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Effects of imagery training on language in expressive writing

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EFFECTS OF IMAGERY TRAINING ON LANGUAGE IN EXPRESSIVE WRITING

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science at Virginia Commonwealth University

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Table of Contents

List of Tables

List of Figures

Abstract

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Research examining language in written and oral trauma narratives indicates that exposure and cognitive processing are important processes responsible for therapeutic change. Bio-informational theory, which defines emotions as the activation of response, stimulus, and meaning units in memory, provides a meaningful structure for evaluating language in traumatic and neutral essays. This study examined the effects of imagery training procedures designed to prime activation of response or stimulus units on word usage. The effect of writing instructions on activation of meaning units was also investigated. Unscreened undergraduates (n=246) were randomly assigned in a 2 writing condition (traumatic or neutral) x 3 training condition (response-training, stimulus-training, or no-training) design. Word count dictionaries were used to capture the effects of training and instructions on language. Overall, results supported predicted effects of stimulus training and trauma writing, but anticipated effects of response-training were inconsistent. Implications for theory and the use of language to measure emotion are discussed.

Effects of imagery training on language in expressive writing

Statement of the Problem

Language is an important, if imperfect, method for assessing internal emotional experience. Lay persons and a majority of emotion researchers alike assume that emotional experience can be coded in natural language. In daily life, we rely on language to tell us what others are feeling and to signal to others what we are feeling. Although body language, voice tone, and other variables can influence these interpretations, the emotional value of word usage allows us to translate emotions even in the absence of non-verbal cues. The reason we can cry while reading a sad story or feel the sting of a co-worker's contempt through a terse e-mail is that emotions can be relayed through text alone. In addition to these interpersonal language-emotion transactions, language can reveal previously unrecognized intra-personal emotional experiences. The practice of journaling, keeping a diary, or even the more modern blog post, are all examples of individuals coding their own emotions in natural language. In sum, words, whether spoken aloud or written, are assumed to provide crucial information about an individual's emotional state.

On the other hand, some research has indicated that reliable measurement of emotional experience is difficult. Studies using multiple measures of emotion have demonstrated a lack of convergence among various measures of emotion (Hoehn-Saric & McLeod, 2000; Gross & Levenson, 1993). In light of this work, emotion researchers have proposed a componential model for measuring emotions in which emotions are conceptualized as "experiential, physiological, and behavioral responses to personally meaningful stimuli" (Mauss & Robinson, pg. 1, 2009). Although the current study will focus on language as a single measure of emotional experience, the multidimensional nature of emotion will be important in interpreting the results of this study.

If a relationship between emotion and language was not detected, then it should not automatically be assumed that an emotional experience did not occur. Rather, the type of emotional experience evaluated in this study may not manifest itself in language. Furthermore, even an apparent connection between a presumed emotional experience and language can never be proven because the occurrence of an emotion relies on the reliability and validity of whatever method is used to measure its occurrence. Because of this circular logic, it is important to acknowledge that any measure of emotion is a probabilistic method of assessing an inferred construct (Larsen & Frederickson, 1999). In this study, the assumed importance of language as a component of emotion was put to the test and the use of language for assessing a specific type of emotional experience was evaluated.

The connection between emotional experience and language is particularly relevant for the study of mental and physical health outcomes in psychology. Two recent literatures in clinical psychology and psychosomatic medicine have used language to understand symptoms and health outcomes in those exposed to stressful or traumatic life events. The first of the two literatures comes out of clinical practice and empirically supported treatment of individuals diagnosed with post-traumatic stress disorder (PTSD). PTSD is characterized by intrusive re-experiencing of a previously-experienced traumatic event (APA, 2000). Pervasive avoidance of thoughts, feelings, and situations that stimulate recollections of the trauma is a defining feature (APA, 2000). According to learning theory models, which provide the basis for cognitive-behavioral treatment (CBT), this pattern of avoidance is assumed to maintain PTSD symptomatology by denying the individual the opportunity to habituate to feared stimuli (Barlow, 2002). Prolonged Exposure (PE) therapy (Jaycox, Foa, & Morral, 1998) and Narrative Exposure Therapy (NET; Bomyea & Lang, 2011) are widely used cognitive-behavioral

approaches for treating PTSD and involve repeated oral or written retelling of the traumatic event with the goal of exposing the patient to feelings, thoughts, and memories associated with the trauma, eventually leading to habituation and PTSD symptom remittance. A second theory postulated to explain these therapeutic strategies is the patient's construction of an increasingly coherent and organized description of the traumatic event. The story that an individual creates about his or her traumatic experience is referred to as a trauma narrative. Trauma narratives can be expressed orally or in writing and can provide information about an individual's thoughts and feelings about the trauma. Researchers have found that language plays a key role as a mediator of treatment outcomes, suggesting that altering language through training or instructions may have important treatment implications (O'Kearney & Perrott, 2006).

The second literature, rooted in psychosomatic medicine and social psychology, has examined the physical and mental health benefits of writing about traumatic or stressful life experiences, primarily among non-clinical populations. This second literature has emerged out of Pennebaker and Beall's (1986) expressive writing, a controlled laboratory paradigm that involves writing about a traumatic or stressful life experience with as much emotion as possible. A recent meta-analysis indicates that expressive writing is associated with small to moderate benefits in physical functioning (e.g. improved immune functioning, fewer doctor's visits) and psychological well-being (e.g. reduced symptoms of PTSD, depression, and enhanced post-traumatic growth) in healthy and select clinical populations (Frattaroli, 2006; Smyth, 1998; Smyth, Hockemeyer, & Tulloch, 2008). However, the results of expressive writing studies have not been universally positive (Mogk et al., 2006), suggesting that an understanding of the underlying mechanisms involved is crucial. Language emerged as an obvious target for investigating both mediation and moderation of expressive writing outcomes. Research on

linguistic variables in expressive writing, primarily using a word count software program called Linguistic Inquiry and Word Count (LIWC), revealed a relationship between certain types of naturally produced language and health outcomes. Numerous studies examining linguistic variables with LIWC have indicated that usage of emotional (positive or negative emotion words) and cognitive (words indicative of insight or inferred causation) words are relevant for expressive writing outcomes (Tausczik & Pennebaker, 2010). However, these correlational studies failed to establish a causal relationship between word usage and outcomes. Thus, researchers began to experimentally manipulate expressive writing instructions with the goal of altering linguistic content in specific ways. Several studies have demonstrated that altering instructions prior to writing or providing feedback to participants during writing can shape linguistic output (Ullrich & Lutgendorf, 2002; Sloan, Marx, Epstein, & Lexington, 2007; Smyth, True, & Souto, 2001; Sloan, Marx, & Epstein, 2005; Owen, Hanson, Preddy, & Bantum, 2011). These studies suggest that further efforts to modify language through experimental manipulation would allow researchers to apply and test specific theories of therapeutic change within the expressive writing paradigm.

Although linguistic analysis of trauma narratives and expressive writing studies with LIWC differ in methodology and target population, they are linked by common theoretical mechanisms. PE, NET, and expressive writing are currently postulated to work by exposing individuals to traumatic thoughts, feelings, and memories leading to habituation and by encouraging cognitive assimilation, allowing individuals to cognitively adapt and derive meaning from the traumatic experience. Although exposure and cognitive assimilation are the strongest theories proposed to explain the benefits of PE, NET, and expressive writing, further evidence is needed to validate the mechanisms involved in traumatic or stressful event

processing. Given the significant theoretical support for both exposure and cognitive assimilation as mechanisms of action in expressive writing, it is important to examine the underlying evidence for each of these constructs. One method for evaluating these theories would be to experimentally manipulate expressive writing instructions to stimulate production of language indicative of exposure or cognitive assimilation. If we assume that one way to change emotions involves changing language, then it is useful to determine whether and how we can change the language people use about emotion in their writing.

