

Brennpunkt

Cognitive Dissonance Theory After 50 Years of Development

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Abstract. Research and theoretical developments on the theory of cognitive dissonance are reviewed. After considering the self-consistency, self-affirmation, and aversive consequences revisions, the authors review research that has challenged each of the revisions and that supports the original version of the theory. Then, the authors review 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, the authors present results from experiments examining predictions derived from the action-based model and neural processes involved in dissonance reduction.

Keywords: cognitive dissonance, attitude change, motivation, social cognition

Die Theorie der kognitiven Dissonanz nach 50 Jahren der Entwicklung

Zusammenfassung. Forschung und theoretische Entwicklungen zur Theorie der kognitiven Dissonanz werden im Überblick dargestellt. Nach der Betrachtung dreier Weiterentwicklungen, die jeweils Selbstkonsistenz, "self-affirmation" bzw. aversive Verhaltenskonsequenzen betonen, besprechen die AutorInnen Forschungsergebnisse, welche jede dieser Weiterentwicklungen in Frage stellen und die Originalversion der Theorie stützen. Dann präsentieren sie das handlungsbasierte Dissonanzmodell. In diesem Modell wird die Annahme der ursprünglichen Theorie aufgegriffen, dass hinreichende kognitive Inkonsistenz Dissonanz verursacht, und es wird erklärt, warum dies der Fall ist. Abschließend werden Ergebnisse von Experimenten dargestellt, in denen Vorhersagen des handlungsbasierten Dissonanzmodells getestet und neuronale Prozesse, die bei der Dissonanzreduktion auftreten, untersucht wurden.

Schlüsselwörter: kognitive Dissonanz, Einstellungsänderung, Motivation, soziale Kognition

Cognitive dissonance theory and research dominated social psychology from the 1950s until the 1970s. The theory revolutionized thinking about psychological processes, particularly regarding how rewards affect attitudes and behavior and how behavior and motivation affect perception and cognition. In recent years, there has been renewed interest in this theory (e.g., Beauvois & Joule, 1996; Harmon-Jones & Mills, 1999). In addition to explicit, renewed interest in dissonance theory itself, the theory has implicitly influenced much contemporary theorizing (Aronson, 1992).

The Original Version of the Theory

Leon Festinger formulated the original theory of cognitive dissonance in the mid-1950s, and the first formal and complete presentation of the theory appeared in 1957. Festinger theorized that, when an individual holds two or more ele-

ments of knowledge that are relevant to each other but inconsistent with one another, a state of discomfort is created.

He called this unpleasant state "dissonance." Festinger theorized that the degree of dissonance in relation to a cognition = $D / (D + C)$, 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, and Shultz & Lepper, 1999, for more precise mathematical models). Frey, Irle, Möntmann, Kumpf, Ochsmann, and Sauer (1982) proposed that the dissonance between cognitions could be determined by assessing whether a person expects one event to follow from another.

Festinger (1957) theorized that persons are motivated by the unpleasant state of dissonance to engage in "psychological work" so as to reduce the inconsistency, and this work will typically support the cognition most resistant to change. Frey et al. (1982) suggested that the resistance to change should be analyzed "in terms of the degree of dissonance over the entire cognitive system, a particular cognition being more resistant, the greater the number of rela-

tions that enters into it" (p. 302). To reduce the dissonance, individuals could add consonant cognitions, subtract dissonant cognitions, increase the importance of consonant cognitions, or decrease the importance of dissonant cognitions. One of the most often assessed ways of reducing dissonance is change in attitudes. Attitude change is expected to be in the direction of the cognition that is most resistant to change. In tests of the theory, it is often assumed that the knowledge about recent behavior is usually most resistant to change, because if a person behaved in a certain way, it is often very difficult to undo that behavior. Thus, attitude change would be consistent with the recent behavior.

Festinger presented dissonance theory during the heyday of cognitive consistency theories, and he discussed dissonance as a cognitive consistency theory. However, as several subsequent theorists noted, dissonance theory contained an important element not present in other consistency theories (Brehm & Cohen, 1962; Wicklund & Frey, 1981). That is, dissonant and consonant cognitions are defined in relation to a particular focal or generative cognition (Beauvois & Joule, 1996, 1999; Mills, 1999). Moreover, this focal cognition is usually related to a behavior, a point to which we return later.

