Steele's findings that was in line with the original theory of dissonance. Festinger's original theory proposed that the degree of dissonance experienced depended upon the importance of the dissonant and consonant cognitions. Simon et al. hypothesized that making an important value salient could reduce dissonance by reducing the individual's perception of the importance of the dissonant act. They conducted an experiment in which dissonance was induced, and then participants were given an opportunity to affirm an important value (self-affirmation condition), were asked to write about a value that was not important to them personally but was of general importance (issue-salient condition, e.g., world hunger), or neither (control condition). Participants in the control condition changed their attitudes to be more favorable toward a tuition increase, as expected. Participants in both the self-affirmation and issue salient conditions did not change their attitudes. Writing about an important value caused participants to reduce the importance of the behavior and attitude to the point that attitude change did not occur. This occurred even when the values were not personally important and thus not self-affirming. Other evidence has been presented that is difficult to interpret in self-affirmation theory terms, such as evidence suggesting that self-affirmations relevant to the recent dissonant act increase rather than decrease dissonance-related attitude change (Aronson, Cohen, & Nail, 1999).

Self models of dissonance have difficulty explaining the dissonance effects produced in rats (Lawrence & Festinger, 1962), which are believed to lack self conceptions of morality, rationality, and competence. Recent

research has revealed that 4-year-old humans and capuchin monkeys, who lack the complex self-concepts described by self models of dissonance, show evidence of dissonance reduction (Egan, Santos, & Bloom 2007). Thus, self aspects moderate dissonance processes, but they are not necessary to cause dissonance (Harmon-Jones, 2000a, 2000c; Stone & Cooper, 2003). In other words, these self models do not provide explanations of the basic dissonance motivation.

Aversive consequences

Cooper and Fazio (1984) proposed that the discomfort experienced in dissonance experiments was not due to an inconsistency between the individual's cognitions, but rather to feeling personally responsible for producing an aversive consequence. In support of this idea, Cooper and Worchel (1970) replicated and extended Festinger and Carlsmith's (1959) classic experiment in which participants were given low or high justification to claim that a boring task is interesting. In addition to the conditions of the original experiment, Cooper and Worchel added a condition in which, when the participant tells the confederate that the boring task is interesting, the confederate is not convinced. Attitude change occurred only in the low-justification condition where the confederate believed the confederate. This result and others have been interpreted as indicating that dissonance-related attitude change only occurs when individuals feel personally responsible for producing an aversive consequence.

According to the original theory of cognitive dissonance, the production of aversive consequences would be expected to increase the amount of dissonance produced because an aversive consequence may be an important dissonant cognition or may cement the behavioral commitment even more strongly (see Harmon-Jones, 1999). However, the original theory would deny that an aversive consequence is *necessary* to produce dissonance. In the induced-compliance experiments testing the necessity of aversive consequences, there are a number of reasons why attitude change may have occurred *only* when participants caused aversive consequences. The null effect of lack of attitude change in the no-aversive-consequences conditions, like all null effects, is difficult to explain and subject to multiple alternatives. Attitude change may have been produced, but the small sample sizes in these experiments may have had insufficient power to detect the change. It is also possible that not enough dissonance was aroused in these experiments to produce attitude change without the additional important cognition of an aversive consequence. Finally, the dissonance in the no-aversive consequences conditions may have been reduced by a route other than attitude change.

To examine whether attitude change could occur in an induced compliance setting in which aversive consequences were not produced, we conducted several experiments (Harmon-Jones, 2000d; Harmon-Jones

et al., 1996). Under the guise of an experiment on memory, participants were exposed to an attitudinal object. Participants were assured of privacy and anonymity and then given high or low choice to write a counter-attitudinal statement about the object (to manipulate justification). They were asked to discard the statement in the trash after writing it, so that there was no chance of the statement causing an aversive consequence. This manipulation was based on Cooper and Fazio's (1984) statement, 'making a statement contrary to one's attitude while in solitude does not have the potential for bringing about an aversive event' (p. 232). In other words, the experiments were designed so that aversive consequences were clearly absent to show that cognitive dissonance processes could occur in such situations.