Theorists have proposed that exposure and cognitive assimilation can be enhanced through language. Lang's (1979) bio-informational theory provides an information processing model of propositional language to explain emotional activation in the brain. Andersen and Bower (1974) and other information processing theorists have conceived of the brain as a network of propositional units. Lang (1979) extended this network model to describe emotional imagery as a network composed of informational units, including response units, stimulus units, and meaning units. Response units are characterized as propositions related to behavioral acts, physiological activation, and verbal behavior. For example, response propositions include statements such as "I felt my heart pounding in my chest", "I ran as fast as I could", and "I cried out in pain". Stimulus units are characterized as propositions related to descriptive details or contextual features of a situation. Thus, stimulus propositions include descriptive information such as "The spider was black" and "The sun was shining." Finally, meaning units are conceptualized as interpretations and later as internal behaviors, such as cognitions, emotional labeling, and meaning-making. Meaning propositions, therefore, include, "I was very afraid", "I realized things would get better soon", and "It made sense that we broke up".

Lang's (1979) proposed network of response, stimulus, and meaning units provides an established structure for measuring emotionally relevant linguistic content. Examination of linguistic variables using this propositional structure may provide a useful methodology by which to test theories of exposure and cognitive assimilation within expressive writing. The primary goal of the current project was to examine whether response training and stimulus training (to be described later) influence linguistic content of expressive writing as theory would predict. Response unit and stimulus unit dictionaries were developed and used to quantify the effects of response and stimulus training on response and stimulus language in expressive writing. A second goal of this project was to examine whether training and writing instructions influence meaning proposition usage in writing. Although meaning-oriented language was not experimentally manipulated in this study, examining meaning proposition usage allowed for a test of the cognitive assimilation theory. A final goal of this project was to examine changes in response and meaning oriented language over time to determine whether response word usage and meaning word usage respectively increased and decreased as the theories of exposure and cognitive assimilation would predict.

Review of the Literature

In the following review, complementary findings from two separate areas of research, the clinical trauma narrative literature and the expressive writing literature, will be integrated using an information processing model of propositional language to reveal how experimental or therapeutic procedures, such as a therapist's instructions, written instruction sets, computerized feedback, or training procedures, can affect linguistic content. First, the relationship between cognitive-behavioral therapy (CBT) for PTSD and the language of trauma narratives will be discussed and the implications of this therapy-language association for treatment outcomes will

6

be highlighted. A dual processing model involving exposure to sensory and emotional information and cognitive assimilation through the creation of an organized trauma narrative is proposed. Next, the expressive writing paradigm is examined with a focus on the relationship between writing instructions or feedback on word usage. The three leading theories proposed to explain the mechanism of action in expressive writing, the psychosomatic theory of inhibition, the exposure hypothesis, and cognitive assimilation, are evaluated in light of linguistic evidence. Again, a dual processing model implicating exposure to physiologically and emotionally relevant linguistic content and cognitive processing, evident in the use of insight and causal words, emerges. Finally, Lang's (1979) bio-informational processing model of response, stimulus, and meaning propositions is applied to incorporate these theories and test them in an investigation of response training and stimulus training augmented expressive writing.

The Language of PTSD

Within the clinical psychology literature, researchers have examined the relationship between language and psychopathology. Because language is the primary modality used in clinical assessment and treatment, it follows that linguistic content is assumed to represent symptom severity and frequency as well as treatment progress. This assumption has perhaps been best tested within the context of treatment for post-traumatic stress disorder (PTSD) and other trauma-related symptoms. Empirical studies on the nature of trauma narratives in PTSD are rooted in information processing models of the disorder, which suggest that the lasting maladaptive symptoms of PTSD develop, in part, because of distortion and fragmentation of autobiographical memory of the event (Foa & Riggs, 1993). From this conceptualization, it is assumed that successful treatment will involve increasing organization and coherence of

7

traumatic memories through repeated disclosure and modification of the traumatic experience under the guidance of a therapist.

The clinical trauma narrative literature has focused on ways in which the expected clinical presentation of PTSD is evident in patient's oral or written trauma narratives. For example, the fragmented nature of traumatic memories might be manifested in repetitious, disorganized, or incoherent language use. Intrusive thoughts about the traumatic event might emerge in language in the form of more frequent use of sensory, perceptual, or emotional content. The leading empirically-supported treatments for PTSD, narrative exposure therapy (NET) and prolonged exposure therapy (PE), involve patients repeatedly giving an oral or written account of their trauma, with the goal of both cognitively integrating the events into memory and experiencing physiological and emotional distress habituation to the feared stimuli (i.e. memories, thoughts, and feelings related to the trauma) (Jaycox et al., 1998; Bomyea & Lang, 2011). In this way, individuals are expected to achieve a more coherent representation of the trauma in working memory and as a result experience a reduction in distress and avoidance of situations or memories associated with the trauma. In order to better understand this process, changes in linguistic patterns of trauma narratives over time have been tracked and shown to be associated with PTSD symptoms, treatment progress, and outcomes.

In a qualitative review of the trauma narrative linguistic analysis literature, O'Kearney and Perrott (2006) identified several overarching themes. First, they pointed to the use of sensory, perceptual, and emotional language and their apparent relationship to "flashbacks" or intrusive re-experiencing of traumatic memories. Specifically, across several reviewed studies, O'Kearney and Perrott (2006) reported that the frequency of sensory, perceptual, and emotion-focused language mirrored the severity of patient-reported and clinician-observed PTSD

symptoms. Second, they identified narrative cohesion (connectedness of ideas) and narrative coherence (conceptual organization) as separate key elements contributing to the conceptualization of fragmented, disorganized memory in PTSD. In one study reviewed, involving rape victims undergoing PE for PTSD, Foa, Molnar, and Cashman (1995) employed a coding system to evaluate audio-recorded and transcribed trauma narratives on dimensions of organization and fragmentation. The major finding of this work was that increased use of organized thoughts, defined as statements indicative of reasoning, realization, meaning-making, or some other form of cognitive integration, in oral trauma narratives from early treatment sessions to later treatment sessions correlated with decreased patient-reported intrusive thoughts and predicted better treatment outcomes overall.

Word Usage Findings in Expressive Writing

The second literature emerged out of psychosomatic medicine and centers around the expressive writing paradigm, a procedure developed by Pennebaker and Beall (1986), to test the benefits of written emotional disclosure on physical health outcomes. Expressive writing, in its original form, involved three, 20-minute sessions in which participants were instructed to write about the most traumatic or stressful event of their lives with as much detail and emotion as possible, or, in the control condition, to write about a neutral or trivial topic such as the events of the previous day with as little emotion as possible. Since the first studies, researchers have adapted the paradigm, including alterations to the instructions to make them specific to a particular population (e.g. writing about the experience of coping with a chronic disease), to extend the number of and duration of time between sessions, and most relevant for the current investigation, to manipulate linguistic content.

Pennebaker, Francis, and Booth (2001) developed a computerized word count program called Linguistic Inquiry and Word Count (LIWC) to perform objective, quantitative linguistic analyses of expressive writing narratives. One goal of this program was to identify individual differences in word usage that might explain inconsistent results of the expressive writing intervention or differences in health outcomes across different groups (Taucszik & Pennebaker, 2010). In their review of this line of research, Pennebaker, Mehl, and Niederhoffer (2003) reported a vast range of LIWC word categories and their psychological correlates. For instance, the use of a high number of positive emotion words and a moderate number of negative emotion words predicted better mental and physical health outcomes in expressive writing compared to a low number of positive emotion words and a high or low number of negative emotion words (Pennebaker, Mayne, & Francis, 1997). Additionally, increasing use from the first writing session to the last writing session of cognitive processing words, indicative of insight ("think" "know" "consider") or causation ("because" "effect" "hence"), predicted better response to the expressive writing intervention (Pennebaker et al., 1997). In sum, these initial studies suggested that word usage might mediate the relationship between the expressive writing task and health outcomes. However, these correlational findings failed to establish a causal relationship, leaving the confounding possibility that the type of individual who used emotion words or cognitive processing words in these specific ways were already more likely to benefit from expressive writing.