Experimental Paradigms Used to Test the Theory

Free Choice

In 1956, Brehm examined dissonance theory's predictions for post-decision processing. According to the theory, after a decision, all of the cognitions that favor the chosen alternative are consonant with the decision, while 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 conducted an experiment in which 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. Brehm found that, after persons made a difficult decision, they changed their attitudes to become more negative toward the rejected alternative. After an easy decision, participants did not change their attitudes.

Induced Compliance

Festinger and Carlsmith (1959) hypothesized that dissonance should be aroused when a person acts in a way that is contrary to his or her attitudes. To test this prediction, they brought participants into the laboratory and asked them to 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 counterattitudinal 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.

Effort Justification

Dissonance is aroused whenever a person engages in an unpleasant activity to obtain some desirable outcome. From the cognition that the activity is unpleasant, it follows that one would not engage in the activity; the cognition that the activity is unpleasant is dissonant with engaging in the activity. Dissonance should be greater, the greater the unpleasant effort required to obtain the outcome. Dissonance can be reduced by exaggerating the desirability of the outcome, which would add consonant cognitions.

In the first experiment designed to test these ideas, Aronson and Mills (1959) had women undergo a severe or mild "initiation" to become a member of a group. In the severe initiation condition, the women engaged in an embarrassing activity to join the group, whereas in the mild initiation condition, the women engaged in an activity that was not very embarrassing to join the group. The group turned out to be dull and boring. The women in the severe initiation condition evaluated the group more favorably than the women in the mild initiation condition. This paradigm continues to be used fruitfully in research (e.g., Beauvois & Joule, 1996), and it has been usefully applied in psychotherapy (e.g., Axsom & Cooper, 1985; Draycott & Dabbs, 1998).

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).

Challenges to the Research and Original Theory

After these and other dissonance results appeared in the literature, some theorists began to question whether the re-

sults were due to motivation. Some theorists hypothesized that the effects were due to non-motivational, cognitive processes (e.g., Bem, 1972) or impression management concerns (Tedeschi, Schlenker, & Bonoma, 1971). However, subsequent research confirmed that dissonance is a motivated process (for reviews, Harmon-Jones, 2000a, 2000b). That is, research revealed that during the state of dissonance, individuals evidence heightened electrodermal activity (which is associated with activation of the sympathetic nervous system; Elkin & Leippe, 1983; Harmon-Jones, Brehm, Greenberg, Simon, & Nelson, 1996) and report increased negative affect (e.g., Elliot & Devine, 1994; Harmon-Jones, 2000d; Russell & Jones, 1980; Shaffer, 1975; Zanna & Cooper, 1974). After discrepancy is reduced (attitude change occurs), self-reported negative affect is reduced (Elliot & Devine, 1994; Harmon-Jones, 2000d). However, electrodermal activity does not decrease at this point (Harmon-Jones et al., 1996) unless individuals are distracted from the cognitive discrepancy (Elkin & Leippe, 1986). It is possible that the arousal following attitude change is the result of a motivation to follow through with the commitment.

Moreover, research using the misattribution paradigm has revealed that discrepancy reduction is motivated by the need to reduce negative affect (Zanna & Cooper, 1974). In the misattribution paradigm, participants are provided a stimulus (e.g., a placebo) that is said to cause specific side effects. It is assumed, following Schachter and Singer (1962), that individuals may mistakenly attribute their dissonance arousal to this other source, but only when the expected side effects of the other source are similar to the state produced by dissonance. The nature of the internal state can then be inferred indirectly by determining the type of stimuli to which individuals misattribute the state aroused by dissonance. In this paradigm, participants are exposed to treatments that will or will not arouse dissonance, and then they are either provided or not provided a possible external cause for their experienced state. Research has indicated that participants in the dissonance arousing conditions will misattribute their arousal to stimuli that are said to cause negative affective side effects and that once this misattribution is made, dissonance reduction (attitude change) does not occur.

Beginning in the late 1960s, researchers began to propose motivational explanations for dissonance effects that differed from Festinger's originally proposed theory. Three revisions of dissonance theory have been proposed, and their originators have provided evidence to support these conceptions. These include Aronson's (1968, 1999) self-consistency theory, Steele's (1988) self-affirmation theory, and Cooper and Fazio's (1984) new look at dissonance.

