
His writing on dissonance inspired me to read everything I could about the theory. And at the time I was reading about dissonance theory, around 1990, it seemed that much of the field had become convinced that the cognitive and behavioral changes caused by “dissonance” manipulations were not due to a motivation to resolve cognitive inconsistency (Festinger, 1957) or self inconsistency (Aronson, 1968). The field appeared to have for the most part accepted that these effects were due to a motivation to avoid feeling personally responsible for producing an aversive consequence (Cooper & Fazio, 1984) or due to a motivation to minimize a general self-image threat (Steele, 1988). But I had the nagging feeling that inconsistency alone was sufficient to
cause the cognitive and behavioral changes attributed to dissonance. I believed, along with Leon Festinger (1957), that if I were to walk in the rain and not get wet, I would experience dissonance. And in the remainder of this chapter in honor of Elliot, I will explain why, and will also summarize what we have learned about cognitive dissonance using the tools of neuroscience.

**DOES INCONSISTENCY UNDERLIE DISSONANCE OUTCOMES?**

*Hypocrisy Experiments*

A major contribution to the dissonance literature made by Elliot and colleagues was the hypocrisy experimental paradigm (Aronson, 1992, 1999; Aronson, Fried, & Stone, 1991; Dickerson, Thibodeau, Aronson, & Miller, 1992; Fried & Aronson, 1995; Stone, Aronson, Crain, Winslow, & Fried, 1994; Thibodeau & Aronson, 1992). Not only does this paradigm present a novel way to test theoretical predictions with important real-world significance, but it also demonstrates that dissonance can occur even when participants engage in proattitudinal behavior that has positive consequences. This is important because a major revision of dissonance theory, the “new look” by Joel Cooper and Russell Fazio (1984), posited that inconsistency was neither necessary nor sufficient to motivate the cognitive and behavioral changes found in dissonance experiments (see Cooper, this volume). Instead, they proposed that for dissonance to occur, individuals must engage in behavior that has the perceived potential to cause an irrevocable unwanted consequence. Results of several experiments reviewed by Cooper and Fazio (1984) suggested that their new look was correct.

Consider the experiment by Joel Cooper and Stephen Worchel (1970). They posited that individuals who are provided little justification for lying to another person would not experience dissonance if the other person did not believe them, that is, if there were no aversive consequences. To test this idea, they conducted a modified version of the classic experiment by Festinger and Carlsmith (1959), in which participants were paid $1 or $20 to lie to another person. Festinger and Carlsmith found that participants paid $1 (given little justification) for lying to the other person changed their attitudes to be more consistent with their behavior; participants paid $20 did not, because the money justified the counterattitudinal behavior. Cooper and Worchel (1970) suggested that participants in the low-justification ($1) condition in the original experiment changed their attitudes not because of cognitive
inconsistency, but instead because they felt personally responsible for producing the aversive consequence of convincing another person to believe that she or he was about to participate in an exciting experiment. Cooper and Worchel found that when low-justification participants were led to believe that they did not convince another person that a boring task was interesting, they subsequently did not rate the task as more interesting. Other experiments have replicated these results by finding that when participants believe that their counterattitudinal statements do not persuade others, they do not change their attitudes (e.g., Cooper, Zanna, & Goethals, 1974; Goethals & Cooper, 1972; Hoyt, Henley, & Collins, 1972; Nel, Helmreich, & Aronson, 1969).

However, it is important to note that the evidentiary basis for the aversive consequences model relies solely on the production of no attitude change in conditions in which aversive consequences do not occur. Because this is a null effect, several alternative explanations can be offered. For example, in these past experiments, participants were encouraged to produce lengthy counterattitudinal statements. These statements may have reduced the likelihood of detecting dissonance-related attitude change, as research has demonstrated that the length of participants’ statements is inversely related to the amount of dissonance-related attitude change (Beauvois & Joule, 1996, 1999; Rabbie, Brehm, & Cohen, 1959). This inverse relation may result because longer statements allow for more consonant cognitions that support the counterattitudinal behavior and, hence, reduce the dissonance. Thus, the overall level of dissonance in these experiments may have been rather low, and the addition of aversive consequences was necessary to produce sufficient dissonance to motivate attitude change. Another explanation for the past failures to find attitude change in nonaversive consequences experiments is that dissonance was aroused but reduced in a manner other than attitude change in the no-aversive-consequences conditions. Other alternative explanations have been presented (Harmon-Jones, 1999).