Building on these initial word usage findings, Smyth and colleagues (2001) experimentally manipulated the writing instruction sets to determine the effects on word usage and whether word usage could explain differences in health outcomes between groups. They randomly assigned participants to use one of the following three instructions in their writing: (1)

focus on forming a coherent story about a traumatic life event (narrative structure group), (2) compose a list of thoughts, feelings, and details of a traumatic life event (expressive list group), and (3) write about a neutral topic (control group). Trained raters evaluated the essays for degree of narrative structure on a seven-point scale from zero (none at all) to six (extreme) and found that, as predicted, the narrative structure group had a higher mean narrative structure than the expressive list group and the control group. Furthermore, only the narrative structure group enjoyed improved physical health outcomes (Smyth et al., 2001). Based on these results, Smyth and colleagues (2001) concluded that the formation of a narrative was a crucial element in determining the outcome of structured writing exercises on health.

However, more recent work by Danoff-Burg, Mosher, Seawell, and Agee (2010) comparing the standard expressive writing instructions to narrative writing instructions challenge this conclusion. In this study, undergraduate participants were randomly assigned to complete the standard expressive writing task or to complete a narrative writing task that emphasized the formation of a coherent story in writing about a traumatic or stressful life event. These authors followed the same methodology used by Smyth and colleagues (2001) in analyzing the essays for degree of narrative structure. They found that the narrative writing group had a higher mean narrative structure rating than the expressive writing group and that the expressive writing group had a higher mean narrative structure rating than the control group. In contrast to patterns observed in correlational studies, an interaction between writing group and writing session was observed such that narrative structure ratings declined from the first session to the last session for the narrative writing group as well as the standard expressive writing group, but not for the control group. Previous studies examining patterns of word usage across sessions had suggested that increasing use of cognitive processing words, indicative of the formation of a coherent

narrative, was associated with superior health outcomes (Pennebaker et al., 1997; Pennebaker & Seagal, 1999). However, in the study by Danoff-Burg and colleagues (2010) the opposite pattern was observed for language indicative of narrative structure, and changes in narrative structure across sessions was unrelated to health outcomes. Greater mean level narrative structure and participants' ratings of the emotionality of their own essays predicted better emotional health outcomes. Yet, the experimental manipulations of narrative structuring and emotionality of writing failed to produce different emotional or physical health outcomes, indicating that naturally produced language and perceptions of emotionality were better predictors of outcomes than writing instructions in this study. In line with the authors' hypothesis and with the extant literature (Batten et al., 2002; Kovac & Range, 2002; van Middendorp, Sorbi, van Doornen, Bijlsma, & Geenen, 2007), instructing participants to form a coherent story about a traumatic or stressful life event resulted in greater narrative structuring of written essays and instructing participants to engage in expressive writing on the same topic resulted in higher perceived emotionality in written essays. Linguistic analysis of narrative structuring and participants' ratings of their own emotionality in their writing confirmed that writing instructions influenced actual and perceived writing content in the expected manner. Furthermore, rater-assessed linguistic content and participants' perceptions of essay emotionality were related to emotional health outcomes. However, these outcomes did not differ as a function of writing instruction groups, suggesting that both narrative structuring and emotionality may be equally important ingredients contributing to structured writing outcomes.

In a similar vein, Sloan, Marx, Epstein, and Lexington (2007) manipulated the instructional set in expressive writing in traumatized undergraduates with PTSD symptoms to determine whether it was possible to experimentally alter word usage. In an effort to test the

12

relative importance of emotional expression (EE) compared to insight and cognitive assimilation (ICA) in writing about a traumatic experience, Sloan and colleagues (2007) randomly assigned participants to an EE writing condition, an ICA writing condition, or a neutral writing condition. EE writers were instructed to write about their most traumatic life experience with as much emotion and feeling as possible. ICA writers were instructed to write about and evaluate their thoughts about their most traumatic life experience. Neutral writers were asked to write about how they use their time, refraining from including emotional responses or thoughts. As a manipulation check and a test for potential mediators, Sloan and colleagues (2007) analyzed the three writing conditions using the LIWC2007 positive and negative emotion word and insight and causal word dictionaries. As predicted, EE writers used a greater percentage of positive and negative emotion words, and ICA writers used more insight and causal words compared to the other conditions. Importantly, EE writers also used a significantly higher number of insight and causal words compared to the control condition, suggesting that increasing emotional expression may also stimulate insight and cognitive assimilation. Individuals assigned to the EE condition showed the greatest improvement on PTSD and depression symptoms and physical health at follow-up. EE writers also showed a pattern of physiological activation and habituation consistent with theories of exposure, providing further evidence that expression of emotion at least partially explains the benefits of writing about a traumatic event.

To determine whether the manipulation of expressive writing instructions affected linguistic content and health outcomes in the expected manner, Sloan and colleagues (2007) performed a series of mediation analyses. Several counterintuitive findings emerged. First, Sloan and colleagues found that emotion word use mediated the relationship between the EE condition and PTSD symptom severity; specifically, use of fewer positive emotion words explained greater

13

reductions in PTSD symptoms among EE writers. Second, use of cognitive insight words mediated the relationship between EE condition and depression symptoms, with lower numbers of cognitive insight words predicting greater reductions in depression symptoms in the EE group. Contrary to the prediction that increased usage of emotion and cognitive processing words would explain the superior outcomes for the EE group, these results suggest a more subtle relationship between expressive writing instructions, word usage, and health outcomes. As expected, rates of emotion word usage were higher among EE writers, indicating that the instructions appropriately altered participants' language. However, within this group of elevated emotional expression, it was those individuals who used fewer positive emotion words that explained the link between writing instruction condition and symptom changes. Furthermore, despite higher numbers of cognitive processing words overall in the EE condition compared to the neutral condition, use of fewer cognitive insight words explained the relationship between EE instructions and superior depression outcomes.

These results stand in contrast to what theory might predict about the relationship between writing instructions, word usage, and health outcomes. However, it is possible that the authors' analysis of word usage at the mean level across all writing sessions failed to capture the complex unfolding of emotional expression and cognitive processing from the first writing session to the last writing session. Other studies have suggested that individuals who show an increase from earlier sessions to later sessions in their use of cognitive processing words benefit most from expressive writing (Pennebaker, 1997); thus, it may be that these individuals use fewer cognitive insight words overall in their writing but that the increase from lower usage to higher usage accounts for the different outcomes. Less easily explained, the positive emotion word mediation findings also contradict earlier word usage analyses by Pennebaker et al. (1997),

14

which demonstrated that greater use of positive emotion words was associated with better treatment outcomes. In this case, the contradiction may be explained by altering the frame of reference in judging what greater use of positive emotion words means. In the Pennebaker and colleagues (1997) study, natural word usage within the usual expressive writing instruction set was examined in relation to health outcomes. Sloan and colleagues (2007), on the other hand, manipulated the typical expressive writing instructions to affect production of emotion and cognitive processing words. Thus, individuals in the EE condition did use a greater number of positive emotion words compared to the other two writing conditions; however, it was the use of fewer positive emotion words within the EE condition that accounted for the variance in PTSD symptom change. In sum, the work by Sloan and colleagues (2007) confirms that writing instructions can be manipulated to systemically alter linguistic content of expressive writing; however, changing natural word usage patterns may affect health outcomes in unexpected ways. To build on these findings, future research should examine changes in experimentally manipulated emotion and cognitive word usage across different writing sessions.

Recognizing linguistic content as an important mediator of expressive writing outcomes, Owen, Hanson, Preddy, and Bantum (2011) used the LIWC emotion word categories to examine the effects of providing linguistically-tailored feedback to participants during an expressive writing intervention on their word usage and subsequent health outcomes. A large sample of college undergraduates were randomly assigned to one of three experimental conditions: simple feedback, directive feedback, or no feedback. All participants completed the classic Pennebaker (1997) expressive writing task of writing for 20 minutes on three occasions about a traumatic or stressful personally-experienced event. Simple feedback consisted of computer generated feedback on the individual's level of emotional expression, which was based on means and

standard deviations reported by Pennebaker and colleagues (2001) across 43 expressive writing studies and were rated as low, average, or high on both positive and negative emotion dimensions. In addition to receiving simple feedback, individuals in the directive feedback group were also encouraged to increase levels of emotional expression commensurate with their current levels. Thus, participants rated as low on emotional expression were asked to "greatly increase" use of positive and negative emotional expression, those using an average level of emotional expression were encouraged to "increase" their use, and individuals rated high on emotional expression were simply told to "keep it up." Results indicated that both simple and directive feedback increased participants' linguistic emotional processing, with larger increases in positive valence emotion words than negative valence emotion words. However, at immediate follow-up, participants did not differ across groups on degree of mood disturbance, indicating that increasing emotional expression did not improve treatment outcomes. It is possible that a longer follow-up and a greater range of outcome measures would have better captured the effects of increased emotional processing. Despite this null result, Owen and colleagues (2011) successfully demonstrated that both simple and directive feedback can alter emotional word usage in expressive writing.

