4-27-2001

Cognitive and Physiological Processes Underlying Written Disclosure

Leila Setork '01
Illinois Wesleyan University

Running Head: BEHAVIORAL AND PHYSIOLOGICAL OUTCOMES OF DISCLOSURE

Cognitive and Physiological Processes Underlying Written Disclosure

Leila Setork

Illinois Wesleyan University

Defense Committee:

John Ernst, Ph. D.
Vicki Magee, Ed.D.
Jim Dougan, Ph.D.
Johnna Shapiro, Ph.D.

Approval: John M Ernst
Committee Head

Date: 27 April 2001

Abstract

The aim of this research was to examine the underlying cognitive processes as well as the physiological outcomes of disclosing traumatic events. Epstein (1973, 1991, 1994, 1998) has argued the existence of two fundamental modes of cognitive processing: a rational mode that involves higher brain functioning and is reason-oriented, and an experiential mode that involves lower brain functioning and is pleasure-pain oriented. We examined the hypothesis that fact-based disclosure invokes rational processing while emotion-based disclosure invokes experiential processing by examining participants' physiological reactivity during as well as their behavior in a decision-making task following written disclosure. Based on previous findings suggesting that events involving high vs. low brain functioning involve different types of physiological activation (Berntson, Cacioppo, & Quigley, 1991), I proposed the following: First, emotion-based retelling would result in a uniform pattern of autonomic activity across subjects, marked by an increase in sympathetic (SNS) activity coupled with a decrease in parasympathetic (PNS) activity. Conversely, fact-based retelling would result in diverse SNS and PNS activity between subjects, including an increase in SNS activity with no change in PNS activity, and a decrease in PNS activity with no change in SNS activity. Second, emotion-based retelling would result in more nonoptimal than optimal choices in the decision-making task, while fact-based retelling would result in more optimal than nonoptimal choices in the task. Sixty undergraduates at a private, liberal arts university wrote about either a personally traumatic life event or a trivial topic for ten minutes and then participated in a decision-making task modeled after Epstein's ratio-bias (RB) paradigm. Impedance cardiography and a blood pressure cuff were employed to examine

autonomic arousal, such as heart rate (HR) , blood pressure (BP), respiratory sinus arrhythmia (RSA), and pre-ejection period (PEP) throughout the study. In partial support of our hypotheses, results indicated a significant degree of coupling between the PNS and SNS for those participants who wrote only about the emotions surrounding their trauma. Significant differences in the RB paradigm were found only in trial 1 of the task, with those writing about both the facts and emotions surrounding their trauma and those writing about trivial topics making the most optimal choices. Although these findings are promising rather than definitive, they suggest that the type of writing regarding a traumatic event invokes different cognitive and physiological processes.

Cognitive and Physiological Processes Underlying Written Disclosure

"I think of writing as a battle between my consciousness and my subconscious...that's my escape" (Nikida's response, Magee, 1999). This was one participant's response in a study that examined the role of written disclosure among female adolescents (Magee, 1999). In addition to serving as an escape, Magee (1999) found that young adults disclose traumatic events for a variety of reasons: To identify emotions, reflect upon the experience, and release sentiments of pain and anger. Research indicates that the outcomes accompanying disclosure of traumatic events surpass psychological benefits alone (Petronio, 2000; Pennebaker, 1995; Pennebaker, Hughes, & O'Heeron, 1987; Pennebaker & Beall, 1986). More specifically, emotional disclosure of traumatic events has been associated with short-term cardiovascular reactivity as well as long-term physical benefits, such as improved immune functioning and fewer visits to the health center (Pennebaker & Beall, 1986; Pennebaker, 1995; Petronio, 2000). For example, Pennebaker & Beall (1986) examined the physiological outcomes related to fact-based versus emotion-based disclosure of a traumatic event. All participants wrote about a personally traumatic event for fifteen minutes on four consecutive days. Those in the emotion-based group were asked to write about the feelings surrounding a personal trauma, while those in the fact-based group were asked to describe a personal trauma in a narrative fashion without referring to any personal feelings. Results indicated that those who wrote about the emotions surrounding a traumatic event displayed temporary increases in blood pressure as well as reductions in illness in the six months following the study as compared to those who wrote about the facts surrounding a traumatic experience. (Pennebaker & Beall, 1986).

The aim of the current study is to examine how disclosure fits into a larger model of cognitive processing. One model of cognitive processing is contained within Epstein's Cognitive-Experiential Self-Theory (CEST) (Epstein 1973; 1991; 1994; 1998). CEST asserts that humans rely upon two distinct yet parallel information processors, rational and experiential, to make sense of the world. The rational mode involves higher brain functioning and is driven by reason and deliberative thought, whereas the experiential mode involves lower brain functioning and is driven by affect (the pleasure-pain principle) and heuristics (Epstein, 1994). This study tested the proposition that disclosure is a function of experiential processing by examining the behavioral and physiological outcomes of written disclosure.

Experiential versus Rational Processing

Epstein's Cognitive-Experiential Self-Theory (1973) is a global theory of personality that proposes the existence of two parallel, interactive systems through which people understand and adapt to the world: A rational system and an experiential system. While all behavior and conscious thought are believed to result from the joint function of the two information processing systems, certain experiences more heavily engage one system over another (Epstein, 1994). The degree of dominance of each system is influenced by various factors, such as the nature of the event, individual differences in styles of thinking, and the degree of emotional involvement (Epstein, 1994). For example, emotional arousal and relevant experience are believed to increase relative engagement of the experiential system, while solving mathematics problems is believed to increase relative engagement of the rational system. While the two systems normally

collaborate in a seamless and interactive manner, they sometimes conflict. This conflict is experienced as a struggle between thoughts and feelings.

According to CEST (Epstein, 1994, 1998), the experiential system represents lower brain functioning and is a highly adaptive system that has evolved in human-like ancestors for over seven million years. It operates similarly in humans and nonhumans yet is more complex in humans, who have a more highly developed cerebral cortex and can use language. At its lower levels of operation, it is a crude system that automatically, rapidly, effortlessly, and efficiently processes information. The experiential system is experienced passively and relies primarily upon cognitive heuristics in determining thoughts and behavior. It is the human "default" option of the brain, resisting change and often functioning according to broad generalizations and the pleasure-pain principle (i.e., what feels good). Moreover, a fundamental distinction between the rational and experiential systems lies in the fact that the experiential system is intimately associated with affect and experience and the rational system with logic and reason.

The rational system is an evolutionarily newer system that dates back approximately 5,000 years and involves higher brain functioning (Epstein, 1998). It encodes reality in symbols, codes, and numbers and operates primarily in the medium of language. Because the use of written symbols, signs, and numbers is estimated to be less than 5,000 years old, the rational system is believed to be evolutionarily newer than the experiential system (Epstein, 1998). The rational system is a deliberative, effortful, abstract system that is experienced actively and consciously (Epstein, 1998). In contrast to the experiential system, the rational system is capable of high levels of abstraction and long-term delay of gratification. Furthermore, it is analytical, logical, and driven

primarily by reason and higher-order thinking. A detailed comparison of the rational and experiential systems can be viewed in Table 1 (Epstein, 1994, 1998).

Cognitive-Experiential Self-Theory and Behavior

As previously stated, Epstein proposes that all behavior typically results from a parallel, interactive collaboration of the experiential and rational systems (Epstein, 1998). The relative contribution of each mode varies from none at all to complete dominance (Pacini & Epstein, 1999). Under most circumstances, both systems operate synchronously, giving the appearance of a single process in function. Emotional involvement and relevant past experiences, however, shift the balance of influence in the direction of the experiential system (Epstein, 1998). Furthermore, certain conditions, such as individual differences in thinking styles and situational variables, result in a conflict between the two modes, distinguishing the qualities of one mode over the other (Pacini & Epstein, 1999).

While both systems are typically involved in determining behavior, Epstein asserts that the automatic processing of the experiential system is dominant over the rational system (Epstein, 1994). It is the effortless, efficient, more compelling "default" option of the brain that precedes and significantly influences the rational system (Epstein, 1994). Moreover, because the experiential system is intimately associated with affect, it is likely to be experienced as more compelling and passionate than logical thinking. Finally, because the influence of the experiential system is usually outside of awareness, it is not controlled by the rational system, as the individual is not aware that there is anything to control (Epstein, 1998).

Because the experiential system is driven by the pleasure-pain principle, dominance of the experiential system over the rational system often occurs in the presence of emotionally stimulating experiences. For example, when a person responds to an emotionally stimulating event, the following sequence of actions is believed to occur: The experiential system automatically searches its memory for related experiences and their "emotional accompaniments" (Epstein, 1994). Next, the recalled feelings result in further processing and reactions, which in subhuman animals are actions and in humans are conscious and unconscious thoughts and behaviors. If the related experiences stored in the memory bank are positive, then actions intended to reproduce the feelings are initiated. If the related stored experiences are negative, then actions are initiated in attempts to avoid the negative feelings (Epstein, 1994). Epstein asserts that in such emotionally stimulating events, the engagement of the rational system is minimal to none (Epstein, 1998). Consequently, this may be why individuals often respond in irrational, passionate, impulsive ways to experiences that are close to their hearts.

Historical and Research Support for the Existence of Two Cognitive Systems

Epstein (1994) claims that research from a variety of disciplines supports the existence of two fundamentally distinct cognitive systems. Historically, the earliest support for two cognitive systems dates back to Socrates, who, in Plato's Republic, recognized and discussed a conflict between desire and reason that is analogous to the conflict between the experiential and rational systems. In the realm of psychology, the most influential division of the mind has been Freud's psychoanalytic distinction between primary and secondary processes. Freud posited a distinction between the id, or the human unconscious that functions according to primary processes (the pleasure

principle), and the ego, the human consciousness that functions according to secondary processes (the reality principle). A variety of other psychologists have also suggested a distinction between two types of information-processors. For example, Pavlov (as cited in Epstein, 1994) proposed a distinction between a first and second signaling system, the former including nonverbal conditioning and the latter verbally mediated processes. Similarly, Labouvie-Vief (1989, 1990) distinguished between logos, a rational, analytical mode of information processing, and mythos, and intuitive, holistic mode (as cited in Epstein, 1994). Social psychologists Tversky and Kahneman (1974, 1983) introduced the concept of heuristics, or cognitive shortcuts, to conclude that there were two common forms of reasoning—a *natural,* intuitive mode and an *extensional,* logical mode. Furthermore, Bargh (1989), Higgins (1989), and Swann (Swann, 1984; Swann, Hixon, Stein-Seroussi, & Gilbert, 1990) demonstrated the existence of an automatic, preconscious processing that operates according to different rules than deliberative, conscious processing (as cited in Epstein, 1994). Thus, Epstein claims that the distinction between two fundamentally different modes of processing has been posited by a variety of researchers dating back to Socrates and Freud.

Everyday Behaviors as Support for Two Cognitive Systems

In addition to historical and research support, Epstein cites a variety of everyday human behaviors as support for the existence of a rational and experiential mode of processing (Epstein, 1973, 1994). Epstein points to the influence of emotions upon thinking as a prime illustration. For example, when experiencing intense emotions, many have heard the advice, "Get a grip on yourself, you're too emotional to think straight." According to Epstein, such advice illustrates that people are intrinsically aware of two

different modes of information processing, one that is emotionally driven and one that is rationally driven (Epstein, 1994).

Similarly, Epstein asserts that the influence of thinking upon emotions people's emotions also supports the distinction between the rational and experiential systems. According to him, people's emotions are a result of their interpretation of an event as opposed to the event itself (Epstein, 1994). For example, if a person interprets an action directed at him or her as unwarranted and deserving of punishment, the person will most likely feel angry. On the other hand, if the same action is interpreted as a serious threat to life from which escape is the desired response, the person will more likely feel frightened (e.g., Avail, 1980; Beck, 1976; Ellis, 1973; Epstein, 1984; Lazarus, 1982, as cited in Epstein, 1994). The preconscious processes that result in human evaluation and interpretation of daily events occur rapidly and automatically and precede the deliberative, linear, analytical thinking that is characteristic of the rational system (Epstein, 1994). Thus, Epstein asserts that such automatic, preconscious thinking suggests an information processing system that operates by different principles as compared to a deliberative, analytical method of thought.