Self-Consistency

In his self-consistency theory, Aronson proposed that dissonance is not due merely to an inconsistency between cog-

nitions. Instead, he posited that dissonance occurs when a person acts in a way that violates his or her self-concept, that is, when a person performs a behavior inconsistent with his or her sense of self. Since most persons have a positive self-concept, dissonance is most often experienced when a person behaves negatively, behaving in an incompetent, irrational, or immoral manner. One of the primary predictions derived from this revision is that low and high self-esteem individuals should respond with less and more dissonance reduction (e.g., attitude change), respectively, because in dissonance experiments high self-esteem individuals are induced to act in ways that are more discrepant from their positive self-views. Experiments testing this prediction have produced mixed results. Also, Beauvois and Joule (1996, 1999) obtained results that are difficult to explain with this revision.

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. While 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 participants who opposed a tuition increase were given high choice to write essays in support of a tuition increase (a counter-attitudinal statement). After writing the essay, participants either 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 (value salient condition, e.g., world hunger), or neither (control condition). Participants were then asked to rate the degree to which they supported a tuition increase. 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 value salient

conditions did not change their attitudes. They had trivialized, or reduced the importance of, the tuition increase issue by thinking about other important values, even when these 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 (for review, Aronson, Cohen, & Nail, 1999).

New Look

Cooper and Fazio (1984) proposed the idea 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. They stated, "Dissonance has precious little to do with the inconsistency among cognitions per se, but rather with the production of a consequence that is unwanted" (Cooper & Fazio, 1984). In support of this idea, Cooper and Worchel (1970) replicated and extended Festinger and Carlsmith's (1959) classic experiment. In addition to the conditions of the original experiment, Cooper and Worchel added conditions in which, when the participant tells the confederate that the boring task is interesting, the confederate is not convinced by the lie. They found that attitude change occurred only in the low-justification condition where the confederate believed the lie. 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. The new look, or aversive consequences, revision of cognitive dissonance theory was widely accepted (but see Berkowitz & Devine, 1989; Eagly & Chaiken, 1993).

However, the results obtained in paradigms other than the counter-attitudinal action paradigm are not consistent with the aversive consequences model. Dissonance research using a selective-exposure paradigm has demonstrated that persons are more willing to examine materials that confirm their beliefs than materials that dispute their beliefs (Brock & Balloun, 1967; Frey, 1986). Research using a belief disconfirmation paradigm has shown that, when persons are exposed to information that challenges their beliefs, they often strengthen their original belief (Batson, 1975; Burris, Harmon-Jones, & Tarpley, 1997). Research using a hypocrisy paradigm has shown that persons change their behavior to be more in line with their beliefs when they are reminded of times when they did not live up to their beliefs (Aronson, Fried, & Stone, 1991; Stone et al., 1994). It is difficult to reconcile any of these lines of dissonance research with a conception of dissonance theory in which the production of an aversive consequence is the only motivator of dissonance-related attitude change.

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 (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, attitude change may have occurred only when participants caused aversive consequences for a number of reasons. First, the lack of attitude change in the no-averse-consequences conditions is a null effect. Null effects are difficult to explain and subject to multiple alternatives. Second, attitude change may have been produced, but may have been too slight to be detected with the small sample size of these experiments. Third, not enough dissonance may have been aroused in these experiments to produce attitude change without the additional help of an aversive consequence. For example, too much justification for the counter-attitudinal behavior may have been provided. Fourth, in these experiments, dissonance may have been produced in the no-averse consequences conditions, but 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, Harmon-Jones and colleagues (Harmon-Jones, 2000d; Harmon-Jones et al., 1996) conducted several experiments. 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 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 during the 3 minutes between the writing of the statement and 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, NS-SCRs indicated that participants in this condition experienced more arousal.

In another experiment, participants who liked chocolate were asked to eat a piece of chocolate and then given 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 and other experiments demonstrate 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. They also demonstrate that the experience of cognitive dissonance evokes an unpleasant motivational state that motivates dissonance reduction. These experiments have supported the original conception of dissonance theory over the revisions. But why does dissonance evoke this negative motivational state? Why is inconsistency aversive? Festinger proposed no answer to the question of what underlies dissonance processes.