In an effort to simultaneously test the importance of emotional expression and cognitive processing, Ullrich and Lutgendorf (2002) systematically altered the expressive writing instructions to compare the effects of emotion-focused instructions to combined emotion and cognition focused instructions on emotion and cognitive word usage and emotional and physical health outcomes. Rather than using the standard three-session writing paradigm, the authors used a more naturalistic procedure in which participants were instructed to write in a journal using their assigned writing instructions for one month at least twice per week for at least 10 minutes

each time. The two experimental groups did not differ significantly on number of journal entries or number of words per entry. Word count analyses using the LIWC2007 positive and negative emotion word and insight and causal word dictionary categories confirmed that the instructional manipulation affected word usage as theory would predict. Participants assigned to the combined emotion and cognition focused instruction set showed significant increases from the first half of journal entries to the second half of journal entries in cognitive processing word usage, whereas participants assigned to the emotional expression focused group showed increases in negative emotion word usage across the journaling exercise. No changes were observed in positive emotion word usage for any of the groups, or in cognitive processing word usage for the emotion focused group, or in negative emotion word usage for the combined emotions and cognitions group. Additionally, the results supported the authors' hypothesis that individuals assigned to write about both emotional and cognitive aspects of a traumatic event would enjoy greater post-traumatic growth and fewer visits to the doctor at follow-up. More importantly for the current discussion, the superior benefits of the combined writing instructions were partially mediated by increases in the use of cognitive processing words. On the other hand, the authors found that higher numbers of sick visits in the emotions-only group was attributable to increased negative emotion word usage over the course of the journaling exercise.

This study's findings stand somewhat in contrast to those reported by Sloan and colleagues (2007) regarding the relative contributions of emotional expression and cognitive processing to expressive writing outcomes. However, it is possible that individuals in Sloan and colleagues' (2007) emotion-focused condition showed more linguistic similarity to Ullrich and Lutgendorf's (2002) combined emotional expression and cognitive processing condition rather than their emotions-only group. The relatively high rate of cognitive processing words in Sloan

17

and colleagues' (2007) emotional expression group compared to the neutral writing group supports this interpretation. Furthermore, Sloan and colleagues' (2007) finding that lower numbers of both positive emotion words and cognitive insight words mediated the relationship between the emotional expression writing condition and superior health outcomes indicates that mean level word usage may be a poor index of emotional and cognitive processing. Instead, Ullrich and Lutgendorf's (2002) examination of changes in word usage from the first half of the journaling exercise to the second half of journaling exercise may better reflect the unfolding of emotional or cognitive changes in writing.

Working under the assumptions of Park and Folkman's (1997) theoretical framework for meaning-making in the context of stress of coping, Park and Blumberg (2002) evaluated linguistic meaning-making as a mechanism of change in expressive writing. In their study, meaning-making was defined as changes in appraisals of the traumatic experience (situational meaning) and in world views, personality, and coping styles (global meaning) resulting in a reduced discrepancy between global and situational meaning. Under Park and Folkman's (1997) model of stress and coping, a situation is experienced as stressful when an individual's situational appraisals ("I am in danger") violate their global beliefs or assumptions about the world ("The world is a safe place"). In order for adaptive coping to occur, Park and Folkman (1997) have argued that individuals must engage in a meaning-making process to reduce this discrepancy by modifying their situational or global appraisals or both. Park and Blumberg (2002) applied this model of stress and coping to the expressive writing paradigm to investigate whether writing about a traumatic life event stimulates meaning-making. Linguistic coding by judges of essays about a traumatic life experience but not neutral essays confirmed that over the course of four writing sessions, the trauma writing group's situational appraisals changed to

18

become less stressful and less threatening. These linguistic changes were associated with self-reported reductions in intrusions and avoidance and in better physical and emotional health outcomes at follow up. The authors concluded that expressive writing about a traumatic life event facilitates meaning-making and that meaning-making is an important mechanism of action in expressive writing outcomes.

Although Park and Blumberg (2002) used coding by human judges rather than word count software, their results show similarity to Ullrich and Lutgendorf's (2002) work in that both examined changes in language indicative of cognitive processing or meaning-making across writing sessions. This conceptualization of cognitive assimilation as a process, rather than an event, which is likely to be evident in linguistic changes from early writing to later writing, seems to best conform to current theoretical models of stress and coping (Park & Folkman, 1997) and narrative formation (Pennebaker et al., 1997; Foa et al., 1995). The accumulation of linguistic evidence from trauma writing and expressive writing research indicates that altering writing instructions and other procedures can influence linguistic indices of emotional and cognitive processing. Thus, researchers should continue to evaluate theoretically-based manipulations of language in writing to better facilitate these processes of therapeutic change.

Methodological Issues about Word Count Data

Although some authors in the previously reviewed studies used judges' ratings or participants' self-ratings as an index of linguistic content, the majority of linguistic analyses in expressive writing studies are performed using the word count program, LIWC. Word count software programs, such as LIWC, have inherent strengths and weaknesses. Efficiency and objectivity are major advantages of LIWC and other programs like it. The ability to create

19

theory-based linguistic categories and scan huge amounts of text have allowed for rapid advancement in our understanding of the relationship between language and psychologically meaningful constructs, including observable behaviors, group memberships, and personality traits. At the same time, critics have rightfully questioned the real world significance of statistically significant differences in, for example, how often an individual uses the word "I". However, in support of LIWC's external validity, a study by Rude, Gortner, and Pennebaker (2004) examined first person singular pronoun usage among depressed, formerly-depressed, and never-depressed college students. In line with their conceptualization of pathological self-preoccupation as a defining feature of depression, depressed college students used "I" significantly more frequently, and formerly-depressed participants showed significant increases in first person pronoun usage by their third writing session, indicating a greater vulnerability to self-preoccupation than never-depressed individuals. Thus, simple word frequencies may capture complex differences among individuals in present mood or even in their vulnerability to psychopathology.

Additional evidence for the validity of word usage as a marker of psychopathology comes from work by Oxman, Rosenberg, and their colleagues. A computerized text analysis program called General Enquirer, which was developed to replace humans as judges of the Thematic Apperception Test, was shown to accurately and reliably classify psychiatric patients into appropriate diagnostic categories, including schizophrenia, depression, and somatization disorder (Tucker & Rosenberg, 1975; Oxman , Rosenberg, & Tucker, 1982). Furthermore, in a head-to-head test of diagnostic accuracy based on samples of patients' speech, General Enquirer outperformed professional psychiatrists (Oxman, Rosenberg, Schnurr, & Tucker, 1988),

20

suggesting that word usage and computerized methods of analysis may be a useful and objective method for assessing language associated with psychopathology.

One more recent study sought to evaluate the construct validity of the LIWC2007 emotion word dictionary category, including sub-categories of total affect, positive and negative emotion words, optimism, anxiety/fear, anger, and sadness/depression (Kahn, Tobin, Massey, & Anderson, 2007). The authors used three experimental manipulations to test the validity of emotion word usage as a measure of emotional expression. In the first experiment, undergraduate participants were assigned to write about autobiographical events with differing expected emotional valence (amusing, sad, and neutral), and it was determined that the emotional valence of the writing topic led to appropriate differences in LIWC2007 total affect, positive and negative emotion, positive feeling, anger, anxiety/fear, and sadness/depression word counts. In the second experiment, momentary emotions were manipulated by exposing participants to videos with either sad or amusing content. Participants were asked to orally report their feelings during the emotional videos. Transcripts of participants' emotional report during the videos were then analyzed with the LIWC2007 emotion word dictionary. Again, results supported the content validity of the LIWC2007 emotion dictionary such that individuals who watched the amusing video elevated the positive feeling and positive emotion word sub-categories and individuals who watched the sad video showed elevation on the negative emotion word and sadness/depression sub-categories. The videos which were selected to specifically target amusement and sadness did not affect the optimism, anxiety/fear, and anger sub-category word counts, providing some evidence for convergent and discriminant validity of the LIWC2007 emotion word sub-categories. This study both bolsters the validity of LIWC as a measurement

21

tool for assessing emotional experience and provides further indication that word usage can be altered through experimental manipulation including written instructions and mood inductions.