Furthermore, Epstein points to the difference between insight and intellectual knowledge as further support for two cognitive systems. For example, researchers have shown that deriving knowledge experientially (via experience) is often more compelling and more likely to influence behavior than abstract knowledge (Brewin, 1989; Fazio & Zanna, 1981; Shiffrin & Schneider, 1977 as cited in Epstein, 1994). Information gained through personally meaningful experience has been shown to be more effective in changing feelings and behavior than information acquired through textbooks or lectures

(Epstein, 1994). Thus, Epstein asserts that the observation that there are two different types of knowledge, intellectual and insightful, parallels the idea that there are two kinds of information processors, analytic-rational and intuitive-experiential (Epstein, 1994).

Moreover, Epstein points to human beliefs such as irrational fears as further support for the existence of two modes of processing. First, irrational fears provide an automatic, illogical way of processing information (Epstein, 1994). People often acknowledge that such fears are irrational yet still maintain them. For example, those who make great efforts to drive everywhere in an attempt to avoid flying realize that statistically speaking, their fear is irrational. They are at greater risk of harm when driving as opposed to flying, yet they feel safer in a situation that they know intellectually to be more dangerous. According to Epstein, such an acknowledged discrepancy provides support for the existence of two different modes of processing.

In addition, Epstein claims that superstitious thinking supports the idea that humans' thoughts do not rely solely upon an intellectual, rational system. A recent Gallup poll surveyed 1,236 adults to find that one in four reported believing in ghosts, one in six said reported communicating with someone deceased, one in four reported communicating telepathically with someone, and one in seven believed they had seen a UFO (Epstein, 1994). Such data illustrate that irrational thinking is common and that beliefs are not composed solely of factual or rational information.

Empirical Research on Heuristic Processing in Support of Cognitive-Experiential Self-Theory

In addition to everyday behaviors, Epstein uses a variety of research on heuristic-based processing as further support for CEST. Heuristic processing refers to the use of

cognitive shortcuts for making decisions under situations of uncertainty. Heuristic processing can but does not necessarily occur under emotionally stimulating circumstances (Epstein, 1991). Much of the work on heuristic processing is based upon work done by Tversky and Kahneman (1974; 1983) which demonstrates that people often think in heuristic ways that are automatic, rapid, and efficient yet sometimes produce errors when judged against logical standards (Epstein, 1991). A series of studies conducted by Sloat (1992) and Epstein et al. (1992; 1993; 1994; 1999) found that individuals engaged in a variety of heuristic-based processing, as demonstrated by arbitrary-outcome-oriented processing, sequential processing, and the ratio-bias phenomenon. According to Epstein and his colleagues (1994), such heuristic-based processing further supports the existence of a rational and experiential information processor as proposed by CEST.

Arbitrary-outcome-oriented processing. Epstein et al. (1992) modeled this study after a study conducted by Tversky and Kahneman (1983). In the original Tversky and Kahneman (1983) study, participants were asked to imagine a scenario in which two individuals arrive at the airport thirty minutes after their scheduled departure time. One individual realizes that her flight left on time, while the other learns that, due to a delay, her flight just left a few minutes ago. Despite the fact that from a logical perspective, the differences in the two situations should not matter, participants consistently reported that they would be more upset in the latter condition (Tversky & Kahneman, 1983).

Epstein suggests that this behavior supports the existence of two different modes of processing. As illustrated, emotion-provoking stimuli, such as imagining that one has missed his/her flight, caused people to consciously disregard reason and rely solely upon

automatic, irrational, experiential processing. According to Epstein, these results also support the idea that the experiential system is associationistic; in other words, the experiential system connects events by similarity and proximity as opposed to an understanding of causality. This was demonstrated by the effect that heuristic, or experiential, processing had upon the rational system. As evidenced in the Tversky and Kahneman study (1983), heuristic processing led people to judge events that were arbitrarily related as causally related.

Sequential processing. To support the claim that the experiential system is a rapid, automatic information processor that precedes the functioning of the rational system, Epstein and colleagues (1993) asked participants to respond to vignettes that described random unfortunate outcomes by writing the first three thoughts that came to mind (Epstein, 1993). For example, one vignette asked participants to put themselves in the place of a protagonist who had an accident when backing his automobile from a space in which his friend had asked him to park. Participants reported that their first emotion was one of anger: "It's his fault. Except for him, I wouldn't have had the accident." By their third thought, however, their thinking was more rational, accepting the responsibility as their own and reporting feelings of guilt as opposed to anger (Epstein, 1993). Consistent with CEST, participants' initial, automatic thought was one of intense emotion associated with the functioning of the experiential system. Upon reflection, however, their thoughts were more consistent with the operation of the rational system, supporting the assumption that the experiential system is a rapid, automatic system that precedes the operation of the more reflective, deliberative rational system (Epstein, 1993).

The ratio-bias phenomenon. The ratio-bias phenomenon, according to Epstein, serves as the most compelling evidence in support of the existence of two distinct modes of processing. This phenomenon becomes evident in the presence of an experimental procedure designed to set the experiential and rational modes in conflict with each other (Kirkpatrick & Epstein, 1992). Epstein calls this test of the ratio-bias phenomenon the ratio-bias task. The ratio-bias (RB) phenomenon occurs when participants assess a lower probability event as being more likely than a higher probability event when the lower probability is presented as a ratio of larger numbers (i.e., 10 in 100) and the higher probability event is given in smaller numbers (e.g., 1 in 10) (Pacini & Epstein, 1999).

This phenomenon first became evident through a series of studies conducted by Miller, Turnbull, and McFarland (1989, as cited in Denes-Raj & Epstein, 1994). These studies showed that people judge the same probability of an unlikely event as lower when the probability is presented in the form of a ratio of smaller rather than of larger numbers. For example, results indicated that participants believed that a mother would be more suspicious that her child had cheated (by peeking) if he succeeded in drawing a desired chocolate chip cookie from a jar that contained 1 chocolate chip cookie of 20 cookies, than if he drew the desired cookie from a jar that contained 10 chocolate chip cookies of 200 cookies (Miller et al., 1989, as cited in Denes-Raj & Epstein, 1994). In other words, drawing the one desired cookie from a jar of twenty cookies was considered to be less likely, and therefore it aroused greater suspicion than drawing one of the 10 desired cookies in a jar containing 190 other cookies (Kirkpatrick & Epstein, 1992).

According to Kirkpatrick & Epstein (1992), the ratio-bias effect can be explained by two principal attributes of the experiential system: the concretive principle and the

experiential learning principle. According to the concretive principle, people primarily encode information in the experiential system in the form of concrete representations (such as absolute numbers) as opposed to abstract representations (such as the relations between numbers). Thus, because absolute numbers are more concrete than ratios, people should generally be more influenced by absolute numbers. Moreover, ratios between large numbers often seem experientially less extreme than rations between small numbers. This is also attributed to the concretive principle; because large numbers of items are less pronounced in memory (i.e. are less concrete) than small numbers, "they are more likely to be perceived as closer to a ratio of equal quantities" (Kirkpatrick & Epstein, 1992). This follows partly from the fact that people can keep approximately seven pieces of information in their short-term memory. Therefore, people can more accurately represent one versus ten items in memory than ten versus one hundred items (Pacini & Epstein, 1999).

Furthermore, according to the experiential learning principle, the schemata that exist in the experiential system represent generalizations from emotionally significant experiences (Kirkpatrick & Epstein, 1992). Consequently, through emotionally significant experiences in their lives, individuals are likely to have learned that any event with a 1-in-20 or 1-in-any-large-number is unlikely to occur. In other words, people have come to learn that the phrase "1 in x odds" is understood to mean "unlikely." For this reason, CEST asserts that the subjective probability of a 1-in-10 outcome is smaller than a 10-in-100 outcome. Thus, when combined, the concretive and experiential learning principles assert that "an unusual event with a given objective probability of occurrence

will have a higher subjective probability when it is represented by larger than by smaller absolute numbers" (Kirkpatrick & Epstein, 1992).

Based on these principles, Kirkpatrick and Epstein (1992) hypothesized that the experiential system would be more responsive to absolute numbers than to ratios, whereas the rational system would exhibit the reverse pattern. To test this hypothesis, the Miller et al. (1989) paradigm was modified to make it a suitable for study in the laboratory as a real experience: Participants were given the opportunity to win money by drawing a red jelly bean from one of two bowls, a small bowl that contained 1 in 10 red jelly beans, and a large bowl that contained 10 in 100 red jelly beans. Participants were told that in order to be able to select the bowl from which they wanted to draw, they would have to pay a dime for every trial; otherwise, the bowl from which they selected would be determined randomly. Although both bowls yielded a 10% of drawing a red jelly bean, participants tended to prefer the large bowl as compared to the small bowl (Kirkpatrick & Epstein, 1992). Moreover, a considerable proportion of participants paid dimes in order to have the privilege of choosing the large bowl over the small one (Kirkpatrick & Epstein, 1992). Participants acknowledged that they felt irrational and foolish in paying to draw from the larger bowl, but they felt that they had a better chance of drawing a red jelly bean when there were more of them (Kirkpatrick & Epstein, 1992).

In a subsequent form of the study in which subjects were presented with a vignette of the jelly bean paradigm *without* the opportunity to win money, the majority of participants reported that they did not have a preference between the two bowls and would not pay extra money to be able to select the bowl from which they chose (Kirkpatrick & Epstein, 1992). When asked to guess how others would respond,

however, participants reported that most people would prefer to draw from the larger bowl (Kirkpatrick & Epstein, 1992).

The ratio-bias phenomenon has also been replicated in extreme versions of the ratio-bias paradigm in which the probabilities between the large and the small bowls are different. In two experiments (Denes-Raj & Epstein, 1994), participants preferred to choose from the large bowl that promised a 9% chance of winning as compared to the small bowl that promised a 10% chance of winning. A minority of participants (20%-30%) even chose to draw from the large bowl even when they knew it offered a 5% chance of winning as compared to the small bowl which offered a 10% chance of winning (Denes-Raj & Epstein, 1994). Among those who made nonoptimal choices, many acknowledged a conflict between emotion and reason and recognized that they had acted irrationally (Denes-Raj & Epstein, 1994). These results demonstrate the dominance of the experiential system over the rational system in a simple task in which the two systems were placed in conflict with each other. Under these circumstances, the majority of participants found their intuitive (experiential) judgments to be more compelling, despite their explicit recognition that their behavior was irrational (Denes-Raj & Epstein, 1994).

Epstein cites the results obtained from the ratio-bias paradigms as support for a variety of CEST assumptions. First, Epstein asserts that the conflict produced by the RB paradigm was due to a conflict between the rational and experiential systems. A majority of participants were initially attracted (in their experiential system) to the large bowl because it contained more winning beans and later recognized (in their rational system) that it made no difference from which bowl they chose. Despite this realization, the

decision invoked by the automatic, change-resistant experiential system dominated the participant's behavior in many cases. Second, the results of the ratio-bias paradigms support the Kirkpatrick and Epstein hypothesis (1992) that the experiential system is more responsive to concrete as compared to abstract representations. Third, the fact that participants expressed no preference to either tray when the opportunity to win money was revoked demonstrates that individuals have the need to appear rational; in the emotionally-stimulating trial, however, in which money was a factor, participants readily relied upon their experiential system. This supports the assertion that the experiential system is more heavily engaged in the presence of emotional stimuli (Kirkpatrick & Epstein, 1992). Moreover, results indicate that in order to demonstrate the ratio-bias phenomenon, it is necessary to "either bypass the rational system by using indirect techniques (such as having subjects estimate the behavior of others) or to strongly engage the experiential system by providing significant rewards" (Kirkpatrick & Epstein, 1992). Lastly, the extreme versions of the ratio-bias paradigm (Denes-Raj & Epstein, 1994) illustrate that the experiential system can override the rational system even when individuals acknowledge their irrationality (Kirkpatrick & Epstein, 1992).