In one experiment (Harmon-Jones et al., 1996), participants were asked to read a boring passage. They were then given high or low choice to write that they found the boring passage interesting. Non-specific skin conductance responses (NS-SCRs) were assessed after the writing of the statement and before the assessment of the participants' attitudes toward the passage. Although no aversive consequences were produced, persons in the high-choice condition changed their attitudes to be more favorable toward the passage. In addition, participants in high-choice condition evidenced more sympathetic nervous system arousal than those in the low-choice condition. Another experiment gave participants who liked chocolate high or low choice to write a statement that they disliked the chocolate (Harmon-Jones, 2000d). Participants in the high-choice condition changed their attitudes to dislike the chocolate. In addition, self-reported negative affect was increased following dissonance-producing behavior and was reduced following the attitude change.

The results obtained in these experiments show that dissonance affect and dissonance-related attitude change can occur in situations in which a cognitive inconsistency is present but the production of aversive consequences is not present. These experiments also show that the experience of cognitive dissonance evokes an unpleasant state that motivates dissonance reduction. These experiments supported the original conception of dissonance theory over the revisions. But why does dissonance evoke this negative motivational state? Why does this state motivate attitude change?

Action-Based Model of Dissonance: Why Do Dissonance Processes Occur?

Festinger (1957) posited no answer to the question of why dissonance processes occur other than to state that inconsistency is motivating. Brehm and Cohen (1962) and Beauvois and Joule (1996, 1999) pointed out that a behavioral commitment is an important component of the dissonance process. However, these past theorists did not indicate why cognitions with implications for behavior motivate persons to engage in discrepancy reductions.

The action-based model of cognitive dissonance was proposed to answer the question 'Why?' (Harmon-Jones, 1999). The action-based model concurs with other areas of psychological research in proposing that perceptions and cognitions can serve as action tendencies. It further proposes that *dissonance between cognitions evokes an aversive state because it has the potential to interfere with effective and unconflicted action*. Dissonance reduction, by bringing cognitions into line with behavioral commitments, serves the function of facilitating the execution of effective and unconflicted action (see also, Jones & Gerard, 1967).

The action-based model proposes both a proximal and a distal motivation for the existence of dissonance processes. The proximal motive for reducing dissonance is to reduce or eliminate the negative emotion of dissonance. The distal motivation is the need for effective and unconflicted action.

Past presentations of the theory of cognitive dissonance have referred to two different constructs as 'cognitive dissonance'. One is the inconsistency between cognitions. The second is the unpleasant emotional/motivational state that occurs when a person holds two contradictory cognitions. In order to better understand the processes of dissonance, the action-based model distinguishes between the two. We refer to inconsistency between cognitions as 'cognitive discrepancy', whereas we call the unpleasant emotive state 'dissonance'. The unpleasant emotive state of dissonance provides motivation to change one's attitudes or engage in other discrepancy-reduction processes.

After an individual makes a difficult decision, psychological processing should assist with the execution of the decision. The tendency of participants in dissonance research to view the chosen alternative more favorably and the rejected alternative more negatively after a decision may help the individual to follow through, to act on the decision in a more effective manner.

As an example, imagine 'Sylvia', who has been offered admission to two different universities. One university is reputed to be more intellectually stimulating, but most of her friends are going to the other one. One university is located in a city with a pleasant climate, but the other is in a city with a more reasonable cost of living. Sylvia sees both universities as similarly attractive, although they are quite different from each other, and she must decide between them. Once Sylvia makes a decision, she will need to perform actions in order to follow through with her decision. She will need to relocate, take on new responsibilities, form new social relationships, and perform well socially and academically. After her decision, if she continues to see the two positions as similar in attractiveness, she may experience excess regret, which could inhibit her from effectively following through with her decision. On the other hand, if Sylvia is able to reduce dissonance, so that she views the chosen university more positively and the rejected university more negatively, she will likely perform better socially and academically and be more satisfied.

In contrast to models of cognitive dissonance that view dissonance processes as irrational and maladaptive (Aronson, 1969), the action-based model views dissonance processes as adaptive. Of course, adaptive, functional psychological processes that are useful and beneficial in most circumstances may not be beneficial in all circumstances. Occasionally, dissonance reduction may cause persons to maintain a prolonged commitment to a harmful chosen course of action, when it would be better to disengage. However, when we state that dissonance processes are adaptive, we mean that they benefit the organism in the majority of cases.