Action-Based Model of Dissonance

To address these questions, Harmon-Jones (1999, 2000c) proposed an action-based model of dissonance. The model concurs with other areas of psychological research in proposing that perceptions and cognitions can serve as action tendencies. The model 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 consonance, serves the function of facilitating the execution of effective and unconflicted action. In describing the model, we use the term "cognitions" to use the language of the original theory. However, we believe that the more accurate term for the psychological construct involved in dissonance is action tendency. That is, it is the inconsistency between important action tendencies that causes dissonance. This line of thinking is consistent with the thinking of past dissonance theorists who emphasized behavior as the focal or generative cognition (Brehm & Cohen, 1962; Beauvois & Joule, 1996, 1999; Mills, 1999; Wicklund & Frey, 1981). The action-based model extends these past views by suggesting that the other (non-generative) cognitions most likely to arouse dissonance are those that have action tendencies inconsistent with the generative cognition.

The action-based model proposes that inconsistency between cognitions makes persons uncomfortable because inconsistency has the potential to interfere with effective action. From the viewpoint of the action-based model, cognitions are important because they guide the actions of an organism. When an individual holds two relatively important cognitions that are inconsistent, the potential to act in accord with them is undermined. To reduce the inconsistency and resulting negative affect, individuals engage in a variety of cognitive strategies.

For example, dissonance results when one "freely chooses" to engage in behavior that is inconsistent with an attitude or belief. The "free choice" is subtly induced by the experimenter in experimental research. Experiments have shown that when individuals engage in such behavior, they often change their attitudes to be consistent

with their recent behavior. After making difficult decisions, individuals value the chosen alternative and devalue the rejected alternative more than they did prior to the decision (for reviews, see Beauvois & Joule, 1996; Brehm & Cohen, 1962; Harmon-Jones & Mills, 1999). In both of these dissonance-evoking situations, dissonance occurs because there are cognitions that are inconsistent with a chosen course of action. That is, in the former situation, the past attitude is inconsistent with the current behavior. In the latter situation, the positive aspects of the rejected alternative and the negative aspects of the chosen alternative are inconsistent with the decision. The dissonance thus has the potential of interfering with the translation of the decision into effective action. According to the action-based model, attitude change produced by dissonance is the result of following through with the commitment to the behavior. The attitude change is posited to be one of a number of processes that would assist with the translation of the commitment into effective and unconflicted action. Thus, according to the action-based model, dissonance evokes a negative affective state that signals the organism that something is wrong and motivates the organism to engage in behavior to correct the problem. The correction of the problem often involves following through with the commitment to the behavior or decision. This view of dissonance is consistent with past as well as present theorizing on the function of dissonance and dissonance reduction (e.g., Beckmann & Kuhl, 1984; Jones & Gerard, 1967; McGregor, Zanna, Holmes, & Spencer, 2001; Newby-Clark, McGregor, & Zanna, 2002).

Other scientists have advanced similar but not identical conceptions (see Harmon-Jones, 2000d). For instance, Lewin (1951) discussed the organism's capacity to "freeze" upon an action tendency following a decision. Later, Jones and Gerard (1967) discussed the concept of an unequivocal behavior orientation that was described as an adaptive strategy that forced the individuals to bring their relevant cognitions into harmony with each other. Another perspective consistent with the present model is Kuhl's (1984, 2000) theory of action control. He proposed that to insure that the intended action rather than a competing action tendency will be executed, the intended action tendency has to be selectively strengthened and protected against interference until the action is executed. The post-decisional spreading of decision alternatives may serve the function of putting the decision into action (Beckmann & Irle, 1985). The efficiency of action control is predicted to be determined by whether the individual is in an action-oriented or state-oriented frame of mind. An individual in a state-orientation focuses excessively on the past, present, or future without attending to plans that would implement the action. In contrast, an individual in an action-orientation would seek to implement a plan of action and would focus simultaneously on the present state, the intended future state, the discrepancy between the present and future state, and the alternative plans that may transform the present state into the future state (see

also Heckhausen [1986] and Gollwitzer [1990]). When one considers that dissonance is primarily a theory about post-decisional processing (Brehm & Cohen, 1962; Festinger, 1964), it is easy to see how these theories fit with the present conception of the function of the dissonance process.