Summary of CEST

In summary, Epstein's CEST model asserts that all beings employ two distinct modes of information processing to make sense of the world. The experiential system is the evolutionarily older cognitive system and represents crude, lower brain functioning. It is experienced automatically, resistant to change, and driven by heuristics and the pleasure-pain principle. The rational system, on the other hand, is the evolutionarily new system and represents abstract, higher brain functioning. It is experienced intentionally,

changes more rapidly, and is driven by reason. A variety of research as well as everyday behaviors support the general distinction between two evolutionarily distinct cognitive systems. More specifically, however, a variety of studies conducted by Epstein and others (Tversky & Kahneman, 1983; Miller et al., 1989; Epstein et al., 1992; Epstein et al., 1993; Epstein, 1994; Denes-Raj & Epstein, 1994) demonstrate that individuals engage in different types of heuristic-based processing. These results support the distinction between a rational and experiential mode of processing as proposed by CEST. In an attempt to fit disclosure into Epstein's CEST model, this study examined the cognitive and physiological processes that underlie written disclosure. To do so, however, it is necessary to examine prior research that examines the physiological effects of disclosure.

Disclosure

A variety of studies indicate that disclosure of traumatic events is associated with temporary increase in cardiovascular reactivity as well as long-term health benefits (Pennebaker, 1995). Many of the studies examining expression of emotions and health benefits utilize a writing paradigm developed by Pennebaker and associates, in which subjects are randomly assigned to write about emotional or control topics over a 4-day period for fifteen minutes a day in the laboratory (Pennebaker, 1995). Pennebaker and Beall (1986) used this paradigm to examine the physiological consequences of writing across four conditions: trauma-fact, trauma-emotion, trauma-combination, and control. The trauma-fact condition was asked to describe an upsetting personal experience in a narrative fashion, being careful to focus on the event itself and not on the feelings surrounding the event. The trauma-emotion condition was instructed to write specifically

about their feelings regarding a personally upsetting experience without mentioning what had actually happened. The trauma-combination condition was asked to describe the facts as well as the emotions surrounding a personally traumatic experience. The control condition was asked to write about a different trivial topic each evening (a description of their living room during the first session, the shoes they were wearing for the second session, and a tree and the room they were sitting in for the third and forth sessions, respectively). Health center records, physiological measures and self-reported moods and symptoms were collected during the study.

Results indicated that writing about earlier traumatic experiences was associated with both short-term increases in physiological arousal (increased heart rate and blood pressure) and long-term decreases in health problems (as measured by the number of reported illnesses and the number of visits made to health services in the 6 months following the experiment). These effects were most pronounced among subjects who wrote about both the trauma and their emotions associated with the trauma. Of the 127 trauma essays, 27% dealt with the death of a close friend, family member, or pet; 20% involved boyfriend/girlfriend problems; and 16% discussed fights among or with parents and friends. Other traumatic topics included major failure, public humiliation, car accidents and health problems. On the other hand, participants who wrote only about the facts surrounding a traumatic event without referring to their own emotions were similar to the control subjects on most physiological, health, and self-report measures. These two conditions reported more health problems in the 6 months following the experiment as compared to the trauma-emotion and trauma-combination participants. The results of this study provide further support for the idea that disclosure, particularly emotion-based

disclosure of traumatic events, is associated with short-term increases in physiological reactivity and long-term health benefits.

Disclosure and long-term health benefits. That emotion-based disclosure is associated with improved long-term physiological outcomes is also supported by a variety of other studies. For example, researchers have discovered that writing about traumatic experiences is linked to improved immune functioning, decreased numbers of physician visits for illness, and improved performance at school and work (e.g., Esterling, Antoni, Fletcher, Margulies, & Schneiderman, 1994, as cited in Pennebaker, 1995). Similarly, other studies indicate that failure to talk or acknowledge significant experiences is associated with increased health problems, autonomic activity, and ruminations (Pennebaker, 1995; Wegner, 1994, as cited in Pennebaker, 1995).

For example, across several surveys, college students and adults who reported experiencing some type of traumatic event (e.g., sexual or physical abuse, death or divorce of parents) were more likely to report current health problems if they had not disclosed the trauma to others than if they had shared it (Pennebaker & Hoover, 1986; Susman, 1986, as cited in Pennebaker, 1995). These results were obtained independent of measures of social support (Pennebaker & Hoover, 1986). Similarly, a survey of spouses of suicide and accidental-death victims revealed that those individuals most likely to become ill in the year following the death were ones who had not confided in others about their experiences (Pennebaker & O'Heeron, 1984).

Other researchers have also shown that inhibition, or a reduction in the ability to disclose stressful events, may be linked to an increased likelihood of illness. For example, the use of a repressive coping style has most frequently been associated with

the onset or progression of cancer (Gross, 1989). In addition, a number of investigations have found an association between repressive personality styles and poor natural killer cell (NKC) activity, the most readily measurable element of immune function with relevance to the control of tumors (Levy, Herberman, Maluish, Schlien, & Lippman, 1985).

Conversely, the expression of emotions in the laboratory, particularly negative emotions, has been associated with improved immune functioning, namely transient changes in blood lymphocyte reactivity to mitogens (Knapp et al., 1992; Zakowski, McAllister, Deal, & Baum, 1992, as cited in Pennebaker, 1995) and with small elevations in natural killer cell (NKC) activity (Futterman, Kemeny, Shapiro, Polonsky, & Fahey, 1992, as cited in Pennebaker, 1995).

Disclosure and short-term physiological arousal. The finding by Pennebaker and others (Pennebaker & Beall, 1986; Pennebaker & O'Heeron, 1984; Pennebaker, 1995 Petronio, 2000) that cardiovascular arousal increases during and immediately after emotion-based self-disclosure has also been validated in other studies. For example, a study that asked participants to verbally disclose an extremely stressful events that had happened in their lives indicated that those classified as high disclosers displayed increased systolic and diastolic blood pressure as well as increased heart rate during disclosing as compared to low disclosers (Pennebaker, Hughes, & O'Heeron, 1987). In addition, Cumes (1983) found that heart rate and blood pressure of participants increased when answering the question, "What makes you angry" as compared to "What did you do today" (as cited in Petronio, 2000). These findings contribute to the evidence that disclosure of emotional events results in temporary increases in cardiovascular reactivity.

Sympathetic versus parasympathetic control of the heart. While the studies described above rely upon increases in heart rate and blood pressure as evidence for increased cardiovascular reactivity during and following disclosure, these measures alone cannot indicate the activity of the two divisions of the autonomic system, the parasympathetic nervous system (PNS) and the sympathetic nervous system (SNS). Recent research indicates that these two divisions can co-vary reciprocally, independently, or nonreciprocally (Berntson, Cacioppo, & Quigley, 1993). For example, an increase in heart rate may arise from a decrease in parasympathetic (vagal) control, an increase in sympathetic expenditure, or a co-activation of both autonomic divisions (Berntson, Cacioppo, & Quigley, 1991; Quigley & Berntson, 1990, as cited in Berntson et al., 1993). Moreover, studies have found that stimuli that invoke low brain functioning, such as cold pressor tasks, result in different patterns of cardiovascular reactivity than stimuli that invoke high brain functioning, such as mental arithmetic tasks (Tomaka, Blascovich, Kelsey & Leitten, 1993). These findings suggest that events involving high brain functioning involve one type of activation whereas lower brain functioning involves another. More specifically, when applying this proposition to Epstein's CEST model, it should follow that events primarily invoking the experiential system (lower brain functioning) should result in different patterns of sympathetic and vagal activity than those events primarily invoking the rational system (higher brain functioning).

Respiratory sinus arrhythmia (RSA) has been demonstrated to serve as an indicator of vagal control of the heart (Berntson et al., 1993). Berntson et al (1993) define RSA as a "rhythmical fluctuation in heart periods at the respiratory frequency that

is characterized by a shortening and lengthening of heart periods in a phase relationship with inspiration and expiration." In other words, RSA is an alteration in the rhythm of heartbeat in either time or force related to breathing. RSA has shown a high degree of sensitivity to psychological and behavioral variables, thus increasing its use as an indicator of vagal control of the heart. For example, cognitive stressors such as mental arithmetic tasks have been shown to increase heart rate and decrease RSA (Berntson et al., 1993).

In contrast to RSA, pre-ejection period (PEP) has been demonstrated to serve as an indicator of sympathetic control of the heart (Sherwood, 1993). Few studies have examined PEP when investigating the relationship between cardiovascular reactivity and disclosure; instead, most studies have examined other factors, such as heart rate, stroke volume, cardiac output, and finger temperature (Richards & Gross, 1999). PEP is a measure of isovolumic contraction time, which is the time during which the left ventricle of the heart contracts before ejecting blood into the aorta (Sherwood, 1993). Thus, PEP is a measure of contractility, or how hard the heart is beating. For this reason, an inverse relationship exists between contractility and PEP: As contractility increases, PEP becomes shorter and vice-versa (Sherwood, 1993). How hard the heart beats (as opposed to how fast) is a function solely of sympathetic nervous system activity. Therefore, in examining autonomic reactivity in this study, we used PEP and RSA as indicators of sympathetic and parasympathetic activation, respectively.

Based on past research examining Cognitive-Experiential Self-Theory, disclosure, and physiological reactivity, I used Pennebaker & Beall's writing paradigm (1987) to examine whether emotional and rational disclosure respectively invoked experiential and

rational processes, respectively. I hypothesized that the trauma-fact and trauma-emotion writing conditions would invoke two different modes of processing: Participants disclosing the facts surrounding their trauma were expected to invoke their rational mode of processing, while those disclosing the emotions surrounding their trauma were expected to invoke their experiential system. I tested this hypothesis by examining participants' behavioral outcomes (as measured by the decisions made in the RB paradigm) following the written disclosure task. Consequently, based on these hypotheses, I expected participants' performances in the decision-making task to be consistent with the writing condition to which they were assigned. Thus, if participants invoked their rational system through fact-based disclosure, they should have more frequently chosen from the smaller tray that yielded an equal or greater chance of success as compared to the larger tray. If, however, participants invoked their experiential system through the emotion-based disclosure, they should have more frequently chosen from the larger tray that yielded a lower chance of winning. No hypotheses were made for the trauma-combination condition, in which participants wrote about the facts and emotions surrounding a traumatic experience. Given that this was a combination condition, it was included for comparison purposes to the conditions with one of each only. Additionally, no behavioral hypotheses were made for the control condition, in which participants described their campus bedroom. This also served as a control condition for writing.

I also hypothesized that the trauma-fact and trauma-emotion disclosure conditions would result in differences in autonomic space. To examine the physiological outcomes of disclosure, heart rate (HR), blood pressure (BP), pre-ejection period (PEP), and respiratory sinus arrhythmia (RSA) were recorded throughout the writing and decision-

making tasks as indicators of sympathetic and vagal activity. First, consistent with the literature that associated emotional disclosure with increased cardiovascular reactivity (Pennebaker & Beall, 1986; Pennebaker, 1995; Petronio, 2000), those in the trauma-emotion condition (i.e. experiential mode) were expected to display overall increases in physiological arousal as compared to those in the trauma-fact and control conditions. Second, based on the assertion that events involving high versus low brain functioning involve different types of activation, I expected to see different patterns of autonomic arousal between the two writing groups. I posited that those in the trauma-emotion condition (i.e. experiential mode) would display autonomic patterns associated with lower brain functioning, marked by an increase in sympathetic activity coupled with a decrease in vagal activity. Conversely, I hypothesized that those in the trauma-fact condition (i.e. rational mode) would display autonomic patterns associated with higher brain functioning, marked by diverse sympathetic and vagal activity. Such patterns included an increase in sympathetic activity with no change in vagal activity and a decrease in vagal activity with no change in sympathetic activity. The existence of such patterns of autonomic reactivity between writing conditions would support the claim that emotional and rational disclosure invoked the experiential and rational systems, respectively.