Tests of the Action-Based Model

Action-orientation and spreading of alternatives

According to the action-based model of dissonance, the post-decisional state is similar to the action-oriented state (Beckmann & Irle, 1985; Gollwitzer, 1990; Kuhl, 1984), where the individual is in a mode of 'getting things done'. Once a decision is made, an organism should be motivationally tuned toward enacting the decision and behaving effectively with regard to it. An implemental or action-oriented mindset is one in which in which plans are made to effectively execute behaviors associated with the decision (Gollwitzer & Bayer, 1999). The individual is in an approach motivational state. When a person is in an action-oriented state, implementation of decisions is enhanced (Gollwitzer & Bayer, 1999). The action-oriented state is similar to Jones' and Gerard's (1967) concept of an unequivocal behavior orientation.

We proposed that the action-oriented state that follows decision-making is equivalent to the state in which dissonance motivation operates and discrepancy reduction occurs (Harmon-Jones & Harmon-Jones, 2002). Thus, experimentally manipulating the degree of action-orientation experienced following a decision should affect the degree of discrepancy reduction. In one experiment, participants were asked to make either an easy decision or a difficult decision. Participants then completed a mindset questionnaire. The neutral mindset asked participants to list seven things they did in a typical day, whereas the action-oriented mindset questionnaire asked participants to list seven things they could do to perform well on the physical exercise they had chosen. Participants then re-evaluated the exercises. Participants in the difficult-decision, action-oriented condition showed a greater increase in preference for the chosen over the rejected exercise (i.e., spreading of alternatives) than participants in the other three conditions.

In a second experiment, we replicated the results of the first experiment using a different manipulation of action-orientation (Harmon-Jones & Harmon-Jones, 2002). In this experiment, action-orientation was induced by asking participants to think about a project or goal that they

intended to accomplish and to list the steps they intended to use to successfully follow through with their decision (Gollwitzer, 1990). Two comparison conditions were also included: one in which participants wrote about a neutral, ordinary day and one in which participants wrote about an unresolved problem, which was defined as a problem characterized by the fact that they were not yet sure whether to take action to change things. Attitudinal spreading of alternatives was measured in response to attractive research studies participants could do (e.g., attention and health). The participants in the action-orientation condition engaged in more spreading of alternatives following a difficult decision than did participants in the comparison conditions. This study provided stronger support for the action-based model because the action-orientation induction was unrelated to the decision in the experiment.

Correlational evidence also suggests that action-oriented processing facilitates discrepancy reduction (Beckmann & Kuhl, 1984). In this study, disposition action orientation was measured by Kuhl's (1980, 1984) action vs. state orientation questionnaire. A sample item from the scale says, 'When I have decided to buy one item of clothing and I find several things I like: (1) I often waver back and forth, trying to decide which I should buy' (state-oriented answer); (2) 'I usually don't think much about it and make a quick decision' (action-oriented answer). Participants were individuals searching for an apartment, and they were shown information about 16 apartments. Participants rated the attractiveness of the apartments before and after choosing the apartment they preferred (i.e., before and after a tentative decision). After the decision, individuals who were dispositionally high in action-orientation increased the attractiveness rating of the chosen apartment more than individuals who were dispositionally low in action-orientation.

Neural Activity Underlying Dissonance and Dissonance Reduction

The action-based model suggests which neural circuits are involved in dissonance processes. When dissonance is aroused, it evokes increased sympathetic nervous activity as measured by increased skin conductance (Elkin & Leippe, 1986; Harmon-Jones et al., 1996; Losch & Cacioppo, 1990). Neurally, dissonance should evoke activity in the anterior cingulate cortex (ACC), a structure that has been found to be involved in the detection of cognitive conflict (e.g., Carter et al., 1998; Gerhing, Goss, Coles, Meyer, & Donchin, 1993). Importantly, recent research has found increased ACC activity when behavior conflicts with the self-concept (Amodio et al., 2004). Amodio et al. found that when individuals who were not prejudiced engaged in behaviors that violated their non-prejudiced self-concept, they evidenced an increase in the amplitude of an event related brain potential referred to as the error-related negativity, which has been found

to be generated by the ACC. This suggests that higher-level conflicts, the type with which dissonance theory has been most concerned, also activate the ACC. More recently, van Veen, Krug, Schooler, and Carter (2007) assessed ACC activation during an induced compliance paradigm and found that ACC activation increased with dissonance and was significantly associated with attitude change. This prediction of dissonance being associated with increased ACC activation was derived from the action-based model, which suggests that dissonance results from the need for effective and unconflicted action (distal motive). This ACC prediction could be viewed as compatible with the original theory of dissonance but is unlikely compatible with other versions of dissonance because of their focus on high level self consistencies or other non-consistency-oriented motivations (e.g., aversive consequences and self affirmation).