Experimental Tests of the Action-Based Model

Action Orientations

An action-oriented state is a state that often occurs following a decision (Beckmann & Irle, 1985; Gollwitzer, 1990; Heckhausen, 1986; Kuhl, 1984). When a person is in an action-oriented state, implementation of decisions is enhanced. Harmon-Jones and Harmon-Jones (2002) integrated these ideas with dissonance theory to propose that this action-oriented state that follows decision-making is equivalent to the state in which dissonance motivation operates and dissonance reduction occurs. They hypothesized that experimentally manipulating the degree of action-orientation experienced following a decision should affect the degree of dissonance reduction.

Harmon-Jones and Harmon-Jones (2002) conducted an experiment to test these ideas. Participants were asked to make either an easy decision or a difficult decision, choosing to perform one of two physical exercises that the participant rated attractive and unattractive or rated as very similar in attractiveness. Participants were asked to fill out a mindset questionnaire after the decision. The neutral mindset questionnaire asked participants to list 7 things they did in a typical day, while the action-oriented mindset questionnaire asked participants to list 7 things they could do to perform well on the exercise they had chosen. Participants were then asked to re-evaluate the exercises. Results indicated that participants in the difficult-decision, action-oriented condition changed their attitudes to prefer the chosen exercise more than participants in the other conditions.

In a second experiment testing the action-based model, Harmon-Jones and Harmon-Jones (2002) replicated the results of the first experiment using a different manipulation of action-orientation. In this experiment, action-orientation was induced by asking participants to think of an important decision that they had made and to list the steps they intended to use to successfully follow through with their decision (Gollwitzer, 1990). The participants in the action-orientation condition engaged in more attitude change following a difficult decision than did participants in the comparison conditions. This study replicated the results of the previous study, but provided stronger support for the model because it used an action-orientation induction unrelated to the decision at hand.

Neural Processes Involved in Dissonance

To assist in translating the behavioral commitment or intention into effective action, approach motivational processes should be activated, as the individual works to successfully implement the new commitment. Thus, the increase in approach motivation should activate the left frontal cortex, as much past research has found this cortical region to be involved in approach motivational processes (e.g., Coan & Allen, 2004; Harmon-Jones, 2003). Interestingly, past research findings are consistent with the idea that the left frontal cortical region may be involved in approach motivational processes aimed at resolving inconsistency. For example, event-related functional magnetic resonance imaging research has found that the left dorsolateral prefrontal cortex is more active during preparation for color naming than during preparation for word naming in a Stroop task (MacDonald, Cohen, Stenger, & Carter, 2000). Moreover, more activity in this brain region was associated with less conflict (i.e., smaller reaction time interference effects). MacDonald et al. suggested that these findings support the hypothesis that the left dorsolateral prefrontal cortex is involved "in the implementation of control, by representing and actively maintaining the attentional demands of the task" (p. 1837). They also suggested that greater activity in the left dorsolateral prefrontal cortex, which implements control, should cause less conflict.

Other research has suggested that activity in the anterior cingulate cortex is involved in monitoring the occurrence of errors or the presence of response conflict (e.g., Carter, Braver, Barch, Botvinick, Noll, & Cohen, 1998; Gehring, Gross, Coles, Meyer, & Donchin, 1993). Importantly, recent research has found increased anterior cingulate cortex activity, as measured by the event-related potential known as the error-related negativity, when behavior conflicts with the self-concept (Amodio et al., 2004). This finding suggests that even higher level conflicts, the type with which dissonance theory has been most concerned, also activate the anterior cingulate cortex.

Based on this past research, it seems plausible that dissonance (or potential response conflict) activates the anterior cingulate cortex, and then activates left dorsolateral prefrontal cortex, which assists in resolving the conflict. To test the prediction that dissonance is associated with increased left frontal cortical activity, university students who were opposed to a tuition increase participated in a study ostensibly concerned with attitudes and personality (Harmon-Jones, Gerdjikov, & Harmon-Jones, in press). They were randomly assigned to one of two choice conditions. In the low-choice condition, participants were told they were to write an essay supporting a 10% tuition increase at their university. In the high-choice condition, participants were told that writing the essay in favor of the tuition increase was their choice and completely voluntary. However, the instructions subtly encouraged them to write such an essay. EEG was assessed for one min following the

beginning of the writing of the counterattitudinal essay, as past research has revealed that dissonance is greatest at this point in time (Beauvois & Joule, 1996). Moreover, the commitment alone (and not the complete essay writing) is sufficient to evoke dissonance (e.g., Beauvois & Joule, 1996; Rabbie, Brehm, & Cohen, 1959). Then, participants completed an attitude measure. Replicating past research, results revealed that high-choice participants changed their attitudes more than low-choice participants. Supporting the primary prediction, results also revealed that high-choice participants evidenced greater relative left frontal activity than low-choice participants.