Method

Participants

Sixty undergraduates were recruited as participants from an Introductory Psychology course at Illinois Wesleyan University, a small, private, liberal arts institution. Of these, 24 were male and 36 were female. Ages of the participants ranged

from eighteen to twenty-two. Each received one research credit toward their general psychology course requirements for participating.

Measures

Ratio-bias paradigm. Participants were presented with two rectangular, transparent, plastic trays containing different mixtures of red and white jelly beans. The large and a small trays were always presented together. The small tray contained a total of 10 jelly beans, 1 of which was red (10% red). The large tray contained a total of 100 jellybeans, with the number of red jelly beans varying among trials from 7, 9, and 10, (7%, 9%, and 10% red). The jellybeans were spread in a flat layer so that all were visible. An index card stating the percentage of red jelly beans and the number of red and white jelly beans was placed in front of each tray for each trial.

Rational-Experiential Inventory (REI). This 40-item inventory (Epstein, 1999) was designed to measure rational and experiential thinking styles. Items on the scale included questions such as, "I try to avoid situations that require thinking in depth about something," and "I like to rely on my intuitive impressions." Participants responded to statements on a 5-point scale ranging from "Definitely false" to "Definitely true." As individual differences may have been related to this construct, I included this measure as a potential co-variate (see Appendix A for REI and REI scoring key).

Letter-circling task. Participants engaged in a letter-circling reaction time task during which their cardiovascular measures, performance, and reaction time were recorded. The objective of this task was to control for the confound of arousal. For example, differences in arousal would predict impaired performance on complex tasks, such as the ratio-bias task, and improved performance on simple tasks, such as the letter-

circling task (Zajonc, 1965). Participants were given a page of text and asked to circle every letter "e" as quickly and accurately as possible (see Appendix B). Participants were told that they would be timed, and their reaction time was recorded with a stopwatch. This task emulated computer-based tasks that have repeatedly been used to examine reaction time in response to simple stimuli. Uniformity of task performance between participants during this task would suggest that any performance differences in the ratio-bias task across the four writing conditions could not be accounted for by arousal differences.

Physiological. ZCG, a non-invasive measure of blood flow through the heart, and ECG, a measure of the electromechanical action of the heart, was obtained using a Minnesota Impedance Cardiograph (model 304B) employing the standard tetrapolar aluminum/mylar tape electrode system. The electrodes were adhesive bands that completely encircled the body. The second band was placed at the base of the neck; the first band was placed at least 3 cm above the second band; the third band was placed at the level of the xiphisternal junction (or just below the bra line for female participants); the fourth band was placed at least 3 cm below the third band. The front and back distances between the inner edges of the second and third bands were recorded for use in data reduction. The impedance signals of primary interest were Zo, a measure of basal thoracic impedance, and dZ/dt, a measure of changes in thoracic impedance. ECG was recorded using the standard lead II configuration with Ag/AgCl disposable electrodes (Protrace 9113). Blood pressure, a measure of pressure within the arteries, was obtained using a get from lab Monitor (model BP-508). Blood pressure was obtained from a self-inflating cuff.

Procedure

Upon arrival at the laboratory, participants were informed of the general nature of the study and completed an informed consent form (see Appendix C). Participants were then seated in the recording chamber, and a blood pressure cuff and various sensors/transducers were attached. Participants rested for up to one minute while the physiological signals were checked and calibrated. Then, the first five-minute baseline recording was obtained. The experimenter left the room during the baseline recording to allow the participant to relax (see Appendix D for log sheet used to record pulse and blood pressure).

After the 5-minute baseline recording, the experimenter returned to the recording room. Participants were then given paper and a pencil and introduced to one of four writing topics: trauma-fact, trauma-emotion, trauma-combination, and control (see Appendix E, F, G & H for respective writing instructions). All sixty participants were randomly and equally assigned to one of the four writing conditions, N=15. The experimenter left the room again during the writing task to give the participant privacy. The participants randomly assigned to the trauma-fact condition were told to discuss a personally traumatic experience from a strictly factual perspective, (i.e. discuss when, where, and what happened), without referring to their emotions at all. Those assigned to the trauma-emotion writing condition were asked to focus on how they felt at the time of the trauma and how they felt now, omitting any discussion of the facts surrounding the experience. Those assigned to the trauma-combination condition were asked to write about the facts and emotions surrounding a personally traumatic experience, focusing on what happened, how they felt then, and how they felt about it now. The control condition

was asked to write about their campus bedroom in detail, describing the furniture, colors, and pictures in their room. Physiological reactivity was measured during the task.

After ten minutes of writing, the experimenter returned, and participants were introduced to the ratio-bias task and the letter-circling task in counterbalanced order. During the ratio-bias task, participants were told that they had the opportunity to win money by drawing a red jelly bean from one of the trays (see Appendix I for instructions). The net amount that could be won ($9) was placed on the table in full view in play money, and this play money was exchanged for real money at the end of the study. Participants were told that they could win $1 upon drawing a red jelly and would neither win nor lose money upon drawing a white jellybean. Participants were given the opportunity to select which tray they would draw for each trial.

The ratio-bias task consisted of nine trials. The first six trials varied by percentage of red jelly beans in the large tray (7%, 9%, 10%). A Latin-square design was used to vary the order of the trials. The last three trials were trials in which the large tray contained either 40% or 50% red jelly beans, and the small tray contained either 50% or 40% red jelly beans, respectively. These trials were not included in the statistical analyses and were included solely to increase the likelihood that all participants would win some money.

For each trial, the experimenter presented the two labeled trays of jelly beans and read a script explaining the valence of each tray. The participant was then asked to indicate the tray from which he or she wanted to draw (see Appendix J for RB recording logs). Tray positions were altered on every trial to control for a position effect (i.e., right or left). After the participant chose a tray, the experimenter placed a blindfold on the

participant's eyes, mixed the jelly beans, and guided the participant's hand toward the selected tray. Depending on the outcome of each trial, the participant was either paid (won by drawing a red jelly bean) or had nothing happen (drew a white jelly bean). Autonomic reactivity was measured throughout the entire task. Upon completion of the ratio-bias task and the letter-circling task, the recording apparatus was removed, and the participant completed the Rational-Experiential Inventory (REI) and a demographics form (see Appendix K for demographics form). Upon completion of the self-report measures, participants underwent a verbal emotional assessment. An emotional assessment was completed as part of the debriefing process to ensure that the participant was not adversely affected as a result of the written disclosure (see Appendix L). If the participant was emotionally stable, he/she was thanked and debriefed (see Appendix M). The entire procedure took approximately 1 hour.

Results

Manipulation check

In order to examine whether effects were consistent with prior literature, manipulation checks were included. First we examined whether heart rate (HR) and mean arterial pressure (MAP) increased from the rest period to the writing period in a way consistent with past research (Pennebaker & Beall, 1987; Pennebaker et al., 1987). A within-subjects analysis of variance (ANOVA) tests indicated main effects, marked by significant increases in heart rate, F (2, 53)=55.3, $p < .05$, and mean arterial pressure, F (2, 53)= 16.4, $p < .05$, from the last minute of rest to the first minute of writing. (Refer to Table 2 for mean values). We did not find significant differences, however, in heart rate,

F (6, 108)=.26, $p > .1$, and mean arterial pressure, F (6, 108)=.11, $p > .1$, by writing condition.

Manipulation checks also examined 1) whether decisions made in the ratio-bias (RB) task mirrored past trends, and 2) whether participants' scores on the Rational-Experiential Inventory (REI) predicted choices made in the ratio-bias (RB) task as found previously. In examining the average number of optimal and nonoptimal choices made in the RB task, our results replicated prior findings (Pacini & Epstein, 1999): Overall, participants made more optimal (M=2.6, SD=1.1) as compared to nonoptimal (M=1.3, SD=1.1) choices across the 6 RB trials, but did make nonoptimal choices. (Recall that there were a total of 9 RB trials, yet the last 3 trials in which the valences of the small and large tray varied between 50% and 40% were included only to increase the chances that participants would win money; these 3 trials were not included in our statistical analyses. Additionally, recall that for two of the six trials, valences in the two trays were equal, and hence the decisions made did not reflect an optimal versus nonoptimal decision).

To examine the relationship between participants' scores on the REI and choices made in the RB task, we conducted a median split to separate those classified as high vs. low experiential/rational thinkers. Those participants with median scores were eliminated from the sample, yielding N=46 scores remaining. A univariate ANOVA indicated that optimal choices made by those low in total rationality (M=2.85, SD=1.2) were not significantly different from those high in rationality (M=2.6, SD=1.1), F=.24, $p > .1$. In addition, a univariate ANOVA revealed that those low in total experientiality made optimal choices (M=2.7, SD=1.1) that were not significantly different from those high in total experientiality, (M=2.8, SD=1.2), F=.04, $p > .1$. Thus, there were no

significant differences in the number of optimal choices made between those classified as high versus low experiential or rational thinkers[1]. These results are inconsistent with past research (Pacini & Epstein, 1999) that found a direct relationship between total rationality scores on the REI and the number of optimal choices made on the RB paradigm.

Finally, one potential confound in our study was participants' level of arousal. As discussed above, differences in arousal would predict impaired performance on complex tasks, such as the RB task, and improved performance on simple tasks, such as the letter-circling task (Zajonc, 1965). Thus, to control for this confound, we included a simple reaction-time task in which participants' circled every letter "e" they found in a paragraph of text. Participants' reaction time and performance on this letter-circling task were measured and analyzed as an indicator of whether any physiological arousal from the writing task might have also influenced decisions made in the RB task. To check for differences in the effects of arousal by writing condition, one-way analyses of variance were used to compare participants' accuracy and reaction time in performing the letter-circling task across the four writing conditions. Results indicated no significant differences in the reaction time, F (3,56)=1.3, $p > .1$, number of missed E's, F (3,56)=.01, $p > .1$, or the number of non-E's circled, F (3,56)=.56, $p > .1$, by writing condition. Because the letter-circling task was counterbalanced with the ratio-bias task throughout the study, we also examined reaction time and performance on the letter-circling task for those participants who participated in the letter circling task immediately after writing (as opposed to immediately following the RB task). This manipulation was included to

[1]When including the median scores in the high experiential/rational groups, the effects were the same. Mean number of optimal choices = 2.8 (SD=1.22) & 2.7 (SD=1.15) for those who scored high and low in rationality, respectively.

account for the possibility of the declining arousal effects of disclosure for those who participated in the circling task immediately after disclosure. Again, results indicated no difference in reaction time, F (3,26)=2.66, $p > .1$, number of missed E's, F (3,26)=1.73, $p > .1$, and number of non-E's circled, F (3,26)=.06, $p > .1$, by writing condition. These results suggest that any performance differences in the RB task across the four writing conditions were not accounted for by arousal differences.

Effects of writing conditions on the ratio-bias task

We first ran a frequency check to examine outliers; no outliers were found. The mean number of optimal choices among each writing condition was the following: trauma-fact M=2.4 (SD=1.2), trauma-emotion M=2.4 (SD=1.1), trauma-combination M=2.6 (SD=1.2), control M=2.9 (SD=1.0). A one-way ANOVA found that these differences were not significant, F (3,56)=.528, $p > .1$. Because the order of the RB and letter-circling task was counterbalanced throughout the study, we next filtered the data to examine only those participants who participated in the RB task immediately following the writing task. A one-way ANOVA found no significant differences between the four groups in this condition, F (3, 26)=1.09, $p > .1$.