Once dissonance is aroused, cognitive discrepancy reduction can occur rapidly. Indeed, research has revealed that dissonance-related attitude change can occur immediately after individuals commit to engage in behavior and before they actually engage in the behavior (e.g., essay writing; Rabbie, Brehm, & Cohen, 1959). We propose that discrepancy reduction engages approach motivational processes, as the individual works to successfully implement the new commitment. To our knowledge, only the action-based model makes the prediction that discrepancy reduction following commitment to action involves approach motivational processes, which the model views as part of the distal motive of effecting unconflicted behavior.

This increase in approach motivation should activate the left frontal cortex. Several methodologies have suggested that the left and right frontal cortical regions have different motivational functions, with the left frontal region being involved in approach motivational processes ('going toward'), and the right frontal region being involved in withdrawal motivational processes ('going away'). For instance, Robinson et al. (e.g., Robinson & Downhill, 1995) have observed that damage to the left frontal lobe causes depressive symptoms. They have found that for persons with left hemisphere brain damage, the closer the lesion is to the frontal pole, the greater the depressive symptoms.

In addition to data obtained from persons with brain lesions (e.g., Robinson & Downhill, 1995), research assessing electroencephalographic (EEG) activity has found that increased left-frontal cortical activation relates to state and trait approach motivation (Amodio, Master, Yee, & Taylor 2008; Harmon-Jones, 2003; Harmon-Jones & Allen, 1997, 1998).

Based on the preceding analysis, we would predict that following commitment to a chosen course of action, relative left frontal cortical activity should be increased, and this increase in relative left frontal cortical activity should be associated with the degree of change in attitudes in support of the chosen course of action. Indeed, past research suggests that the left frontal cortical region may be involved in approach motivational

processes aimed at resolving inconsistency (MacDonald, Cohen, Stenger, & Carter, 2000; van Veen & Carter, 2006).

Induced compliance and relative left frontal cortical activation

In one experiment, participants were randomly assigned to a low vs. high choice condition in an induced compliance paradigm. Immediately after starting to write the counter-attitudinal essay, EEG activity was recorded. After essay completion, attitudes were assessed. Results revealed that participants in the high choice condition evidenced greater relative left frontal activation than individuals in the low choice condition (Harmon-Jones, Gerdjikov, & Harmon-Jones, 2008). Moreover, this commitment (high-choice) caused attitudes to be more consistent with the behavior, as compared to a low-commitment (low-choice) condition. However, in this experiment, relative left frontal activation did not relate to attitudes perhaps because the attitude measure lacked the needed sensitivity (e.g., it did not tap attitude change from pre-commitment, but only tapped attitudes following the commitment).

Neurofeedback of relative left frontal cortical activity and free choice

In the previous experiment, when the psychological process (commitment to a chosen course of action) was manipulated and the proposed physiological substrate was measured (left frontal cortical activation), commitment to a chosen course of action increased relative left frontal cortical activation (Harmon-Jones et al., 2008). To provide stronger causal inferences regarding the role of the left frontal cortical region in following through with the commitment (discrepancy reduction), it is important to manipulate the physiology and measure the psychological outcome. Manipulation of the mediator also provides stronger causal evidence than simply correlating the proposed mediator with the outcome (Sigall & Mills, 1998). Therefore, we conducted another experiment in which relative left frontal cortical activation was manipulated after dissonance was aroused to test whether a manipulated increase in relative left frontal cortical activation would increase dissonance reduction (attitude change).

To manipulate relative left frontal cortical activity, we used neurofeedback training of EEG. Neurofeedback presents the participant with real-time feedback on brainwave activity. If brainwave activity over a particular cortical region changes in the direction desired by the experiment, then the participant is given 'reward' feedback; if brainwave activity does not change in the desired direction, either negative feedback or no feedback is given. Rewards can be as simple as the presentation of a tone that informs the participant that brain activity has changed in the desired way. Neurofeedback-induced changes result from operant conditioning, and as such, these changes in EEG can occur without awareness of how the

brain activity changes occurred (Kamiya, 1979; Siniatchkin, Kropp, & Gerber, 2000; awareness of how one causes the changes requires extensive practice, e.g., 8 weeks of practice; Kotchoubey, Kubler, Strehl, Flor, & Birbaumer, 2002).