Despite some promising evidence, the creators of LIWC have argued that the typical methods of evaluating reliability and validity of a new measurement instrument may not be appropriate to assess the psychometrics of word usage. Word categories do not conform to assumptions of normal distribution and generally have low base rates (Tauszik & Pennebaker, 2010). Standard tests of reliability, such as using Cronbach's alpha to assess inter-item correlation coefficients, may not be appropriate, given that even in a widely-agreed upon category like articles (i.e. "a, "an", "the"), Cronbach's alpha only reached .14 in one study examining a large sample of text data (Pennebaker et al., 2007). Temporal stability or split-half reliability measures, such as multiple administrations of the same writing task, are also likely to be problematic since individuals are more likely to respond differently to open-ended questions and are less likely to repeat themselves within one written response. In contrast to some of the more pessimistic views expressed about establishing the reliability and validity of words, a recent review of the psychological aspects of word usage (Pennebaker et al., 2003) reported more promising psychometric properties for word data. Across several studies using both spoken and written language, the authors found evidence for good internal consistency of word choice within individuals across different topics and modalities and for adequate temporal stability in individuals' word usage at intervals ranging from two minutes to four weeks. However, reported estimates of reliability were highest for word categories capturing standard linguistic dimensions such as articles and pronouns, but were generally lower for psychological processes such as emotion words, and cognitive processing words. Taken together, these somewhat contradictory findings suggest that the reliability of word choice remains an open question. Tests of LIWC's

validity, including judges' ratings and group membership criterion like the depression study

mentioned above, have been more promising. Further research, particularly studies that use

experimental manipulation (e.g. induction, training procedures, instructions), to alter word usage

according to theoretical predictions, will add to our understanding of the reliability and validity

of words.

Despite the widespread use of LIWC2007 dictionaries and the dictionary development

procedures outlined by its creators, it is important to note that other methods to measure

linguistic content have been used, particularly outside the field of psychology. Latent semantic

analysis (LSA), for example, is a statistical technique that identifies similarities in word usage

across text samples (Mehl, 2006; Campbell & Pennebaker, 2003). LSA differs from the methods

involved in the creation of LIWC dictionaries because it relies upon inductive methods to

identify patterns of word usage across groups. By contrast, LIWC's dictionaries were developed

using deductive reasoning based on established theories about the type of word that was expected

to be important or affected by experimental manipulations. Although researchers in psychology

are beginning to explore the potential of LSA for studying the relationship between language and

emotion, this research is in its infancy (Mehl, 2006; Pennebaker et al., 2003). Potential benefits

of LSA include its reliance on data-driven statistical methods to derive patterns of word usage

rather than subjective judgments made by individual researchers (Mehl, 2006). On the other

hand, the atheoretical nature of LSA could lead to findings that are difficult to interpret or that

fail to build on the existing literature. Despite this increasing interest in LSA as a method for

identifying word usage patterns, the procedures used to develop LIWC were used in the current

study. Using procedures that mirror those used to develop LIWC dictionaries was better suited to

the current study for two reasons. First, it allowed for a more direct test of existing theoretical

assumptions. Second, by using the same procedures to develop custom dictionaries, comparisons could be made between custom dictionaries created in this study and established dictionaries that have been previously validated.

Linguistic Mechanisms of Trauma Processing

Despite using unique methodologies and participant populations, the clinical trauma narrative and the expressive writing linguistic analysis literature share common theoretical bases as well as overlapping empirical evidence. Three major theories, the psychosomatic theory of inhibition (Pennebaker, Hughes, & O'Heeron, 1987), the cognitive assimilation or narrative formation hypothesis (Pennebaker & Francis, 1996), and the exposure hypothesis (Sloan, Marx, & Epstein, 2005) have been advanced to explain the mechanisms through which expressive writing enacts its positive health outcomes (Sloan & Marx, 2004).

Psychosomatic Theory of Inhibition. The psychosomatic theory of inhibition (Pennebaker, Hughes, & O'Heeron, 1987; Pennebaker, Barger & Tiebout, 1989; Pennebaker & Susman, 1988) has roots in Freudian psychological principles about the damaging effects of suppressing unpleasant thoughts, feelings, or experiences. According to this theory, inhibiting a traumatic or stressful experience requires 'physiological work.' In the long term, chronic suppression takes a toll on the body and acts as a cumulative physical stressor. This type of stress is thought to compromise the immune system, leading to an increased risk of physical illness. Support for the physiological work required to inhibit comes from a study showing that skin conductance levels increased during emotional inhibition and decreased following emotional disclosure (Pennebaker et al., 1989). James Gross' work on the immediate and long-term costs of suppression, a form of emotion regulation defined as "behaving in such a way that a person watching you would not know you were feeling anything" (pg. 970), partially supports the

24

psychosomatic theory of inhibition. In one study, Gross and Levenson (1993) exposed participants to disgust-eliciting videos and randomly assigned them to engage in suppression or to simply watch the video and respond as they normally would. Compared to the control group, individuals in the suppression condition showed a conflicting pattern of physiology characterized by reduced somatic response and reduced heart rate paired with increased eye blinking and sympathetic nervous system activity (Gross & Levenson, 1993). Although using suppression in this study did not affect subjective emotional experience, studies indicate that chronic use of suppression as a primary emotion regulation strategy is associated with psychopathology and particularly with the anxiety disorder spectrum (Werner & Gross, 2009; Gross, 2002).

Expressive writing interventions are hypothesized to counteract the damaging effects of inhibition through cathartic release. Studies supporting this assertion have tied expressive writing interventions to improved immune functioning, including antibody response to the Epstein-Barr Virus (Esterling, Antoni, Fletcher, Marguiles, & Schniederman, 1994; Lutgendorf, Antoni, Kumar, & Schneiderman, 1994), antibody response to Hepatitis B vaccinations (Petrie, Booth, Pennebaker, Davison, & Thomas, 1995) and CD-4 (t-lymphocyte) levels (Booth, Petrie, & Pennebaker, 1997). While these studies do lend some support for the psychosomatic theory of inhibition, they do not provide confirmatory evidence of a causal relationship between reduced inhibition via expressive writing and health benefits. It remains plausible that other mechanisms, such as exposure to previously avoided thoughts or emotions or cognitive assimilation, involved in writing are necessary to achieve the observed physiological and emotional benefits.

Cognitive Assimilation Model. The cognitive assimilation model (Pennebaker & Francis, 1996) emphasizes the importance of constructing a coherent narrative in order to process upsetting internal or external experiences. The natural process of writing is thought to facilitate

narrative construction, allowing the individual to organize and assimilate the experience into their memory and self-concept. Cognitive assimilation allows the individual to derive meaning from the experience and develop adaptive coping strategies. In this way, stress associated with the event is reduced, promoting better physical and psychological outcomes. Empirical basis for this cognitive assimilation theory comes from linguistic analysis of expressive writing samples. Specifically, LIWC analyses have demonstrated that increased use of insight ("think" "know" "consider") and causation ("because" "effect" "hence") words from the first to the last writing session are correlated with superior physical and emotional health at follow-up, lending support for the importance of developing a coherent narrative to see the benefits of expressive writing. Providing further evidence of a causal relationship between cognitive assimilation and health, Smyth and colleagues' (2001) experimental manipulation of writing task instructions to promote narrative construction confirmed that it is possible to promote cognitive assimilation by altering instructions and that the formation of a coherent narrative contributes to health outcomes. However, some have argued that there may be alternative explanations for these findings. For example, it may be that narrative construction but not writing a list involves elicitation of emotion. Perhaps expressing emotion and not constructing a narrative itself is necessary to reap the rewards of expressive writing.