As a follow-up, we examined contrasts comparing the number of optimal decisions for each of the 3 trauma conditions (trauma-fact, trauma-emotion, and trauma-combination) to the 1 non-trauma (control) condition for all 6 trials of the RB task. A Student's T-test indicated no significant differences between the trauma-fact and control group, trauma-emotion and control group, or trauma-combination and control group, $p > .1$ in all cases. Next we examined the effect of writing on just the first trial of the RB task. A Pearson chi-square test indicated significant differences in the frequency of types

of choices made across the different writing conditions in trial 1 of the RB paradigm, x^2 (3, $\underline{N}$=60)=14.4, $\underline{p} < .05$. More specifically, participants in the control condition made the most optimal choices in trial 1 of the RB paradigm (11 optimal choices compared to 1 nonoptimal choice), followed by the trauma-combination condition (6 optimal choices compared to 1 nonoptimal choice), the trauma-emotion condition (5 optimal choices compared to 6 nonoptimal choices) and the trauma-fact condition (4 optimal choices compared to 6 nonoptimal choices). (Refer to Table 3 for mean scores). Inspection of these frequencies revealed 91% and 85% optimal choices made by the control and trauma-combination conditions (respectively) in trial 1, as compared to 41%, and 40% optimal choices made by the trauma-emotion and trauma-fact conditions, respectively. Thus, these results suggest that those in the trauma-combination and control conditions may have been processing in the rational mode, whereas those in the trauma-emotion and trauma-fact conditions may have been processing in the experiential mode. Given that the effects were not significant across all 6 trials, these results also suggest that the cognitive effects of the writing task may be short-lived.

The above analyses, however, did not filter the equal optimality trials (trials in which the probability of drawing a red jelly bean was equal in the two trays) from the optimal and nonoptimal trials. Therefore, as a follow-up analysis to ensure that the overall effect was not somehow due to the equal valence trials, we repeated the chi-square test after filtering out any trials in which the trays contained equal percentages of red jelly beans. Again, results indicated significant differences in the frequencies of types of choices made by participants in different writing conditions in trial 1 of the RB task, x^2 (3, $\underline{N}$ = 40) = 9.6, $\underline{p} < .05$. These significant differences were also replicated

when examining the number of optimal choices on trial 1 of the RB task only for those who participated in the RB task immediately after writing, x^2 (6, N=30) = 10.5, $p < .05$.

Effects of writing condition on autonomic activation

As discussed above, autonomic space is measured by respiratory sinus arrhythmia (RSA) and pre-ejection period (PEP). RSA is an indication of parasympathetic activity; as RSA increases, parasympathetic control of the heart increases. PEP is an indication of sympathetic activity; as PEP decreases, sympathetic control of the heart increases. Correlational analyses were conducted to examine the effects of writing condition on autonomic activation. Specifically, we examined the correlation between the change in RSA and the change in PEP from the last minute of the rest period to the first minute of writing. The greater the correlation between these two variables, the greater the coupling of the sympathetic and parasympathetic divisions of the autonomic nervous system. (For all tests with rejection criteria set at $p < .05$, only the correlation for the trauma-combination condition was significant). (Refer to Figures 1-4 for scatter graphs indicating degree of sympathetic and parasympathetic coupling by writing condition).

Inspection of autonomic coupling revealed a relatively small correlation between the change in RSA and the change in PEP during the first minute of writing for those in the trauma-fact condition, $r=.28$, n.s. This indicated relatively weak coupling of the sympathetic and parasympathetic divisions of the autonomic system for those in this writing condition. Those in the trauma-emotion writing condition, however, demonstrated a relatively strong positive correlation between the change in RSA and PEP from the last minute of rest to the first minute of writing, $r=.50$, $p < .05$. Combined, these findings lend partial support for our hypotheses. They suggest more coupling of the

autonomic system during the first minute of writing for those in the trauma-emotion condition (r=.50) as compared to the trauma-fact condition (r=.28). The degree of coupling between the sympathetic and parasympathetic divisions was weak in the first minute of writing for those in the trauma-combination group, r=.05, n.s. Moreover, similar to the trauma-fact and trauma-combination conditions, coupling of the sympathetic and parasympathetic divisions was also weak in the control condition, r=.18, n.s. Again, these results indicate less coupling of the autonomic nervous system in the first minute of writing for the control condition (r=.18) as compared to the trauma-emotion condition (r=.50).

Discussion

The results of this experiment should be viewed as promising rather than definitive. Results replicated past findings demonstrating increases in heart rate and mean arterial pressure during disclosure. Results were inconsistent, however, with past studies that suggested a relationship between scores on the REI and performance in the RB task. Across the four writing conditions, we found limited differences in physiological reactivity (as measured by autonomic activation) and behavioral outcomes (as measured by choices made in the ratio-bias paradigm). This suggests that if the writing tasks evoked differential thinking, the effect was small. Consistent with our hypotheses, participants in the trauma-emotion condition displayed significantly greater coupling of the sympathetic and parasympathetic divisions of the autonomic system as compared to the other writing conditions. Thus, to the extent that differences in autonomic coupling reflect control of different parts of the brain, writing about the emotions surrounding a traumatic event may indeed have primed a different mode of

cognitive processing than the other tasks. The results of the RB task did not confirm our hypotheses that participants in the trauma-emotion condition would make fewer optimal choices than those in the trauma-fact condition. Instead, differences by writing condition in the RB choices were evident only during trial 1 of the RB task, with those in the control condition along with those in the trauma-combination condition making proportionally more optimal choices relative to those in the trauma-emotion and trauma-fact groups. The results of all the RB trials combined did not indicate significant differences by writing condition.

While the pattern displayed in the RB paradigm did not support our hypotheses, these findings nonetheless hold important implications in understanding the cognitive effects of written disclosure. That is, the trauma writing condition that resulted in the most optimal choices in the RB task was the condition that integrated both rational and emotional disclosure (trauma-combination group). These results highlight the possible importance of cognitive integration in predicting rationality. One can speculate that this means that combined emotional and factual disclosure as compared to just emotional or factual disclosure allows one (at least in the short-run) to place the traumatic event in the most rational light. Moreover, recall that the rational system encodes information in the form of abstract representations (as opposed to concrete representations). Thus, these results suggest that thinking about both the facts and emotions surrounding personal trauma may result in more abstract thinking about the event, leading to the highest level of rational thinking. Thus, the increased proportion of optimal choices displayed by those in the trauma-combination condition in trial 1 (as compared to the trauma-fact and trauma-emotion conditions) may be due to the abstract thinking or to the cognitive

integration of the rational and experiential modes that occurred during disclosure. Moreover, that differences across the writing conditions were only evident in trial 1 of the RB task may suggest that the effects of disclosure were short-lived. In other words, the mode of thinking that was conjured through written disclosure may have lasted just long enough to influence the first trial of the RB task. After the first trial, participants may have become engrossed in the game, thus overriding any cognitive effects that the writing task may have conjured. How long these effects were maintained during the writing task is open to future research.

Although potentially revealing, the results must be tentatively interpreted. First, the total number of participants in the study (N=60) and the total number of participants in each writing condition (N=15) were relatively small compared to prior RB studies. Furthermore, participants were not selected in any way for having a debilitating undisclosed trauma; therefore, it was impossible to evaluate whether or not participants were able to write about the given topic. Additionally, participants' writings had not yet been coded at the time of the analyses. Therefore, we were unaware of the participants' levels of disclosure (i.e., high or low) and whether they had disclosed according to the directions given (i.e. disclosing solely the facts or emotions surrounding a traumatic event). Consequently, if participants did not write according to the directions given, the possibility of evoking a particular mode of thinking would not be possible. Lastly, lack of time limited the extent and depth of our analyses. It is possible that more trends may appear in the physiological and ratio-bias data after further analyses.

Our results hold a great deal of promise for future research. As demonstrated in earlier studies (Pennebaker, 1995; Pennebaker & Beall, 1987), our results replicate the

finding that written disclosure evokes cardiovascular reactivity. Moreover, our results hold future promise for revising the ratio-bias task in attempts to prevent the diminishing effect of writing past the first trial. To do this, we may substitute a pair-wise preference task in place of the RB task, in which pictures of the small and large jelly bean trays flash on a computer screen for 2.5 seconds for 45 trials, thereby allowing us to examine more trials of the RB task during a shorter period of time. Participants will have 2.5 seconds to select a tray, thus causing quicker judgments and increased potential for variability (by increasing the number of trials in the task from 6 to 45). These changes may prevent the participant's ability to "regroup," as may have happened in this study, and may allow them to remain in the cognitive mode evoked by the writing task. Future endeavors should also examine gender differences in the RB task. Moreover, a close examination of CEST is suggested, as some skepticism has been cast on the idea that the rational system is an evolutionarily newer system that dates back only 5,000 years.

These modifications will yield more comprehensive findings relating to the effects of written disclosure upon behavioral outcomes. The ultimate resolution of these issues should have direct bearing on our understanding of the cognitive and physiological underpinnings of written disclosure. In sum, the results reveal tentative support for the idea that different types of written disclosure may invoke different cognitive and physiological processes.

Table 1

A Comparison of the Experiential and Rational Systems (Epstein, 1994; Epstein, 1998)

Experiential	Rational
1. Holistic	1. Analytic
2. Automatic, effortless	2. Intentional, effortful
3. Affective: pleasure-pain oriented (what feels good)	3. Logical: Reason oriented (what is sensible)
4. Associationistic connections	4. Logical connections
5. Behavior mediated by "vibes" from past events	5. Behavior mediated by conscious appraisal of events
6. Encodes reality in concrete images, metaphors, and narratives	6. Encodes reality in abstract symbols, words, and numbers
7. More rapid processing: oriented toward immediate action	7. Slower processing: capacity for long-delayed action
8. Slower and more resistant to change	8. Changes more rapidly and easily
9. More crudely differentiated	9. More highly differentiated
10. More crudely integrated—dissociative, emotional complexes; context-specific processing	10. More highly integrated; context-general principles
11. Experienced passively and preconsciously; we believe we are seized by our emotions	11. Experienced actively and consciously; we believe we are in control of our conscious thoughts
12. Self-evidently valid: "Experiencing is believing"	12. Requires justification via logic and evidence

Table 2

Mean Heart Rate (HR) and Mean Arterial Pressure (MAP) During Last Minute of Rest and First Minute of Writing Across the Four Writing Conditions

	Writing Condition			
Physiological Reactivity	Trauma-fact	Trauma-emotion	Trauma-combination	Control
HR-rest	74.6 (SD=10.6)	71.1 (SD=12.4)	70.5 (SD=11.4)	73.7 (SD=9.7)
HR-writing	79.3 (SD=12.6)	78.4 (SD=13.9)	78.1 (SD=12.2)	80.2 (SD=9.7)
MAP-rest	87.0 (SD=7.5)	85.4 (SD=8.1)	87.3 (SD=10.8)	86.3 (SD=6.9)
MAP-writing	90.1 (SD=9.6)	92.7 (SD=11.4)	91.9 (SD=8.9)	89.6 (SD=7.1)

Table 3

Number of Optimal and Nonoptimal Choices Made in Trial 1 of the Ratio-Bias Task by Writing Condition

	Choice in trial 1	
Writing Condition	Optimal	Nonoptimal
Trauma-fact	4 (6.5)	6 (3.5)
Trauma-emotion	5 (7.2)	6 (3.9)
Trauma-combination	6 (4.6)	1 (2.4)
Control	11 (7.8)	1 (4.2)

Note. The values in parentheses represent the expected values.