As noted earlier, however, the hypocrisy paradigm is important because it suggests that dissonance can occur even when individuals produce positive consequences, thus supporting the idea that cognitive inconsistency still arouses dissonance. In one experiment representative of the hypocrisy paradigm (Stone et al., 1994), participants either made a persuasive speech about AIDS and safe sex in front of a video camera (allegedly to find the best communicator for a message to be presented about safe sex to high school students) or developed a persuasive message but did not deliver the speech to a video camera. The researchers also manipulated the salience of participants’ past failures to use condoms. Participants were either made aware of their past failures to use condoms
by publicly writing about instances when they had failed to do so or were not made aware of their past failures. Jeff Stone and colleagues (1994) reasoned that if participants made the pro-attitudinal speech and were then made aware of their past failures to practice what they preached, they would experience dissonance and would attempt to reduce their dissonance by modifying their future behavior. In support of their predictions, participants who were induced to feel hypocritical purchased more condoms than did participants in the other conditions.

Is Inconsistency the Motivating Force in Other Dissonance Experiments?

Although the hypocrisy experiments by Elliot and colleagues provided evidence for inconsistency as a motivating force in dissonance outcomes, they used a new—and very creative—paradigm, and thus left readers to wonder whether inconsistency was a motivating force in the most commonly used framework: the induced compliance paradigm. In addition, Joel Cooper (1992) had taken issue with the hypocrisy experiments, writing, “For some people, acting hypocritically may be devastating to a central core of the self-concept and thus be an extremely aversive event” (p. 322). Although this statement seems to confuse producing an aversive consequence with causing oneself to feel negative affect (i.e., dissonance), it demonstrates that some scientists expressed concerns about the hypocrisy experiments (which I did not share). Nonetheless, the question still remained: Could inconsistency itself motivate dissonance-related outcomes such as attitude change in a standard dissonance paradigm? If this question were not addressed, then one could logically posit that the major experimental paradigms used in dissonance research were producing outcomes driven by a motivation to avoid an aversive consequence rather than a motivation to resolve cognitive inconsistencies.

One morning, Jack Brehm and I were discussing how to create an induced-compliance paradigm in which participants would not produce aversive consequences. We were searching for a minimal-induced-compliance paradigm. We stumbled onto the idea of using a cover story that would tell participants that the study was about influences on memory. During the midst of this discussion over cups of terrible coffee from the Kansas University psychology department, we had to take a bathroom break. While taking this break, we discussed having participants drink an unpleasant tasting beverage while thinking that they would have to recall characteristics of the beverage. In true induced-compliance paradigm form, participants would be asked to write that they liked the beverage, so as to produce a counterattitudinal statement. But our cover story would lead them to believe that the writing was only done to see
whether it affected their memory. In fact, before they wrote the statement, we would tell participants that they should throw the statement in the trash once it was written. This would ensure that their counterattitudinal behavior was conducted in private and thus did not produce an aversive consequence.

We piloted the experiment, making sure that the participants disliked the beverage (they did, extremely so), making sure that experimenters remained blind to the beverage type and choice manipulation, and making sure that participants believed that their behavior was truly private. (With pilot participants, we discovered that if no other trash was in the trash can, participants would tell us in debriefing that they thought we would retrieve their statements from the trash, so we added wadded-up “confederate” statements to the trash can. See Ellsworth’s chapter, this volume, for a discussion of the importance of piloting experimental procedures.) Once everything was in order, we conducted the experiment and found that in keeping with predictions supporting an inconsistency model, participants given high choice to write the counterattitudinal statement changed their attitudes to become more consistent with their behavior: They convinced themselves that they like the beverage better.

Subsequent experiments replicated this basic effect, using different attitude objects such as a boring passage (Harmon-Jones, Brehm, Greenberg, Simon, & Nelson, 1996, Experiment 2). We also used a positive attitude object and had participants write that they disliked the object toward which they previously held very positive attitudes (Harmon-Jones, 2000). We also measured arousal (skin conductance) and found that this counterattitudinal behavior increased arousal (Harmon-Jones et al., 1996, Experiment 3), consistent with past research using the standard induced compliance paradigm (Elkin & Leippe, 1986). Finally, we measured self-reported negative affect and found that this minimal-induced-compliance paradigm also created subjective experience of negative affect (Harmon-Jones, 2000), consistent with past research using the standard induced compliance paradigm (Elliot & Devine, 1994).