In past research, neurofeedback was effective at decreasing but not increasing relative left frontal activity after only 3 days of training. The decrease in relative left frontal activity brought about with this brief neurofeedback training caused less approach-related emotional responses (Allen, Harmon-Jones, & Cavender, 2001). Based on these past results, we predicted that a decrease left frontal condition would be more successful at changing brain activity than an increase left frontal condition.

Most importantly, we predicted that a decrease in relative left frontal activity would lead to a decrease in discrepancy reduction as measured by spreading of alternatives. To test these predictions, we used the decision paradigm developed by Brehm (1956). Neurofeedback training of relative left frontal activation occurred for 2 days, and participants were randomly assigned to increase or decrease relative left frontal activation. Then, on the third day, immediately following a difficult decision, neurofeedback training occurred in the same direction as previous days. Finally, attitudinal spreading of alternatives was assessed. In support of predictions, neurofeedback training caused a reduction in relative left frontal cortical activity, which caused an elimination of the familiar spreading of alternatives effect (Harmon-Jones, Harmon-Jones, Fearn, Sigelman, & Johnson, 2008). Together with past research showing that commitment to a chosen course of action increases activity in the left frontal cortex (Harmon-Jones et al., 2008), the current experiment's manipulation of relative left frontal cortical activity, a presumed mediator of the effect of commitment on discrepancy reduction, provides strong support for the role of relative left frontal activity in discrepancy reduction processes.

Action-oriented mindset and relative left frontal cortical activation

A follow-up experiment was designed to conceptually replicate the previous experiment. In this experiment, we manipulated action-oriented mental processing following a difficult decision. We expected to replicate past research that showed that the action-oriented mindset would increase discrepancy reduction following a decision. Second, we expected the action-oriented mindset would increase relative left frontal cortical activity. Finally, we expected this increase in left frontal cortical activity would relate to discrepancy reduction, as assessed by spreading of alternatives.

To further extend past research, we included a condition to manipulate positive affect that was low in approach motivation (i.e., participants wrote about a time when something happened that caused them to feel very good about themselves but was not the result of their own actions).

This was done to distinguish between the effects of positive affect and of approach motivation on spreading of alternatives. Past research suggested that action-oriented mindsets increase positive affect (Taylor & Gollwitzer, 1995), but we do not predict that positive affect, itself, causes increased left frontal cortical activity or an increase in spreading of alternatives.

Results from the experiment were consistent with predictions and revealed that the action-oriented mindset increased relative left frontal cortical activity and spreading of alternatives, compared with a neutral condition and a positive affect/low approach motivation condition. These results provide a conceptual replication of the past results by using a different operationalization of action-oriented motivational processing. Both experiments revealed that the hypothesized increase in action-oriented processing was manifested in increased relative left frontal cortical activity. Moreover, both studies revealed that relative left frontal activation correlated positively with spreading of alternatives.

Increasing Strength of Action Tendencies and Discrepancy Reduction

According to the action-based model of dissonance, dissonance should be increased as the salience of the action implications of cognitions that are involved in a dissonant relationship are increased. Several perspectives consider emotions to involve action tendencies (Brehm, 1999; Frijda, 1986). To the extent that an emotion generates an action tendency, as the intensity of one's current emotion is increased and is involved in a dissonant relationship with other information, dissonance should be increased.

Research has shown that the emotion of sympathy (empathy) increases helping behavior because it evokes altruistic motivation (i.e., motivation to relieve the distress of the person in need of help; Batson, 1991). We conducted an experiment that tested whether an inconsistency between the emotion of sympathy and knowledge about past failures to act in accord with the sympathy would evoke motivation to reduce this inconsistency (Harmon-Jones, Peterson, & Vaughn, 2003).

In the experiment, we tested the hypothesis that after experiencing sympathy for a target person in need of help, individuals will be more motivated to help that person when they are reminded of times that they failed to help similar persons. Participants were informed that they would be listening to a pilot broadcast for a local radio station and that the researchers would like students' reactions to the tape. Participants then listened to a tape-recorded message that was purportedly from a person in need of help (an adolescent with cancer). Before listening to the tape, participants were assigned to one of two conditions: one in which they tried to imagine how the person must feel (high empathy set) or one in which they tried to remain objective as they listened to the tape (low empathy set). Then they listened to the tape-recorded message. Afterward,

they completed questionnaires assessing self-reported emotional responses and evaluations of the tape-recorded message. Participants were then asked to list times when they failed to help other persons who were in need of help (in order to induce dissonance) or they completed a demographic survey (control condition). Finally, participants were given an opportunity to help by volunteering time to assist the person with addressing letters that would request money from possible donors or by donating money to the person's family. The design was a 2 (low vs. high empathy) x 2 (reminded of times that did not help or not reminded) between-subjects factorial. Consistent with predictions derived from the action-based model, results indicated that more helping occurred in the high-empathy/reminder of past failures condition than in other conditions.