We recently completed another experiment that was designed to extend our past research by testing the hypothesis that an action-oriented mindset would not only facilitate discrepancy reduction following a decision, but would also increase relative left frontal cortical activity. Because our past research found effects of action orientation on spreading of alternatives only after difficult decisions, the present research included only difficult decisions. To further extend past research, we included a condition to manipulate positive affect that was low in approach motivation. This was done to distinguish between the effects of positive affect and approach motivation on spreading of alternatives. Past research suggested that action-oriented mindsets increase positive affect, but we do not predict that positive affect, itself, is causing the effects on spreading of alternatives.

Replicating our past results, the current experiment demonstrated that the action-oriented mindset caused greater spreading of alternatives than the neutral and positive-non-action-oriented mindset conditions. Moreover, the action-oriented mindset caused greater relative left frontal activation than the other conditions. These results supported our predictions and suggest that the dissonance reduction involves activation of the left frontal cortex and approach motivational processes.

In the previous experiment, the psychological process (action-orientation) was manipulated and the proposed physiological substrate was measured (left frontal cortical activation). Studies of this type are limited in the causal inferences that can be drawn. Because the measured physiological activation may be only one of a number of physiological activations that occur in response to the psychological manipulation, it is possible that one of the other unmeasured physiological activations is more responsible for the psychological process. To provide stronger causal inferences regarding the role of a particular neural structure's involvement in a particular psychological process, it is important to reverse the direction and manipulate the physiology and measure the psychology. Such also provides stronger causal evidence than simply correlating the proposed mediator with the outcome (Sigall & Mills, 1998). Thus, we conducted an experiment in which neurofeedback was used to manipulate left frontal cortical activity. After neurofeedback training, participants were given

a difficult decision and following the decision their attitudinal spreading of alternatives was measured.

To manipulate relative left frontal cortical activity, we used neurofeedback training of EEG alpha power. Past research used similar neurofeedback training to increase relative left frontal activity in clinically depressed individuals; the increase in left frontal activity led to less depression after approximately 27 training sessions (Baehr, Rosenfeld, & Baehr, 2001). Other research with non-depressed individuals revealed that neurofeedback was effective in decreasing but not increasing relative left frontal activity after only three days of training; this neurofeedback-induced decrease in relative left frontal activity caused less approach-related emotional responses (Allen, Harmon-Jones, & Cavender, 2001). Therefore, we predicted that brief neurofeedback training of asymmetrical frontal brain activity would decrease relative left frontal activity. Moreover, we predicted that this decrease in relative left frontal activity would lead to a decrease in spreading of alternatives. Our results supported these predictions. The last two experiments are described in Harmon-Jones, Fearn, Johnson, Sigelman, and Harmon-Jones (2006).

Conclusion

Several experiments have challenged the revisions of dissonance theory and have provided support for Festinger's original conception of dissonance. Clearly, dissonance has much to do with inconsistency and is not due to such limiting conditions as a self-threat or the production of an aversive consequence. As Aronson (1992) noted, a number of social psychological theories, such as self affirmation theory, could be thought of as dissonance in other guises. In addition to the theories noted by Aronson (1992), much research and theory concerned with guilt (Baumeister, Stillwell, & Heatherton, 1994) and self-regulation over prejudiced and other impulses (Amodio et al., 2004) may be understood from the perspective of dissonance. Incorporation of the key variables and past research of dissonance theory into these and other research enterprises will likely benefit those enterprises and lead to a more cumulative psychological theory.

Festinger did not propose why cognitive inconsistency produces discomfort and motivates perceptual, cognitive and behavioral changes. However, the action-based model of dissonance does propose an underlying motivation. Research on the action-based model suggests that dissonance reduction may serve the function of assisting in the successful execution of a commitment, which may facilitate effective and unconflicted action. Incorporation of these ideas derived from action control thinking may assist in stimulating new 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.

As dissonance theory celebrates its 50th birthday, it is clear that this middle-aged theory has weathered many challenges but still provides much explanatory, integrative, and generative power. It is hoped that recent empirical and theoretical developments within dissonance theory will assist in keeping one of our major theories alive and fertile.

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