These experiments strongly suggested that a motivation to reduce cognitive inconsistency does indeed underlie the attitude change observed in induced-compliance experiments. We hypothesized that the aversive state of dissonance resulted because behavior, including verbal behavior, must, in general, be in accord with one’s perception of reality. After all, if behavior is not in accord with perceptions of the environment, an organism’s most basic welfare is threatened. Hence, people feel uneasy when they say something that is not true, even
though the perception (of the original attitude object in our experiments) may be of little importance. The behavior causes dissonance because the person knows that behavior does not match perception, even when no aversive consequence follows that behavior. The aversive state of dissonance then motivates attitude change, so that perception now matches behavior.

**Cognitive Inconsistency or Self-Concept Inconsistency?**

The aforementioned experiments suggest that cognitive inconsistency even in the absence of aversive consequences can arouse dissonance. However, another question arose. Does the inconsistency need to involve self-conceptions of rationality, morality, or competence as Elliot (Aronson, 1992) has posited? Or might more simple cognitive inconsistencies arouse dissonance? To return to Festinger’s example, were I to walk in a downpour and not get wet, would I experience dissonance? In one of the minimal dissonance experiments just reviewed, measures of various forms of self-reported negative affect were included to address this question. If a self-concept violation were motivating dissonance reduction, then we might expect the dissonance-arousing event not only to increase self-reported discomfort, but also to decrease state self-esteem. The results, however, revealed that although the dissonance manipulation increased discomfort, it did not affect state self-esteem (Harmon-Jones, 2000). These results suggest inconsistencies implicating the self-concept are not necessary to arouse dissonance.

One could quibble with whether these self-reported affect and self-esteem results legitimately support such a statement. Although the self-consistency revision is quite similar to the original theory, it restricts dissonance processes to organisms with self-concepts, thus excluding most nonhuman animals and humans under age 2. However, experiments demonstrating that dissonance effects occur in white rats, which presumably lack a self-concept (Lawrence & Festinger, 1962), contradict this revision. In addition, the self-consistency revision restricts dissonance processes to organisms whose self-concepts become accessible as a standard for comparison whenever they encounter self-discrepancies. This restriction would probably omit several situations, as it does not seem plausible that a self-concept would become accessible each and every time an individual encounters a cognitive discrepancy.

In addition, one of the primary predictions derived from the self-consistency revision is that individuals with high self-esteem should respond with more dissonance reduction than individuals with low self-esteem, because dissonance experiments induce individuals to act in ways discrepant from positive views of themselves as moral, rational, or
competent people. Studies testing this prediction have produced mixed results: Some showed that individuals with high self-esteem showed greater attitude change, some showed that individuals with low self-esteem showed greater attitude change, and some found no differences between self-esteem groups (see Stone, 2003, for a review). Therefore, the experience of dissonance and the engagement in dissonance-reducing activities does not appear to be limited to discrepancies involving the self-concept.

I suspect, however, that the self-concept has the power to increase the magnitude of dissonance, particularly when the self-concept is in the forefront of working memory (see Stone, this volume). That is, when the self-concept is accessible, inconsistencies that implicate the self likely generate more dissonance than inconsistencies that do not. Given these concerns about the self-consistency model, it seems that several critical theoretical issues remain. Which inconsistencies arouse dissonance? And why does inconsistency arouse dissonance?

THE ACTION-BASED MODEL OF DISSONANCE

The action-based model of cognitive dissonance was proposed to answer the aforementioned questions (Harmon-Jones, 1999). This model concurs with other areas of psychological research in proposing that perceptions and cognitions can serve as action tendencies (Berkowitz, 1984; Gibson, 1966, 1979; McArthur & Baron, 1983). 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 underlying dissonance processes. The proximal motive for reducing dissonance is to reduce or eliminate the negative affective state of dissonance. The distal motive 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. Indeed, Festinger (1957) used the term dissonance to refer to both constructs. To better elucidate the processes of dissonance, the action-based model distinguishes between the two. The model refers to inconsistency between cognitions as cognitive discrepancy, and to attempts to reduce the inconsistency as discrepancy reduction. It refers
to the unpleasant emotive state as dissonance, and to the reduction of the unpleasant state as dissonance reduction. The unpleasant emotive state of dissonance provides motivation to change one’s attitudes or to engage in other discrepancy-reduction processes. As an example of this confusion of constructs, authors often refer to attitude change as dissonance reduction (Stone, 1999), even though attitude change presumably reflects changes in cognitions or cognitive discrepancy reduction. In most experiments, it is empirically unknown whether dissonance is actually reduced (e.g., a person could change her attitude but still feel uncomfortable if the cognitive discrepancy were large enough).