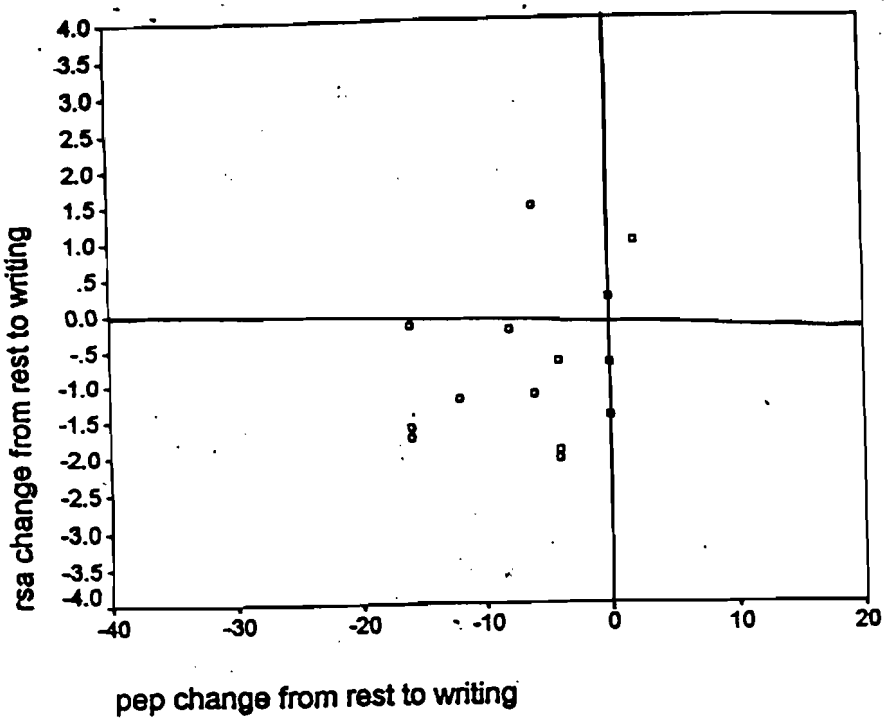

Figure 1

Autonomic Space as a Function of Change in Pre-Ejection Period (PEP) and Change in Respiratory Sinus Arrhythmia (RSA) for Participants in the Trauma-Fact Condition

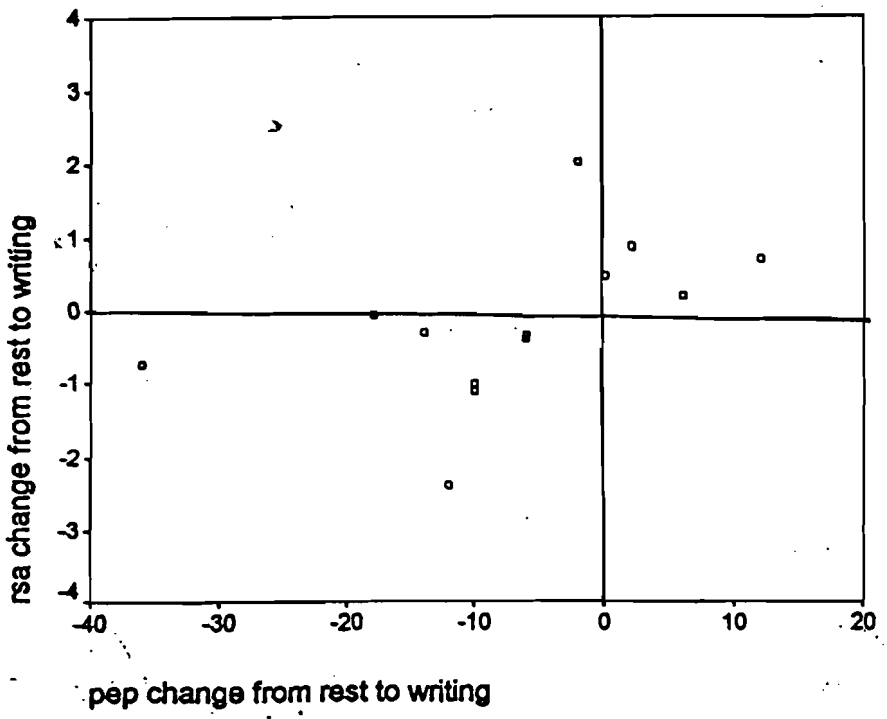

Figure 2

Autonomic Space as a Function of Change in Pre-Ejection Period (PEP) and Change in Respiratory Sinus Arrhythmia (RSA) for Participants in the Trauma-Emotion Condition

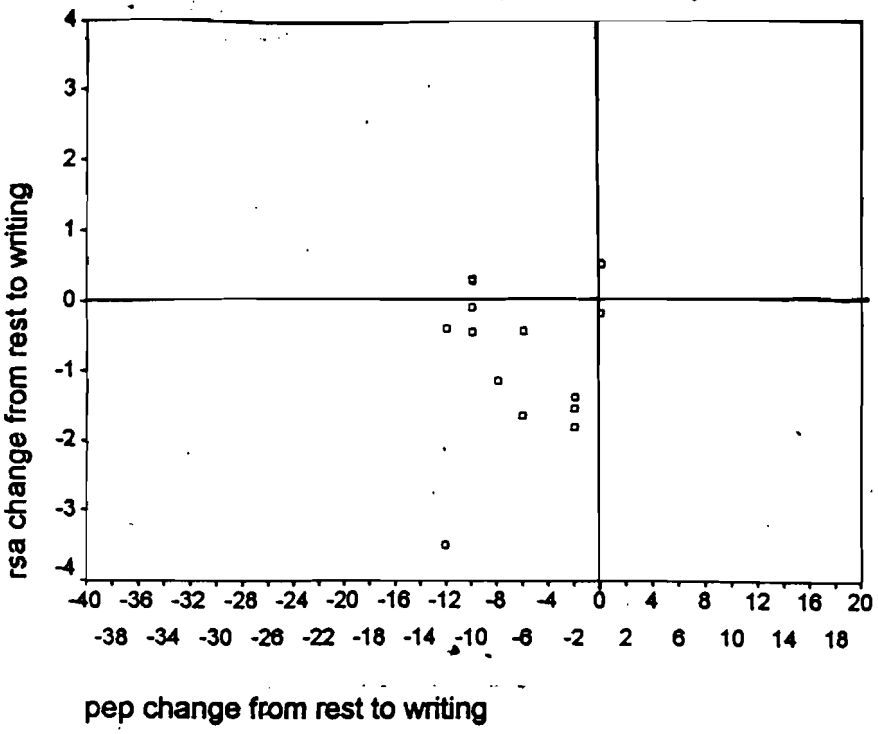

Figure 3

Autonomic Space as a Function of Change in Pre-Ejection Period (PEP) and Change in Respiratory Sinus Arrhythmia (RSA) for Participants in the Trauma-Combination Condition

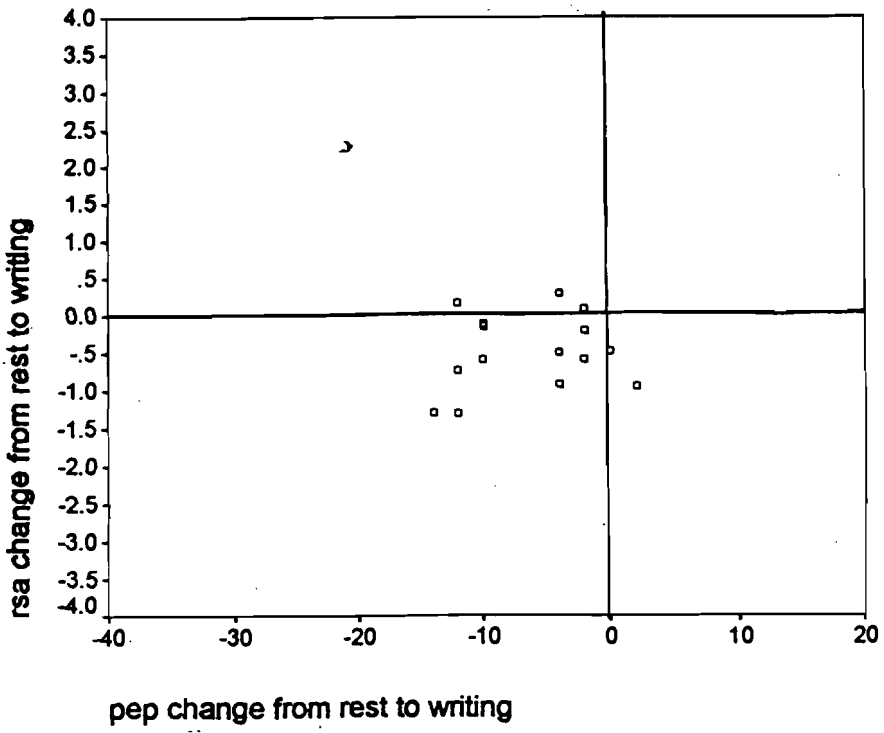

Figure 4

Autonomic Space as a Function of Change in Pre-Ejection Period (PEP) and Change in Respiratory Sinus Arrhythmia (RSA) for Participants in the Control Condition

References

Berntson, G. G., Cacioppo, J. T., & Quigley, K.S. (1991). Autonomic determinism: The modes of autonomic control, the doctrine of autonomic space, and the laws of autonomic constraint. Psychological Review, 98, 459-487.

Berntson, G. G., Cacioppo, J. T., & Quigley, K. S. (1993). Respiratory sinus arrhythmia: Autonomic origins, physiological mechanisms, and psychophysiological implications. Psychophysiology, 30, 183-196.

Epstein, S. (1973). The self-concept revisited, or a theory of a theory. American Psychologist, 28, 404-416.

Epstein, S. (1991). Cognitive-experiential self-theory. In M. R. Gunnor & A. L. Sroufe (Eds.), Self processes and Development (pp. 211-238). Hillsdale, Lawrence Erlbaum Associates.

Epstein, S. (1993c). Implications of cognitive-experiential self-theory for personality and developmental psychology. In D. Funder, R. Parke, C. Tomlinson-Keasy, & K. Widamen (Eds.), Studying lives through time: Personality and development (pp. 399-438). Washington, D.C.: American Psychological Association.

Epstein, S. (1994). Integration of the cognitive and the psychodynamic unconscious. American Psychologist, 8, 709-724.

Epstein, S. (1998). Cognitive-experiential self-theory: A dual-process personality theory with implications for diagnosis and psychotherapy. In R. F. Bornstein & J. M. Masling (Eds.), Empirical perspectives on the psychoanalytic theories (pp. 99-141). Washington, D.C.: American Psychological Association.

Epstein, S. (1998). Cognitive-experiential self-theory: Implications for developmental psychology. In D. F. Barone & M. Herson (Eds.), Advanced Personality, The Plenum Series in Social/Clinical Psychology (pp. 79-122). New York: Plenum.

Epstein, S., Lipson, A., Holstein, C., & Huh, E. (1992). Irrational reactions to negative outcomes: Evidence for two conceptual systems. Journal of Personality and Social Psychology, 62, 813-825.

Epstein, S., Pacini, R., Denes-Raj, V., & Heier, H. (1996). Individual differences in intuitive-experiential and analytical-rational thinking styles. Journal of Personality and Social Psychology, 2, 390-405.

Gross, J. (1989). Emotional expression in cancer onset and progression. Social Science and Medicine, 28, 1239-1248.

Kirkpatrick, L. A., & Epstein, S. (1992). Cognitive-experiential self-theory and subjective probability: Further evidence for two conceptual systems. Journal of Personality and Social Psychology, 63, 534-544.

Levy, S, M., Herberman, R. B., Maluish, A. M., Schlien, B., & Lippman, M. (1985). Prognostic risk assessment in primary breast cancer by behavioral and immunological parameters. Health Psychology, 4, 99-113.

Magee, V. L. (1999). Making up her own mind: A psychological study of the role of personal writing in adolescent girls' development. Unpublished doctoral dissertation, Harvard University.

Miller, D. T., & Gunasegaram, S. (1990). Temporal order and the perceived mutability of events: Implications for blame assignment. Journal of Personality and Social Psychology, 59, 1111-1118.

Pacini, R., & Epstein, S. (1999). The relation of rational and experiential information processing styles to personality, basic beliefs, and the ratio-bias phenomenon. Journal of Personality and Social Psychology, 76, 972-987.

Pennebaker, J. W. (1995). Emotion, Disclosure, & Health. Washington, DC: American Psychological Association.