Exposure Hypothesis. The third, more recently proposed, theory likens expressive writing to exposure therapy (Kloss & Lisman, 2002; Sloan, Marx, & Epstein, 2005). Supporters of this theory argue that writing about upsetting events requires re-experiencing associated memories and emotions in much the same way that guided imagery or *in vivo* exposures do. This exposure forces the individual to face his or her fears and disrupts the cycle of behavioral avoidance that can perpetuate the development and maintenance of psychopathology. Proponents

26

of the exposure model theorize that, just like exposure therapy, expressive writing facilitates a corrective learning experience (Kloss & Lisman, 2002).

Consistent with other exposure-based treatments, some researchers have found that expressive writing works best when individuals are instructed to write about the same topic at multiple writing sessions, presumably maximizing exposure to a specific stressor (Sloan et al., 2005). However, other researchers employing latent semantic analysis (LSA) to evaluate linguistic content similarity across sessions have found that the opposite is true (Campbell & Pennebaker, 2003). In fact, these authors found that the more similar the writing content was from one session to the next, the less people's health improved (Campbell & Pennebaker, 2003). While this finding initially appears to undermine the exposure hypothesis, it is also possible that similarity in linguistic content across sessions represents an inflexible cognitive repertoire and a lack of emotional and cognitive processing— all of which are associated with worse therapeutic outcomes (Tausczik & Pennebaker, 2010; Pennebaker et al., 2003). The literature is more inconclusive regarding symptoms typically targeted through exposure. Sloan and Marx (2004) reported mixed results in their review of the reduction of intrusive thoughts and avoidance symptoms following expressive writing interventions. They concluded that differences in task instructions and the number of writing sessions across various studies contributed to these mixed findings (Sloan & Marx, 2004). Convincing evidence for the exposure hypothesis comes from the study, described in detail above, in which writing instructions were manipulated to promote emotional expression or insight and cognitive assimilation (Sloan et al., 2007). Traumatized undergraduates with PTSD symptoms who were instructed to write about their emotions and feelings showed a pattern of physiological habituation across the three writing sessions and consequently enjoyed greater improvement on psychological and physical health outcomes.

Thus, although the exposure mechanism hypothesis has strong theoretical support, further research is needed to resolve discrepancies in the available empirical evidence.

The linguistic analysis evidence, described above, best supports a combination of cognitive assimilation and exposure to explain traumatic event processing. Although it is plausible that alleviation of physiological inhibition is achieved through emotional disclosure of stressful life events, the psychosomatic theory of inhibition has been difficult to evaluate empirically and does not lend itself to linguistic representation. The importance of narrative coherence and use of cognitive processing words supports the cognitive assimilation hypothesis, while the presence of sensory, perceptual, and emotional language in trauma narratives and the importance of emotional expression in expressive writing lend credence to exposure as a theoretical basis for therapeutic change. The promising work by Ullrich and Lutgendorf (2002) and Sloan and colleagues (2007) suggests that dual processing, involving both exposure to emotionally salient material and cognitive integration of that material into working memory, may be necessary to achieve symptom reduction.

Linguistic markers of exposure and cognitive assimilation

Lang's (1977; 1979) bio-informational theory of emotion as a network in the brain that can be described in propositional language can be used to integrate and test these two theoretical explanations. Lang proposed that emotional networks are composed of mutually activating response, stimulus, and meaning propositional units in the brain. According to this theory, response propositions consist of expressive language, bodily responses, and behavioral acts, stimulus propositions consist of descriptions of environmental conditions, and meaning propositions consist of interpretations or knowledge about the relationship between response and stimulus propositions (Lang, 1979). Importantly for the current discussion, Lang (1994) argued

that "emotional networks can be described in natural language as a linked set of propositions" (pg. 64). Thus, linguistic representations of response, stimulus, or meaning propositions might be manipulated in order to activate specific units of an emotional fear network in the brain, resulting in traumatic event processing. This claim is supported by the key theoretical assumptions and empirical evidence of Lang and colleagues' research program investigating the effects of response training and stimulus training on physiological response to guided imagery. First, bio-informational theory proposed that response propositions can be represented in natural language but that their memorial representation also includes efferent output (Lang, 1979). Thus, activation of response units can be measured in multiple ways, including increases in physiological response and increases in response-oriented language. Furthermore, increasing verbal report, through imagery description or in writing, should result in increased activation of response propositions in memory and therefore increased physiological output. A final assumption of Lang's bio-informational theory of mental imagery is that full activation of a fear memory network including response propositions, is necessary for fear memory change (Lang, 1979). In contrast to response training, stimulus training was shown not to affect efferent output (Lang et al., 1980). This finding supported Lang's conviction that increasing the reported vividness of mental imagery would not result in increased emotional activation (Lang, 1977). Activation of stimulus propositions in memory was not sufficient to produce activation of response units measured in efferent output, whereas activation of response propositions resulted in appropriate physiological responding (Lang et al., 1980). These results strengthened Lang and his colleagues' position that mental imagery should not be conceived as literal pictures in the brain but rather as functional brain processes, including response, stimulus, meaning units (Cuthbert, Vrana, & Bradley, 1991).

29

Based on these principles, Lang and colleagues (1980) developed response and stimulus training procedures designed to amplify activation of response or stimulus networks and test their hypothesis that increased activation and processing of fear networks could be achieved through instructionally manipulating propositions in imagery scripts. Although response and stimulus training procedures (Lang, Levin, Miller, & Kozak, 1983) led to increasing the frequency of response or stimulus propositions, respectively, in imagery descriptions, the effects on efferent output differed. In one study, snake-phobic and socially anxious participants initially showed no significant physiological response to fear imagery, despite verbally reporting high levels of fear. However, response training increased subsequent physiological response to fear imagery whereas stimulus training procedures did not influence physiological response (Lang et al., 1983). Furthermore, response-trained individuals exhibited greater concordance between their verbal report and visceral arousal than did untrained participants (Lang et al., 1983). These results provided initial evidence that imaginal exposure-based treatments for fear and anxiety could be enhanced with the addition of response pre-training.

The clinical utility of Lang and colleagues' research depended on the assumption that increased physiological response to emotional imagery would enhance treatment outcomes. Later applications of bio-informational theory have confirmed this assumption, demonstrating that low initial physiological reactivity during exposure predicts poor treatment outcomes and high initial physiological reactivity during exposure predicts good treatment outcomes (Foa & Kozak, 1986; Lang, Melamed, & Hart, 1970; Watson & Marks, 1971). Furthermore, in one study of flight phobic individuals, concordance between elevated physiological reactivity and self-reported fear levels during exposure was associated with better treatment outcomes (Beckham et al., 1990).

Thus, elevating physiological response through response proposition activation may enhance the benefits of other treatments targeting emotional processing, such as expressive writing.

In order to determine whether Lang's theory of an emotional network composed of propositional response, stimulus, and meaning units, can be applied to expressive writing, it is necessary to establish whether response and stimulus training influence the linguistic content of expressive writing in a similar manner to guided imagery scripts. Lang himself (1994) stated that, "if quantity of matching propositions is the key to prototype access, it is expected that response training would have the same enhancing effect on efferent responding regardless of the input medium" (pg. 213), supporting the idea that alternate mediums like expressive writing might be similarly affected by response or stimulus training. Thus, linguistic analysis of the effects of training on expressive writing will reveal whether the proposed mechanism of action, "quantity of matching propositions" in emotional imagery, holds for written emotional disclosure.

Exposure and cognitive assimilation theories of emotional processing have been previously integrated using Lang's bio-informational theory of emotion. Foa and Kozak (1986) have proposed that the reduction of pathological anxiety or fear requires complete activation of a fear structure in memory, composed of stimulus information about the feared situation, the individual's responses to the situation, and the meaning the individual attributes to it. According to this conceptualization, evidence for the role of exposure as a mediator of therapeutic emotional processing comes from the observed patterns of habituation in physiological arousal and self-reported distress that occur both within and across treatment sessions (Foa & Kozak, 1986). Physiological activation and eventual attenuation is assumed to indicate successful processing of response information in the fear structure.

Given that a pattern of physiological habituation has been demonstrated using both imaginal and *in vivo* methods, Foa and Kozak (1986) and Lang (1994) have argued that evocation of response units in the fear structure could be achieved through a variety of media. Some studies have suggested that particular disorders may respond better to a given treatment modality; however, appropriate tailoring of the medium used to access the fear structure remains an open question. Therefore, it may be fruitful to examine alternative exposure-based treatment modalities, such as writing.