According to the action-based model, 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—the spreading of alternatives—may help the individual to follow through, to act on the decision in a more effective manner. The induced compliance situation is just another instance of a difficult decision; in this paradigm, the person must decide whether to act in opposition to his or her attitudes.

To illustrate, consider Sylvia, who has been offered admission to two 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 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 universities as similar in attractiveness, she may experience excess regret, which could inhibit her from effectively following through with her decision. Alternatively, 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 short, she will be better able to convert her decision into effective action.

The action-based model views the experience and reduction of dissonance (and cognitive discrepancy) as adaptive. Of course, functional psychological processes that are adaptive in most circumstances may not be beneficial in all circumstances. Occasionally, discrepancy reduction may cause people to maintain a prolonged commitment to a harmful chosen course of action when it would be better to disengage. Still, when
the action-based model predicts that dissonance processes are adaptive, it means 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, individuals who have made a decision are poised for action (Beckmann & Irle, 1985; Gollwitzer, 1990; Kuhl, 1984), such that they are in a mode of “getting things done.” Once a decision is made, an organism should be motivated to implement that decision and to do so effectively. After all, an implemental or action-oriented mind-set yields plans for how to execute behaviors that follow from a particular decision (Gollwitzer & Bayer, 1999). When individuals are in this action-oriented state, they are more likely to work to accomplish their goals (Gollwitzer & Bayer, 1999; Gollwitzer & Sheeran, 2006).

The action-oriented state is similar to Ned Jones and Harold Gerard’s (1967) concept of an unequivocal behavior orientation. The unequivocal behavior orientation “represents a commitment to action in the face of uncertainty. Such a commitment involves the risks of acting inappropriately, but such risks are assumed to be less grave on the average than the risks of hesitant or conflicted action” (p. 185). Jones and Gerard further posited, “When the time comes to act, the great advantage of having a set of coherent internally consistent dispositions is that the individual is not forced to listen to the babble of competing inner forces” (p. 181).

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). In other words, following a decision, particularly a difficult one, individuals should be motivated to successfully enact the decision, and this will entail changes in attitudes and other perceptions and cognitions that will assist with executing the decision. Thus, experimentally manipulating the degree of action-orientation that participants experience after they have made a decision should affect the degree of discrepancy reduction (often but not always measured as attitude change in dissonance experiments).

In our first experiment (Harmon-Jones & Harmon-Jones, 2002), we used the decision paradigm developed by Jack Brehm (1956), who asked participants to rate a number of consumer products, to choose between two that they had rated similarly, and then to rerate the products. He
found that participants rated the chosen product more positively after choosing it, and the rejected product more negatively after leaving it behind. These attitudinal changes are known as spreading of alternatives because ratings of the chosen and rejected alternatives, which were close to each other prior to the decision, spread apart following the decision. In our first experiment, participants made either an easy decision or a difficult decision about which kind of physical exercise they preferred. As in past research (Brehm, 1956), the easy decision was between a lowly and highly valued alternative, whereas the difficult decision was between two highly valued but different alternatives. They then completed a questionnaire designed to manipulate their postdecision mind-sets. In the neutral mind-set condition, participants listed seven things they did in a typical day; in the action-orientation mind-set condition, participants listed seven things they could do to perform well on the physical exercise they had chosen. Participants then reevaluated the exercises. Compared to participants in the other three experimental conditions, participants who made a difficult decision and who listed what they could do to perform well demonstrated a significantly greater spreading of alternatives, as we say in dissonance parlance: They evaluated their chosen alternative more positively, and their rejected alternative more negatively, than did other participants.