Pennebaker, J. W., & Beall, S. K. (1986). Confronting a traumatic event: Toward an understanding of inhibition and disease. Journal of Abnormal Psychology, 95, 274-281.

Pennebaker, J. W., & Hoover, C. W. (1986). Inhibition and cognition: Toward and understanding of trauma and disease. In R.J. Davidson, G. E. Schwartz, & D. Shapiro (Eds.), Consciousness and self-regulation (Vol. 4, pp. 107-136). New York: Plenum Press.

Pennebaker, J. W., Hughes, C. F., & O'Heeron, R. C. (1987). The psychophysiology of confession: Linking inhibitory and psychosomatic processes. Journal of Personality and Social Psychology, 52, 781-793.

Petronio, S. (2000). Balancing the Secrets of Private Disclosures. Mahwah, NJ: Lawrence Erlbaum Associates.

Richards, J. M. & Gross, J. (1999). Composure at any cost? The cognitive consequences of emotion suppression. Personality and Social Psychology Bulletin, 25, 1033-1044.

Sherwood, A. (1993). Use of Impedance Cardiography in Cardiovascular Research. In J. Blascovich & E. Katin (Eds.), Cardiovascular reactivity to psychological stress

and disease, pp. 157-201. Washington, D.C.: American Psychological Association.

Tomaka, J., Blascovich, J., Kelsey, R. M., & Leitten, C. (1993). Subjective, physiological, and behavioral effects of threat and challenge appraisals. Journal of Personality and Social Psychology, 65, 248-260.

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. Science, 185, 1124-1131.

Tversky, A., & Kahneman, D. (1983). Extensional versus intuitive reasoning. The conjunction fallacy in probability judgment. Psychological Review, 90, 293-315.

Zajonc, R. B. (1965). Social facilitation. Science, 149, 269-274.

Appendix A

REI

Participant #_____

Please circle the corresponding number as you rate the following statements about your feelings, beliefs, and behaviors. Work rapidly; first impressions are as good as any.

	1 Definitely False	2 Mostly False	3 Undecided or Equally True and False	4 Mostly True	5 Definitely True
1. I'm not that good at figuring out complicated problems.	1	2	3	4	5
2. If I were to rely on my gut feelings, I would often make mistakes.	1	2	3	4	5
3. I prefer complex to simple problems.	1	2	3	4	5
4. I generally don't depend on my feelings to help me make decisions.	1	2	3	4	5
5. I have no problem in thinking things through clearly.	1	2	3	4	5
6. When it comes to trusting people, I can usually rely on my gut feelings.	1	2	3	4	5
7. Thinking is not my idea of an enjoyable activity.	1	2	3	4	5
8. I like to rely on my intuitive impressions.	1	2	3	4	5
9. I am not a very analytical thinker.	1	2	3	4	5
10. I believe in trusting my hunches.	1	2	3	4	5
11. I enjoy solving problems that require hard thinking.	1	2	3	4	5
12. I think it is foolish to make important decisions based on feelings.	1	2	3	4	5
13. I suspect my hunches are inaccurate as often as they are accurate.	1	2	3	4	5
14. I usually have clear, explainable reasons for my decisions.	1	2	3	4	5
15. Knowing the answer without having to understand the reasoning behind it is good enough for me.	1	2	3	4	5
16. I would not want to depend on anyone who described himself or herself as intuitive.	1	2	3	4	5
17. Using logic usually works well for me in figuring out problems in my life.	1	2	3	4	5

18. I enjoy intellectual challenges.	1	2	3	4	5
19. I can usually feel when a person is right or wrong, even if I can't explain how I know.	1	2	3	4	5
20. I often go by my instincts when deciding on a course of action.	1	2	3	4	5
21. My snap judgments are probably not as good as most people's.	1	2	3	4	5
22. Reasoning things out carefully is not one of my strong points.	1	2	3	4	5
23. I don't like situations in which I have to rely on intuition.	1	2	3	4	5
24. I try to avoid situations that require thinking in depth about something.	1	2	3	4	5
25. I trust my initial feelings about people.	1	2	3	4	5
26. I have a logical mind.	1	2	3	4	5
27. I don't think it is a good idea to rely on one's intuition for important decisions.	1	2	3	4	5
28. I don't like to have to do a lot of thinking.	1	2	3	4	5
29. I don't have a very good sense of intuition.	1	2	3	4	5
30. I am not very good in solving problems that require careful logical analysis.	1	2	3	4	5
31. I think there are times when one should rely on one's intuition.	1	2	3	4	5
32. I enjoy thinking in abstract terms.	1	2	3	4	5
33. Using my "gut feelings" usually works well for me in figuring out problems in my life.	1	2	3	4	5
34. I don't reason well under pressure.	1	2	3	4	5
35. I tend to use my heart as a guide for my actions.	1	2	3	4	5
36. Thinking hard and for a long time about something gives me little satisfaction.	1	2	3	4	5
37. I hardly ever go wrong when I listen to my deepest "gut feelings" to find an answer.	1	2	3	4	5
38. I am much better at figuring things out logically than most people.	1	2	3	4	5
39. Intuition can be a very useful way to solve problems.	1	2	3	4	5

40. Learning new ways to think would be very appealing to me.	1	2	3	4	5

Note. From "The Relation of Rational and Experiential Information Processing Styles to Personality, Basic Beliefs, and the Ratio-Bias Phenomenon," by Rosemary Pacini and Seymour Epstein, 1999, Journal of Personality and Social Psychology, 76, p. 976. Copyright 1999 by the American Psychological Association. Adapted with permission.

REI Scoring Key

Scoring: Sum of ratings (1-5) of items in a scale. Item numbers with an "r" are reverse scored as follows: 1 = 5, 2 = 4, 3 = 3, 4 = 2, 5 = 1.

Rational Ability

1. I'm not that good at figuring out complicated problems.
5. I have no problem in thinking things through clearly.
r9. I am not a very analytical thinker.
14. I usually have clear, explainable reasons for my decisions.
17. Using logic usually works well for me in figuring out problems in my life.
r22. Reasoning things out carefully is not one of my strong points.
26. I have a logical mind.
30. I am not very good in solving problems that require careful logical analysis.
r34. I don't reason well under pressure.
38. I am much better at figuring things out logically than most people.

Rational Favorability

3. I prefer complex to simple problems.
r7. Thinking is not my idea of an enjoyable activity.
11. I enjoy solving problems that require hard thinking.
r15. Knowing the answer without having to understand the reasoning behind it is good enough for me.
18. I enjoy intellectual challenges.
r24. I try to avoid situations that require thinking in depth about something.
r28. I don't like to have to do a lot of thinking.
32. I enjoy thinking in abstract terms.
r36. Thinking hard and for a long time about something gives me little satisfaction.
40. Learning new ways to think would be very appealing to me.

Total Rationality = Sum of Rational Ability & Rational Engagement

Experiential Ability

r2. If I were to rely on my gut feelings, I would often make mistakes.
6. When it comes to trusting people, I can usually rely on my gut feelings.
10. I believe in trusting my hunches.
r13. I suspect my hunches are inaccurate as often as they are accurate.
19. I can usually feel when a person is right or wrong, even if I can't explain how I know.
r21. My snap judgments are probably not as good as most people's.
25. I trust my initial feelings about people.
r29. I don't have a very good sense of intuition.
33. Using my gut feelings usually works well for me in figuring out problems in my life.
37. I hardly ever go wrong when I listen to my deepest gut feelings to find an answer.

Experiential Favorability

r4. I generally don't depend on my feelings to help me make decisions.
8. I like to rely on my intuitive impressions.
r12. I think it is foolish to make important decisions based on feelings.
r16. I would not want to depend on anyone who described himself or herself as intuitive.
20. I often go by my instincts when deciding on a course of action.
r23. I don't like situations in which I have to rely on intuition.
r27. I don't think it is a good idea to rely on one's intuition for important decisions.
31. I think there are times when one should rely on one's intuition.
35. I tend to use my heart as a guide for my actions.
39. Intuition can be a very useful way to solve problems.

Total Experientiality = Sum Experiential Ability & Experiential Engagement

Appendix B

Participant #_____

Wine cork takes the form of a suberose tissue, composed of an arrangement of parenchymatous cells originating from a secondary meristem: phellogen. All trees produce cells of the cork type, but it is only the Quercus Suber that produces a protective layer that achieves considerable thickness (which is harvested and regenerates) with characteristics that make it commercially profitable. Not only does the cork oak bear the distinction of producing suberose tissues, it is also, due to its long lifespan (150 to 200 years), certainly the only tree to show a conspicuous production of suberin, with an excellent capacity for regeneration and a protective tissue characterized by extraordinary physio-mechanical and chemical properties.

Appendix C

Informed Consent

We are requesting that you participate in a research study being conducted by Leila Setork, an undergraduate psychology student here at Illinois Wesleyan University under the supervision of Dr. John Ernst. At the end of this form you will be asked to initial two paragraphs to ensure that you have carefully read them. The purpose of this project is to better understand the cognitive and physiological processes underlying written disclosure. In order to do this, we are first going to ask you to write about a personal event for ten minutes. You may be asked to write about something traumatic or something not traumatic. While you write, you will be hooked up to sensors and a blood pressure cuff. This equipment will be used to collect your physiological responses (such as heart rate, blood pressure, etc.) throughout the study.

In order to measure your heart function, two adhesive bands, like long Band-Aids, will be placed around your neck and two around your abdomen. This will require that you raise your shirt slightly so we can place the lower bands around your stomach. These bands will be placed on you by a female research assistant. In addition, a very few individuals report that the bands leave a slight reddening of the skin. Although this causes no discomfort, the marks sometimes take up to 24 hours to completely fade.

_____ initials

You may then be asked to write about a personally traumatic experience for ten minutes.

_____initials

Afterwards, you will be asked to participate in a decision-making task and a visual performance task. Lastly, you will be completing a total of four surveys and a brief demographics questionnaire (questions about your age, year in school, etc.), which will take approximately 15 minutes. The questions we ask you are about your beliefs and thinking styles. You may find some of the questions to be personal or they may ask you about feelings that you are not comfortable with. You are free to withdraw from the session at any time and are free to answer or to not answer any of the questions. There will be no penalty or loss of credit for withdrawing or for omission of answers. The entire procedure will last about an hour.

The specific information that you provide will be strictly confidential. Your questionnaires and writing samples will be identified by a random numbered code, and your name will not appear on any of the materials. Your responses will be classified and stored by a participant ID number only. All information will be held under lock and key. Your writing samples may be viewed only by members of the research team, and your identity will remain

anonymous at all times. *Under no circumstances will your writing sample or your responses to the questionnaires be matched with your name.* The anonymous responses that you provide will be used by the members of the research team to better understand the people's experiences. Summaries of information you and others participating in the study provide may appear in research publications about psychology.

If you have any questions regarding this project, please feel free to contact Leila Setork at (309) 556-3213 or the supervising faculty member, Dr. John M. Ernst at (309) 556- 3907. If you have any concerns regarding this project, please feel free to contact Dr. Catherine Scherck, a member of IWU's independent review board for ethics in experimentation, at (309) 556-3271.

I have read the above information pertaining to the cognitive and physiological processes underlying disclosure.

____ I agree to participate in this research. I understand that I may stop participation at any time or to not answer any of the questions without penalty.

____ I do not agree to participate in this research.

_____

Participant Name (Print)

_____ _____

Participant Signature Date

_____ _____

Interviewer Signature Date

Appendix D

Participant Log

Participant ID#_____ Date_____ Time_____

Participant Gender_____

Experimenter_____

Writing Condition_____

Task order: 1) 2)

Measurements (between tape 2 and 3): Front_____cm Back_____cm

BP Readings: Push "start" at the time indicated in the parentheses.