It is important to note that this experiment is similar to other dissonance research using a hypocrisy paradigm (Aronson, 1999; Stone, Wiegand, Cooper, & Aronson, 1997). However, the present experiment differs from the hypocrisy research in an important way. In the hypocrisy experiments, the dissonance was aroused between a public behavior (e.g., video-taped speech to be delivered to other students about safe sex) and a reminder of past failures to practice what was spoken (i.e., they had not always practiced safe sex). In the current experiment, dissonance was aroused between a private emotional experience that generates an action tendency and a reminder of past failures to behave in accord with what the emotion motivates the person to do. Thus, past hypocrisy work only shares with the current experiment the explicit reminder of past failures to behave in certain ways. More importantly, the action-based model generated the hypothesis that because sympathy generates an action tendency, it could be involved in evoking dissonance. In general, we view past work on hypocrisy as consistent with the action-based model, because the conflicting 'cognitions' have strong behavioral implications and the reduction of the dissonance between these 'cognitions' enables one to behave effectively with regard to the cognition most resistant to change (i.e., in past studies, the information provided in the speech).

Considering the Action-Based Model and Other Modes of Dissonance Reduction

Would a change in action orientation and/or relative left frontal cortical activity affect discrepancy reduction in other dissonance-evoking situations? We would expect left frontal cortical activity to affect dissonance processes when dissonance is aroused by a strong commitment to behavior, which is what typically occurs in the induced compliance and free choice paradigms (e.g., Beauvois & Joule, 1996; Brehm & Cohen, 1962). In such situations, we predict that individuals are motivated to follow through with their behavioral commitment and to change their attitudes to be consistent with their behavior (Stone et al., 1997). However, in some induced

compliance situations, individuals may reduce dissonance by means other than attitude change perhaps because their commitment is not sufficiently strong (Gilbert & Ebert, 2002) or because their original attitude is highly resistant to change (Simon et al., 1995). Thus, in other dissonance paradigms, we would predict relative left frontal activation to relate to dissonance reduction to the extent that dissonance is likely to be reduced via approach motivational processes, such as changing one's attitudes to be more supportive of the recent behavioral commitment.

Changing one's cognitions to bring them in alignment with each other is one way of reducing the negative emotion of dissonance. This is the method of reducing dissonance most often measured in research. However, this is not the only way persons can deal with the emotive state of dissonance. It is also possible to trivialize the cognitions (Simon et al., 1995) or drink alcohol to reduce the negative dissonance state and the motivation to engage in discrepancy reduction (Steele, Southwick, & Critchlow, 1981). The action-based model would predict that reducing dissonance by means other than attitude change would be more likely when action was not greatly needed or when the action implications of the cognitions were low.

It is also possible to experience dissonance and not do anything to reduce it. The negative emotion of dissonance provides motivation, but just because an individual is motivated to do something does not necessarily mean that he/she acts on the motivation. He or she might, instead, continue to experience cognitive discrepancy, in which case the action-based model predicts that negative affect would remain elevated. The action-based model also predicts that if an individual experienced dissonance and did not reduce it, the effectiveness of his or her behavior would be hampered. These and other ways of dealing with cognitive discrepancies, and with the negative emotion of dissonance, need to be considered in future research.

The action-based model does not make the claim that dissonance reduction in the direction of a decision always occurs. Sometimes, a person makes a decision and the evidence is overwhelming that the wrong decision has been made. This information would arouse dissonance. When a person realizes that he/she has made a mistake, his/her original decision is no longer the cognition most resistant to change. Consider Sylvia, who went to one university over another. After beginning the first semester, Sylvia might realize that it is completely unsuitable for her. She will likely not be able to reduce the dissonance associated with her decision; in fact, the negative emotion of dissonance will increase. At some point, if dissonant cognitions continue to increase, she may reverse her decision and look for a different university (Festinger, 1957, reports the results of such an experiment). Like the original theory of dissonance, the action-based model predicts that the direction of attitude change will be in the direction of the cognition that is most resistant to change.