In our 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, participants assigned to the action-orientation condition thought about a project or goal that they intended to accomplish, and listed the steps that they planned to use to successfully accomplish the goal (Gollwitzer, 1990). We also included two comparison conditions. In the first, participants wrote about an ordinary day, and in the second, they wrote about a problem on which they were not yet ready to take action. The experimenter told participants that the study examined the relationship between personality characteristics and preferences for different types of psychological research. Participants first read descriptions of nine research projects (e.g., attention, health) and evaluated each one by indicating how desirable it would be to participate in a study similar to the one described. Next, the experimenter gave participants a choice to participate in one of two research projects; the two projects were ones that the participant had earlier rated positively and similarly (e.g., two 7s on a 9-point attitude scale). After this difficult decision, participants completed the above-described action-orientation manipulation. To do this, they completed open-ended “personality questionnaires” about a goal they planned to accomplish, a problem on which they were deliberating, or
an ordinary day. Finally, the experimenter returned to the participant’s room and told the participant she or he was interested in how familiarity with research descriptions might affect ratings of the research projects. Consequently, participants rerated the nine research descriptions. The participants in the action-orientation condition engaged in more spreading of alternatives following the 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 not directly related to the decision in the experiment. In other words, the action-orientation manipulation in the present study tuned individuals toward action but was not directly tied to their recent decision about the research projects.

Correlational evidence also suggests that action-oriented processing facilitates discrepancy reduction (Beckmann & Kuhl, 1984). In this study, Jürgen Beckmann and Julius Kuhl measured participants’ dispositional action orientation using Kuhl’s (1980, 1984) action versus state orientation questionnaire, which measures the extent to which people who confront a decision either waiver (state orientation) or take action after deciding quickly (action orientation). For example, participants imagine finding several alternatives when they set out to buy a single item of clothing, then report whether they struggle with the decision (“I often waver back and forth, trying to decide which I should buy”) or make a decision and act relatively quickly (“I usually don’t think much about it and make a quick decision”). Participants in their study were actually searching for an apartment, and they were shown information about 16 apartments. As in the standard postdecision dissonance paradigm, participants rated the attractiveness of the apartments before and after choosing the apartment they preferred. After participants decided which of the 16 apartments they preferred, those who reported that they typically make decisions and act quickly (high dispositional action-orientation) rated their apartment choice more positively than did participants who reported that they typically struggle when making decisions (high dispositional state-orientation). Thus, Beckmann and Kuhl’s (1984) correlational results are consistent with the results obtained in the previously mentioned experiments.

**Neural Activity Underlying Dissonance Arousal**

Our action-based model suggests which neural circuits are involved in dissonance processes, something that no previous model of dissonance has attempted. 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,
Neurally, dissonance should evoke activity in the anterior circu- late cortex (ACC), a structure that has been implicated in response conflict on tasks such as the Stroop task (e.g., Carter et al., 1998; Gehring, Goss, Coles, Meyer, & Donchin, 1993). Moreover, recent research has demonstrated increased ACC activity when behavior conflicts with the self-concept (Amodio et al., 2004). David Amodio and his colleagues (2004) found that when individuals who did not view themselves as prejudiced engaged in behaviors that violated their egalitarian self-concept, they evidenced increased activity in the ACC. This suggests that higher-level cognitive conflicts, the type with which dissonance theory has been most concerned, also activate the ACC. More recently, van Veen, Krug, Schooler, and Carter (2009) 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 yielding increased ACC activation is consistent with the action-based model, which suggests that dissonance results from the need for effective and unconflicted action. This ACC prediction could be viewed as compatible with the original theory of dissonance but is unlikely compatible with other versions of dissonance, given their focus on inconsistencies that implicate the self-concept, a more abstract construct (e.g., self-affirmation processes) and on motivations unrelated to cognitive inconsistencies per se (e.g., the centrality of aversive consequences to dissonance arousal).

Neural Activity Associated with Discrepancy Reduction

Once dissonance is aroused, individuals are immediately motivated to reduce the cognitive inconsistency. Indeed, research has revealed that dissonance-related attitude change can occur immediately after individuals commit to a behavior and before they actually engage in that behavior (e.g., essay writing; Rabbie et al., 1959). The action-based model proposes 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 our model views as part of the distal motive of producing effective and 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 involved in approach motivational processes (“going toward”), and the right frontal region involved in withdrawal
motivational processes (“going away”). For instance, Robert Robinson and colleagues (e.g., Robinson & Downhill, 1995) have observed that damage to the left frontal lobe causes depressive symptoms. They have found that for individuals with left hemisphere brain damage, the closer the lesion is to the frontal pole, the greater the depressive symptoms. Additionally, 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; Harmon-Jones & Sigelman, 2001; Pizzagalli, Sherwood, Henriques, & Davidson, 2005).