Rest task (Block 1):

	SDP	DBP	Pulse
Reading 1 (30 sec.)	_____	_____	_____
Reading 2 (2 1/2 min.)	_____	_____	_____
Reading 3 (4 min.)	_____	_____	_____

Writing (Block 2):

	SDP	DBP	Pulse
Reading 1 (1 min.)	_____	_____	_____
Reading 2 (3 min).	_____	_____	_____
Reading 3 (5 min.)	_____	_____	_____
Reading 4 (7 min.)	_____	_____	_____
Reading 5 (9 min.)	_____	_____	_____

Letter-circling task: _____seconds

Notes:

Appendix E

Writing Instructions for Trauma-Fact Condition
(Pennebaker & Beall, 1987)

I am now going to give you a pen and a pad of paper. Once I leave the room and the door is closed, I want you to write continuously for 10 minutes about the most upsetting or traumatic experience of your entire life. Don't worry about grammar, spelling, or sentence structure. In your writing, I want you to discuss the details of the event. You can write about anything you want. But whatever you choose, it should be something that has affected you very deeply. Ideally, it should be about something you have not talked about with others in detail. It is critical, however, that you do not mention your feelings toward the experience. Instead, focus only upon the facts of the experience. Let yourself go and retell the event as clearly as possible. In other words, write about what happened, where it happened, and when it happened without referring to your emotions.

Appendix F

Writing Instructions for Trauma-Emotion Condition
(Pennebaker & Beall, 1987)

I am now going to give you a pen and a pad of paper. Once I leave the room and the door is closed, I want you to write continuously for 10 minutes about the most upsetting or traumatic experience of your entire life. Don't worry about grammar, spelling, or sentence structure. In your writing, I want you to discuss your deepest feelings about the experience. You can write about anything you want. But whatever you choose, it should be something that has affected you very deeply. Ideally, it should be about something you have not talked about with others in detail. It is critical, however, that you do not mention the trauma itself. Instead, focus only upon your emotions. Let yourself go and touch the deepest emotions you have. In other words, write about how you felt at the time of the event and how you feel about it now.

Appendix G

Writing Instructions for Trauma-Combination Condition
(Pennebaker & Beall, 1987)

I am now going to give you a pen and a pad of paper. Once I leave the room and the door is closed, I want you to write continuously for 10 minutes about the most upsetting or traumatic experience of your entire life. Don't worry about grammar, spelling, or sentence structure. In your writing, I want you to discuss your deepest thoughts and feelings about the experience. You can write about anything you want. But whatever you choose, it should be something that has affected you very deeply. Ideally, it should be about something you have not talked about with others in detail. It is critical, however, that you let yourself go and touch those deepest emotions and thoughts that you have. In other words, write about what happened and how you felt about it, and how you feel about it now.

Appendix H

Writing Instructions for Control Condition

I am now going to give you a pen and pad of paper. Once I leave the room and the door is closed, I want you to write continuously for 10 minutes about your campus bedroom. Don't worry about grammar, spelling, or sentence structure. In your writing, I want you to clearly describe what your bedroom looks like at school. It may be your dorm room, an apartment bedroom, or your bedroom in a fraternity or sorority house. Describe what your bedroom looks like using the most detail possible. You can describe the furniture you have, the colors of the room, posters on the wall, and any other descriptive features of your bedroom.

Appendix I

Instructions for RB task

You will now participate in a decision-making task in which you will have the opportunity to win and keep real money. As you can see, there are two trays in front of you filled with jellybeans. You'll notice that there are currently _____ red jellybeans in the small tray and _____ red jellybeans in the large tray, as indicated by the index cards. So currently, the small tray contains ____% red jellybeans, and the large tray contains ____% red jellybeans.

You will have nine trials to draw a red jellybean from either one of the trays. For each trial, I will be varying the percentage of red jellybeans in the two trays. If you draw a red jellybean, you will win $1, which will be exchanged for real money at the end of the study. If you draw a white jellybean, nothing happens, and you neither win nor lose money. For each trial, you have the opportunity to select which tray you want to draw from. Once you select a tray, I will cover your eyes, and you will draw one jellybean..

Do you have any questions?

For the first trial, you'll notice that the small tray contains ____% red jellybeans, and the large tray contains ____% red jellybeans. Which tray would you like to draw from for trial 1?

Participant selects a tray, your partner covers the participant's eyes, you mix up the jellybeans, you guide the participant's hand to the tray, and they draw a jellybean.

If red-→ give them a dollar.

If white-→ say "I'm sorry, it's white. You neither win nor lose money."

Then go to the next trial. Look on your sheet to see what the appropriate percentages are. Add/remove jellybeans, and put the appropriate notecards in front of the trays. *Don't forget to switch the position of the trays for each trial!!* Read them the percentages again, and ask them to draw. Do this for all 9 trials.

Appendix J

Participant #_____

RB Recording Sheet

Trial	% Jellybeans in Large/Small tray	Participant's Choice	Win or lose
1			
2			
3			
4			
5			
6			
7			
8			
9			

Appendix K

Participant # _____

Demographics

1. Age (in years): _____ 2. Gender: M F (Please circle one)

3. Year in school: 1 2 3 4 5 (Please circle one); 4. Major _____

5. What is your ethnicity? (Please circle all that apply)
   a. Caucasion
   b. African-American
   c. Asian-American
   d. Asian-Indian-American
   e. Pacific Islander
   f. Asian-Indian
   g. Latino/Latina
   h. Asian
   i. Native American
   j. International Student _____ country of origin
   k. Other

6. What social groups do you belong to on campus (Please circle all that apply)
   a. volunteer organization
   b. church group
   c. academic club
   d. fraternity or sorority
   e. musical group
   f. varsity sports team

7. How often, if at all, do you engage in personal writing (whether it be in a journal/diary, writing poetry, writing poetry/stories outside of class, etc.).
   a. Once or more a week
   b. A couple of times a month
   c. A few times a year
   d. Never
   e. Other _____

For this study personal writing is defined as any type of writing that you do because it is a way to reflect on your life. For this study we are not including work that you've done for schooling.

1. Would you define personal writing in another way than my definition?
   Yes.....1 No.....2

2. If you would define personal writing in another way, what is your definition of personal writing?

3. At some time in your life have you ever done personal writing -- any type of writing that you do as a way to reflect on your life?
   Yes.....1 If yes, answer questions # 4-7.
   No.....2 If no, why you have NEVER done personal writing at any time in your life.

4. Have you ever kept a diary or a diary?
   Yes.....1 No.....2

5. There are many reasons for personal writing. Which of these reasons fit you. Please circle the number corresponding to the statement in the left side of the column. Circle all that apply.

To document, explore, escape from, or reflect on extremely painful memories or feelings and how separate you feel from these feelings, including anger	1
To record daily events, hold onto writing for a lifetime, and to write innocent stories	2
To access the self -- to have a place where I can think about things related to me	3
To reflect on social change or social justice	4
To provide temporary relief/ventilation of daily stress/smaller issues (7.5%)	5
To tell the truth	6
To break the isolation of feeling alone	7
To give myself a boost	8
To hide secret acts, feelings and thoughts in the writing	9
To complete creative writing or freewritings at school	10
To communicate with or write about God	11
To reflect or solve problems with friends or relationships	12
To share thoughts/feelings/daily life with others in letters or gifts	13
Other reasons: please list the other reasons.	14

6. Which of the above reasons is your main reason for doing personal writing? _____

7. **Please let us know anything else related to your personal writing.**

Appendix L

Verbal Debriefing

[Note to experimenter-if at anytime you feel like you want help-immediately call Dr. Ernst (X-3907 or 820-1099). If he cannot be reached then call the health services at X-3107.]

Thank you very much for participating in this study. Your participation will help us to better understand the physiological and cognitive processes underlying disclosure. I will be giving you a debriefing form before you leave that will further explain what this study is examining.

Right now, however, I want to specifically thank you for agreeing to write about a personal experience. As previously mentioned, everything you have written will remain confidential and anonymous. Often times if we write about something upsetting, we may experience feelings of sadness, anger, or pain, or we may experience new feelings that we had not previously experienced.

(1) Did the writing exercise conjure up feelings for you?

[Regardless of whether they say yes or no the experimenter is to move on to the next question.]

(2) Is there anything you would like to talk about?

[If the answer is yes-then the experimenter is to listen to what the participant has to say.]

What if the participant doesn't seem hysterical:

A. let the participant talk.
B. At the end say something like, "Thanks for sharing those feelings with me. Your participation is really appreciated and as I mentioned above, very valuable for understanding the repercussions of traumatic events." Go to (3) below.

Imagine that the subject seems upset:

A. let the participant talk. At the end say something like, "You seem upset to me. Would you like to have a chance to talk with my supervisor, Dr. John Ernst, or someone at the health services? If they say yes, then contact Ernst (X-3907 or 820-1099) or health services (X-3107). If they ask for Ernst and he is not available call health services. If they don't answer and the participant seems truly hysterical and/or suicidal (we

don't anticipate suicidal ideation-indeed the literature suggests that disclosing a traumatic event is likely to make the participant feel better) then call the PATH Crisis Center @ 827-4005. If they say no, ask them if they want you to call a friend to come pick them up.

(3) Is there someone you can talk to about this experience if you want to do so later on?

If they say no-then refer them to the contact numbers for Dr. Ernst and the Health Services Center.

(4) If at any time upon leaving should you want to talk to someone about any feelings that this study may have evoked, please feel free to contact Dr. John Ernst, social psychologist at Illinois Wesleyan University, or IWU Counseling Services, located in the basement of Magill Hall. The numbers for both places are on the debriefing form I am about to give you. Thank you again for your participation.

[After reading the debriefing form the participant will be asked if they have any further questions, thanked for their participation, and dismissed.]

***Don't forget to give the participant their debriefing form and informed consent form before they leave..*

Appendix M

Debriefing

Thank you very much for your participation! The main purpose of this study was to examine the events surrounding written disclosure of traumatic experiences. Research conducted by Epstein suggests the existence of two distinct modes of processing: rational and experiential. The rational mode of processing is driven by logic and deliberative thought involving higher brain functioning, whereas the experiential mode of processing is driven by emotions and automatic heuristics involving lower brain functioning. For example, solving math problems would more heavily invoke the rational system, whereas painting a picture would more heavily rely upon the experiential system. It is possible that writing about the facts surrounding a traumatic event invokes rational processing, whereas writing about the emotions surrounding a traumatic event invokes experiential processing. We will be examining this possibility by observing the relationship between your writing sample and the decisions you made in the jelly bean and visual performance tasks.

In addition to self-report and behavioral measures, people's physiological responses have often been examined as a way to learn more about their psychological processing. Berntson and Cacioppo propose that events involving high brain functioning involve one type of autonomic activation whereas lower brain functioning involves another. We will examine this hypothesis by looking at your physiological reactivity throughout the study.

This research is valuable because it will help us better understand the cognitive and physiological processes underlying disclosure. Disclosure is a central aspect in many therapies and every day encounters. It is our hope that our research will shed some light on the hidden processes that accompany emotional versus factual disclosure.

It is *very important* that you not talk about the specifics of this study with other students at IWU. You are doing this study with lots of students and it's important that everyone comes with the same information. We don't want some students and not others to know about specific tasks or questions. However, you can say that you participated in a study that examined the cognitive and physiological processes underlying disclosure.

If you have questions in the future, please contact John Ernst, Ph.D. at (309) 556-3907. In addition, if you would like to discuss any feelings that this study may have invoked, please contact Dr. Ernst or the counseling services at IWU (free services): (309)-556-3052.

If you are interested in this study and would like further information, the following is recommended reading used in this study:

Pacini, R., & Epstein, S. (1999). The relation of rational and experiential information processing styles to personality, basic beliefs, and the ratio-bias phenomenon. Journal of Personality and Social Psychology, 76, 972-987.

Pennebaker, J. W. Emotion, Disclosure, & Health. Washington, DC: American Psychological Association.

Thanks again for your participation! Your help is of great service as we explore the cognitive and physiological processes underlying disclosure.