In addition to the importance of modifying response information through habituation, Foa and Kozak (1986) highlight the role of correcting pathological meaning information to achieve long-term modification of the fear structure. In the majority of cases, they argue, within-session habituation alone may not be sufficient if interpretations of the potential for harm persist. This meaning information about the relationship between stimulus and response can be modified through repeated exposure to information that is contradictory. For example, the belief that motor vehicles are dangerous following a car accident is an example of meaning information that might be modified through gradual, repeated car trips during which the individual does not experience another car accident, experiences physiological and emotional habituation, and learns that the degree of threat attributed to riding in motor vehicles was excessive. In addition to this "exposure to corrective information" hypothesis, it is also possible that the individual consciously engages in cognitive assimilation. This process might be observed in the use of language indicative of causality or insight, such as "I realized that you have to accept some level of risk in driving, but I know that it's unlikely I will be an accident every time I drive" or "I may have increased my chances of having an accident because I was texting while driving". Meaning

propositions or cognitive processing language of this kind may be enhanced as a result of repeated exposure during which corrective information becomes more salient.

In summary, the previous review presented evidence for a dual model involved in the emotional processing of traumatic or stressful events. Numerous studies from two separate but complementary literatures suggest that exposure and cognitive assimilation are important mediators of treatment outcome. However, it is important to determine whether and how these mechanisms of change can be enhanced. Within the expressive writing paradigm, linguistic variables have been examined as indicators of emotional and cognitive processing. Previous research suggests that it is possible to alter linguistic content by manipulating written instructions or providing feedback to participants. Training procedures, such as response and stimulus training, may be uniquely suited to affect linguistic content indicative of emotional processing. Converging evidence from the clinical trauma narrative literature and the expressive writing literature supports an investigation of the effects of response and stimulus training on the linguistic content of expressive writing narratives.

Objectives of Proposed Research

In a previous investigation, participants received response, stimulus, or no training (Konig, 2011) before completing Pennebaker and Beall's (1986) expressive writing task. Response training is designed to amplify appropriate physiological responding by increasing use of response propositions (i.e. bodily responses, overt behavioral acts, verbal exclamations) and was hypothesized to increase the physiological exposure effects of writing about a traumatic event, as demonstrated by higher heart rate, skin conductance, and salivary cortisol levels during writing and resulting in reduced PTSD and depression symptoms and enhanced physical health at follow-up. Conversely, stimulus training is not designed to increase physiological responding

33

and served as a comparison training group to measure the effects of encouraging participants to pay attention to stimulus details in their writing (i.e. descriptions of contextual details).

The current study tested whether response and stimulus training systematically altered the linguistic content of participant's written narratives. It was hypothesized that writing content would reflect imagery training condition such that response-trained participants would include a higher frequency of response propositions and stimulus-trained participants would include a higher frequency of stimulus propositions. Additionally, consistent with previous research, it was expected that individuals in the trauma writing condition but not the neutral writing condition would show an increase in use of cognitive processing words from the first writing session to the third writing session. Finally, a pattern of linguistic exposure and cognitive assimilation across writing sessions was hypothesized such that response-trained trauma writers would demonstrate higher response proposition usage during the first writing session compared to the third writing session and would also demonstrate an increase in cognitive processing words from the first writing session to the third writing session. This study is the first to examine whether imagery training procedures influence linguistic content of expressive writing narratives and aimed to reveal whether the benefits of adjunctive response training can be explained by the proposed mechanism of action: increased frequency of response propositions. Training was expected to affect writing in the same way it has been shown to affect imagery because the propositional structure of memorial representations of response, stimulus, and meaning units should hold regardless of the medium used to access them. Finally, these linguistic analyses will allow for future investigation of the relationship between word usage and physiological responding during writing, further clarifying the mechanisms of change in imagery training enhanced expressive writing.

Research Hypotheses

As suggested above, imagery training procedures were expected to influence patterns of word usage in the expressive writing paradigm. In the current investigation, the effects of response and stimulus pre-training during emotional and neutral writing on linguistic content were be examined. Response-training procedures involved systematic reinforcement of using verbal expression, behavioral actions, or bodily response propositions in verbal imagery descriptions. Conversely, stimulus training procedures involved reinforcement of participants' use of descriptors in their imagery descriptions. Although meaning-training procedures have not been employed, meaning units were conceptualized as language indicative of insight and cognitive processing. With these theoretical constructs in mind, the following hypotheses were proposed:

Hypothesis 1. Because response training has taught subjects to use and process response-oriented words (Lang et al., 1980), it was expected that in the three writing sessions, response trained trauma writing and trivial topic participants would produce a greater proportion of total written response words (defined as a custom dictionary category containing words indicative of behavioral action, physiological responding, or verbal expression) than will stimulus trained or untrained participants. It was also hypothesized that, compared to stimulus and untrained participants, response trained individuals would use a greater frequency of several LIWC2007 default dictionary categories ('verbs', 'feeling', 'biological', 'body', and 'motion') based on the conceptual similarity of these categories to the response construct (see Table 1 below for exemplar words from each category).

Table 1.

LIWC2007 dictionaries and sub-categories used to capture response construct

LIWC 2007 Dictionary or Sub-category	Exemplar words
Verbs	walk, went, see, called, looks, ran
Feeling (sub-category of Perceptual dictionary)	feels, touch, grab, grips, caress
Biological	eat, blood, pain, drank, arouse
Body (sub-category of Biological dictionary)	cheek, hands, spit, heart, breathe
Motion (sub-category of Relativity dictionary)	arrive, moving, go, jump, shake

(Pennebaker, Chung, Ireland, Gonzales, & Booth, 2007)

Hypothesis 2. Because stimulus training has taught subjects to use and process stimulus-oriented words (Lang et al., 1980), it was expected that in the three writing sessions, stimulus trained trauma writing and trivial topic participants would produce a greater proportion of total written stimulus words (defined as a custom dictionary category containing words indicative of contextual description or detail) than will response or untrained participants. It was also predicted that, compared to response trained and untrained participants, stimulus trained participants would use a greater frequency of several LIWC2007 default dictionary categories ('perceptual', 'see', 'hear') based on the conceptual similarity of these categories to the stimulus construct (see Table 2 below for exemplar words form each category).

Table 2.

LIWC2007 dictionary and sub-categories used to capture stimulus construct

LIWC2007 dictionary or sub-category	Exemplar words
Perceptual dictionary	cool, pink, rough, fire, feels
Seeing sub-category	saw, vivid, color, bright
Hearing sub-category	Noisy, thunder, sound, scream

(Pennebaker, Chung, Ireland, Gonzales, & Booth, 2007)

Hypothesis 3. Because previous research has established a link between changes in cognitive processing and therapeutic outcomes in both traditional exposure therapy and writing about traumatic events (e.g. Ullrich & Lutgendorf, 2002; Sloan et al., 2007), it was expected that, from Session 1 to Session 3, trauma writers (regardless of imagery training) would show a greater increase in the proportion of total written meaning words (defined as cognitive processing, causal, and insight words from the LIWC2007 default dictionary Cognitive Process and its Causal and Insight sub-categories) than would trivial topic writers.

Hypothesis 4. Because theory and the relevant empirical evidence suggest that expressive writing works through a combination of activation of and exposure to response information in memory (Foa & Kozak, 1986; Konig, 2011) and cognitive assimilation (Sloan & Marx, 2004), and response-training enhanced trauma writing is the condition most likely to stimulate these processes, it was expected that response-trained trauma writers would show a

pattern of linguistic habituation in which:

Hypothesis 4a. Response words (defined as custom response word and response sub-category dictionaries and default LIWC2007 verbs, feeling, biological, body, and motion dictionaries) would be highest in Session 1 and would be significantly reduced by Session 3, in line with patterns of physiological and emotional habituation observed in exposure treatment.

Hypothesis 4b. Meaning words (defined as cognitive processing, causal, and insight words from the LIWC2007 default dictionary) would be lowest in Session 1 and significantly increased by Session 3, consistent with theories of exposure to corrective information, cognitive assimilation, and cognitive processing word usage observed in expressive writing.