Based on the preceding analysis, we would predict that following commitment to a chosen course of action, left frontal cortical activity should increase relative to right cortical activity, and that this relative increase in left frontal cortical activity should be associated with the degree of change in attitudes in support of the chosen course of action: The greater the amount of left frontal cortical activity, the greater the attitude change. Indeed, past research suggests that the left frontal cortical region may be involved in approach motivational processes aimed at resolving inconsistency on tasks such as the Stroop (1935) task (MacDonald, Cohen, Stenger, & Carter, 2000; van Veen & Carter, 2006).

In one experiment, participants were randomly assigned to a low versus high choice condition in an induced compliance experiment. Low-choice participants were assigned to write an essay counter to their true attitudes, and high-choice participants were subtly induced to choose to write the same counterattitudinal essay. Immediately after participants began their essays, we recorded EEG activity. After participants completed their essays, we measured their attitudes toward the essay topic with which they had earlier disagreed. Results revealed that participants in the high-choice condition evidenced greater relative left frontal activation than did individuals in the low-choice condition (Harmon-Jones, Gerdjikov, & Harmon-Jones, 2008). Moreover, participants given choice over the position to take in their essays reported attitudes more consistent with their essay-writing behavior; this was not the case for participants who were assigned to write the essays. 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 precommitment, but only tapped attitudes following the commitment).

In the previous experiment, when we manipulated the psychological process of interest (commitment to a chosen course of action) and measured the proposed physiological substrate (left frontal cortical
activation), commitment to a chosen course of action increased relative left frontal cortical activation (Harmon-Jones, Gerdjikov, et al., 2008). Of course, if we believe that engaging in a counterattitudinal behavior elicits attitude change because it causes greater relative left frontal cortical activation, we can strengthen our causal argument by manipulating the physiology and measuring the outcome of interest, in this case attitude change. In short, if we believe that a given physiological process mediates the relation between an experimental manipulation and a dependent variable, we can make a stronger case by manipulating the proposed mediator directly, and measuring the effect on the dependent variable (see Sigall & Mills, 1998; Spencer, Zanna, & Fong, 2005). In another experiment, my colleagues and I did just that: We manipulated relative left frontal cortical activity after dissonance was aroused to test whether that cortical activity would actually affect attitude change.

To manipulate relative left frontal cortical activity, we used neurofeedback training to teach participants to control EEG activity. This training presents participants with real-time feedback on brainwave activity. When participants’ brainwave activity changes in the desired direction, we “reward” them with feedback that they’ve succeeded; these rewards can be as simple as presenting participants with a tone that informs them that they’ve changed their brainwaves in the right direction. When participants’ brainwave activity does not change in the desired direction, we provide them with either negative feedback or no feedback at all. In essence, we rely on operant conditioning, and the rewarded EEG changes can occur even without participants’ awareness (Kamiya, 1979; Kotchoubey, Kübler, Strehl, Flor, & Birbaumer, 2002; Siniatchkin, Kropp, & Gerber, 2000).

In past research, after only three days of training, neurofeedback was effective in teaching participants to decrease the relative activity in the left frontal cortex, and this decrease resulted in fewer approach-related emotional responses (Allen, Harmon-Jones, & Cavender, 2001). Thus, we believed that feedback training would not only enable participants to decrease the relative activity in the left front cortex, but more important, that this decreased activity would affect the extent to which they changed their attitudes after they had made a difficult decision.

To test these predictions, we used the difficult-decision paradigm described earlier. In our experiment, we provided participants with two days of neurofeedback training designed to increase or decrease relative left frontal cortical activity. On the third day, we first asked them to make a difficult choice among different experiments in which they could participate later in the session. Immediately following their decision, we administered the same neurofeedback training as before. Finally,
we measured their attitudes toward their chosen and rejected experiments. We found that participants who learned to decrease relative left cortical activity rated the chosen and rejected experiments more similarly than did other participants; in other words, there was less spread between their (positive) evaluations of the experiment they chose and their (less positive) evaluation of the experiment they rejected. In short, 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, Gerdjikov, et al., 2008), our 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.