Individual and Cultural Differences

Recent research has suggested that individual and cultural differences may moderate dissonance processes. For instance, individuals with greater preferences for consistency show greater attitude change after high-choice in an induced compliance situation (Cialdini, Trost, & Newsom, 1995), and individuals from Eastern cultures compared with Westerner cultures show greater dissonance-related attitude change when inter-dependence is salient (Hoshino-Browne et al., 2005). As noted by Wicklund and Brehm (1976), individual (or cultural) differences in dissonance-related attitude change could emerge because of differences in the initial perception of discrepant cognitions, the awareness of dissonance, the tolerance of dissonance, and/or the mode of dissonance reduction. If only attitude change is measured in a standard dissonance experiment examining individual differences, it is impossible to determine why said individual difference was related to differences in attitude change.

Assuming no differences in the above variables (e.g., initial perception of discrepancy), the action-based model might suggest that these individual and cultural differences may be associated with differences in the extent to which unconflicted action would be important. For example, preference for consistency may be related to tendencies toward action orientation. In addition, individuals high in preference for consistency may prefer consistency because of the implications (in)consistency has for behavior, and they may be more concerned about executing effective behavior. With regard to cultural differences, cultures that value or emphasize the group over the individual may cause one to evaluate cognitions, their relevance to each other and to behavior, and their (in)consistency according to group standards rather than individual standards. Alternatively, these cultures may differ in their tendencies toward individual vs. group action orientation. The relationship between individual/cultural differences in dissonance processes and the action-based model is unexplored territory awaiting interesting future research.

Conclusion

The action-based model assumes that dissonance processes operate because they are functional (i.e., most often useful for the organism). However, the action-based model does not claim that dissonance reduction is always functional. We think of dissonance processes as being similar to other functional, motivated behaviors such as eating. Eating is necessary for the survival of the organism; however, disordered eating can be harmful. Similarly, if a person makes a poor decision and then reduces the dissonance associated with the decision, he/she will persist in acting on the decision. The action-based model proposes that dissonance reduction, while not always functional, is functional more often than not. In the majority of cases,

it is advantageous for persons to reduce dissonance, and act effectively on their decisions. The dissonance–reduction mechanism down-regulates continued psychological conflict that would interfere with effective action.

We suggest that the action-based model provides an explanation of the underlying, basic motivation behind dissonance processes. The action-based model assumes that, in most cases, dissonance processes are behaviorally adaptive. Dissonance reduction primarily functions to facilitate effective action. The reason organisms experience discomfort when they hold conflicting cognitions is because conflicting cognitions impede effective action. We hope that this new way of thinking about dissonance processes will stimulate research on dissonance theory and assist in connecting the large body of dissonance theory evidence with other research literatures concerned with action orientation, behavioral regulation, emotion regulation, and the neural processes that underlie these important psychological processes.

Acknowledgement

The work in this article was supported by a National Science Foundation Grant (BCS-9910702).

Short Biographies

Eddie Harmon-Jones is Professor of Psychology at Texas A&M University. He received his PhD in social psychology and psychophysiology in 1995 from the University of Arizona. Before joining Texas A&M University, he was an assistant professor and then associate professor at the University of Wisconsin–Madison. His research is currently funded by the National Science Foundation and National Institute of Mental Health. Professor Eddie Harmon-Jones has contributed almost 80 professional publications, including three co-edited books. He has served as an Associate Editor at *Journal of Personality and Social Psychology* and edited a special section on Social Neuroscience for the same journal. In addition to his interest in cognitive dissonance theory and research, he conducts research on approach motivational processes and emotions and their effects on attention and behavior. He has extended his basic research on these processes to bipolar disorder. His work takes a multidisciplinary approach and utilizes a range of measures including physiological ones.

Cindy Harmon-Jones is a graduate student in psychology at Texas A&M University. She received her BS in psychology from Excelsior University. Cindy Harmon-Jones has contributed approximately 15 professional publications in psychology. Prior to being a graduate student in psychology, she worked as a home-birth midwife, was a leader in La Leche League, and served as editor of *Breastfeeding Abstracts*. She has also authored over a dozen popular press articles on natural childbirth, breastfeeding and mothering.

Endnotes

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