We designed a follow-up to conceptually replicate the previous experiment. In this experiment, we manipulated action-oriented mental processing following a difficult decision. First, we expected to replicate past research that showed that an action-oriented mind-set would increase discrepancy reduction following a decision. Second, we expected that an action-oriented mind-set 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). We did this to distinguish between the effects of positive affect per se versus approach motivation on participants’ differential evaluations of chosen and rejected alternatives. Past research suggested that action-oriented mind-sets 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 mind-set increased relative left frontal cortical activity and spreading of alternatives, compared to a control condition and the positive affect/approach motivation condition. These results provide a conceptual replication of past results by using a different operationalization of action-oriented motivational processing. Both experiments revealed that increases in action-oriented processing yielded increased relative left frontal cortical activity. Moreover, both
studies revealed that relative left frontal activation correlated positively with the spreading of alternatives.

**Increasing Strength of Action Tendencies and Discrepancy Reduction**

According to our action-based model of dissonance, dissonance should increase as the press for action increases. More formally, dissonance should increase as the salience of the action implications of dissonant cognitions increases. 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 that emotion increases and is inconsistent with other information, dissonance should increase.

Research has demonstrated that the emotion of sympathy (empathy) increases helping behavior because it evokes altruistic motivation, that is, the 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). Our experiment was similar to Elliot and colleagues’ research using a hypocrisy paradigm (Aronson, 1999; Stone, Wiegand, Cooper, & Aronson, 1997). However, instead of involving an inconsistency between past behavior (e.g., practicing unsafe sex) and a public speech (e.g., telling others to practice safe sex), our experiment involved an inconsistency between past behavior and a private emotional experience, as described next.

In the experiment, we predicted that when participants experience sympathy for a person in need of help and are reminded of times when they failed to help people in similar straits, they would be more motivated to help. Participants were told that they would be listening to a pilot broadcast for a local radio station and that we were interested in their reactions to the tape. 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). Participants then listened to a tape-recorded message that was purportedly from a person in need of help (an adolescent with cancer). Afterward, they completed self-report questionnaires assessing their emotional responses to and evaluations of the tape-recorded message. Participants then listed times when they failed to help other individuals 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 cancer-stricken teenager by addressing letters that would solicit money from possible donors or by donating money to the person’s family. Consistent with predictions derived from the action-based model, results indicated that participants offered significantly more help when they were encouraged to be empathic and were reminded of past failures to come to others’ aid.

As noted earlier, this experiment is similar to Elliot and colleagues’ research using a hypocrisy paradigm (Aronson, 1999; Stone et al., 1997). However, the present experiment extends the hypocrisy research in an important way. In Elliot and his colleagues’ hypocrisy experiments, dissonance was aroused when participants who engaged in a public behavior (i.e., making a videotaped speech) were reminded of past failures to practice what they publicly preached (i.e., they had failed to engage in the same behavior that they were advocating). In our experiment, dissonance was aroused when a private emotional experience was inconsistent with a reminder of past failures to act on a past emotional experience. Thus, hypocrisy-like effects can emerge, even when the dissonance arises in response to a private emotional experience on the one hand, and on the other hand, a reminder of past failures to behave in keeping with that emotional experience. In general, we view past work on hypocrisy as consistent with the action-based model, because the conflicting “cognitions” have strong behavioral implications, and because the reduction of the dissonance between these “cognitions” enables individuals to behave effectively with regard to the cognition most resistant to change (i.e., in past studies, the information provided in the speech). We were clearly inspired by Elliot and colleagues’ work on hypocrisy in creating this experiment.

A PERSONAL CONCLUSION

Elliot has had a profound impact on psychology through his applied and theoretical research, and through his guidance on the art of methodology. I have been deeply influenced by Elliot’s work, and without his influence, I would probably never have joined the field. I greatly appreciate this opportunity to highlight some of Elliot’s contributions to dissonance theory and research, and then to review recent research on the action-based model of dissonance. Consistent with Elliot’s philosophy of science that champions synthesis of multiple perspectives (Aronson, 1992), the action-based model builds on past dissonance theory research, and offers an analysis that synthesizes dissonance research and theory with developments on perception-action perspectives and
the cognitive neuroscience of control and affective neuroscience of motivation. Although even Elliot may not have been prescient enough to predict the role of perception-action perspectives and neuroscience research in the elaboration of cognitive dissonance theory, I hope that he is pleased.

REFERENCES