Hypothesis 5. Based on patterns of word usage observed in previous expressive writing studies (Owen et al., 2011; Pennebaker, 1997; Ullrich & Lutgendorf, 2002), it was expected that, compared to neutral writers, trauma writers would use a greater frequency emotion words, defined as the following LIWC2007 default dictionary categories: 'affective process' ('positive emotion', 'negative emotion', 'anxiety', 'anger', 'sadness'), and 'feeling'.

Hypothesis 6. Because theories of meaning-making (Park & Folkman, 1997; Park & Blumberg, 2002), narrative formation (Pennebaker et al., 1997; Foa et al., 1995), and exposure (Foa & Kozak, 1986; Kloss & Lisman, 2002; Sloan, Marx, & Epstein, 2005) would predict that repeatedly writing about a traumatic event promotes less threatening appraisals of the event and more positive appraisals or benefit-finding, it was expected that, from session 1 to session 3, compared to neutral writers, trauma writers would show greater increases in positive emotion words (defined as the 'positive emotion' sub-category of the LIWC2007 default affective process dictionary) and greater reductions in negative emotion words (defined as the 'negative emotion',

'anxiety', 'anger', and 'sadness' sub-categories of the LIWC2007 default affective process dictionary).

Method

The data collection for this study was performed by another investigator as a doctoral dissertation examining the effect of response and stimulus imagery training on expressive writing's effects on physiological response, PTSD and depression symptoms, and physical health (Konig, 2011). For the purpose of the current study, the original methodology are described but only an analytic strategy for the current investigation of word use across the different conditions and writing sessions is proposed

Participants

Participants were 246 undergraduates from a large southeastern university, with an average age of 21 years old. The sample was 72% female and was composed of 48% Caucasians, 28% African Americans, 27% Asians, 2 % Hispanics, 1 % Native Hawaiian or Other Pacific Islander, and 10 % identifying as Other (Konig, 2011). Participants were drawn from a non-clinical population and were not screened for having previously experienced a traumatic event. (See Table 3 on next page for demographic information).

Design

In the original imagery training enhanced expressive writing intervention study (Konig, 2011), participants were randomly assigned to one of six conditions in a 2 (expressive writing/neutral writing) by 3 (response training/stimulus training/no training) between subjects design. All participants completed three writing sessions. The independent variables in the

current study will be imagery condition, writing condition, and writing session. The dependent

variable will be word usage, and in particular, the frequency of response, stimulus, and meaning

words.

Table 3.

Demographic information

Variable	Response Trained Trauma N (%) or M (SD)	Stimulus Trained Trauma N (%) or M (SD)	No Training Trauma N (%) or M (SD)	Response Trained Neutral N (%) or M (SD)	Stimulus Trained Neutral N (%) or M (SD)	No Training Neutral N (%) or M (SD)	Total Sample N (%) or M (SD)
Age	20.9 (4.2) (Range 18-37)	20.9 (2.8) (Range 18-28)	23.9 (9.8) (Range 18-53)	20.8 (4.3) (Range 18-26)	21.1 (4.7) (Range 18-43)	21.4 (4.0) (Range 18-35)	21.5 (5.5) (Range: 18-53)
Gender							
Male	9 (22.5%)	9 (25.7%)	10 (26.3%)	10 (25.6%)	10 (20.4%)	21 (46.7%)	69 (28%)
Female	31 (77.5%)	26 (74.3%)	28 (73.7%)	29 (74.4%)	39 (79.6%)	24 (53.3%)	177 (72%)
Race							
White	23 (57.5%)	16 (45.7%)	19 (50.0%)	23 (59.0%)	19 (38.8%)	18 (40.0%)	118 (48%)
Black/African American	8 (20.0%)	11 (31.4%)	8 (21.1%)	7 (17.9%)	19 (38.8%)	16 (35.6%)	69 (28%)
Asian	4 (10.0%)	4 (11.4%)	2 (5.3%)	6 (15.4%)	5 (10.2%)	6 (13.3%)	27 (11%)
Hispanic	1 (2.5%)	1 (2.9%)	1 (2.6%)	1 (2.6%)	0 (0.0%)	1 (2.2%)	5 (2%)
Native Hawaiian or Other Pacific Islander	1 (2.5%)	0 (0.0%)	1 (2.6%)	0 (0.0%)	0 (0.0%)	1 (2.2%)	3 (1.2%)
Other	3 (7.5%)	3 (8.6%)	7 (18.4%)	2 (5.1%)	6 (12.2%)	3 (6.7%)	24 (9.8%)
Year in School							
Freshman	14 (35.0%)	9 (25.7%)	12 (31.6%)	15 (38.5%)	19 (38.8%)	23 (51.1%)	92 (37.4%)
Sophomore	13 (32.5%)	7 (20.0%)	8 (21.1%)	9 (23.1%)	6 (12.2%)	7 (15.6%)	50 (20.3%)

Junior	8 (20.0%)	7 (20.0%)	5 (13.2%)	5 (12.8%)	9 (18.4%)	7 (15.6%)	41 (16.7%)
Senior	5 (12.5%)	12 (34.3%)	13 (34.2%)	10 (25.6%)	15 (30.6%)	8 (17.8%)	63 (25.6%)

Native
Language

English	35 (87.5%)	32 (91.4%)	27 (71.1%)	35 (89.7%)	45 (91.8%)	37 (82.2%)	211 (85.8%)
Other	5 (12.5%)	3 (8.6%)	11 (28,9%)	4 (10.3%)	4 (8.2%)	8 (17.8%)	35 (14.2%)

Study Conditions

Training and Writing Conditions. Participants were randomly assigned to one of six groups in a 3 Training Condition (Response-Training, Stimulus-Training, No Training) x 2 Writing Condition (Trauma Writing, Neutral Writing) design.

Training Conditions. Following established procedures (Miller et al., 1987; Peasley-Miklus & Vrana, 2004), subjects participated in a 45-minute individual imagery training session prior to the first writing session. During training, participants listened to four action-oriented scripts, all of which lacked reference to emotion, but either contained descriptive detail and reference to behavioral and physiological responding (response training scripts) or just contained descriptive details (stimulus training scripts). After listening to the scripts, participants were asked to imagine the script and were encouraged to describe their imagery out loud (see Appendix A for complete imagery training protocol).

Response Training. The response training imagery condition was intended to amplify participant's use of response-oriented imagery descriptions, including verbal responses (i.e. "I cried aloud"), overt motor acts (i.e. "I craned my neck"), and responses of the physiological organs (i.e. "my hands were sweating") (Lang, 1977). The training leader provided positive

feedback to participants for including response propositions in their imagery. Participants who did not include behavioral or physiological response content in their imagery descriptions were encouraged to do so for the remaining trials.

Stimulus Training. The stimulus training imagery condition was intended to amplify participant's use of sensory details in their imagery descriptions (Lang, 1977). For example, participants received positive feedback from the training leader for including descriptors such as "the sky was blue" and "the sun was shining brightly." Prior research supports the use of stimulus training as an active comparison control for response training (Lang et al., 1980).

No Training. Participants in this condition did not receive imagery training. In this way, the traditional writing paradigm procedures were replicated to allow for direct comparisons of the effects of response and stimulus training above and beyond the writing intervention.

Writing Conditions. Participants followed the typical expressive writing paradigm protocol of writing on three separate days within one week for 20 minutes each session. An adaptation of Pennebaker's (1997) writing instructions were used (see Appendix B for complete writing instructions), with participants assigned to one of the two following conditions:

Expressive Writing (Trauma Writers). Participants were instructed to write about the most traumatic or distressing experience of their lives with as much emotion and feeling as possible. In session 1, the instructions encouraged the participant to "really let go" and to explore how the event relates to other aspects of life. In session 2, the participant is asked to continue writing about the same event and to continue to "explore your very deepest emotions and thoughts". Finally, in session 3, the instructions tell the participant to continue writing about the same event, remind the participant that it is the final day of writing, and encourage the participant to "wrap everything up".

Trivial Topic Control (Neutral Writers). Participants were instructed to write about how they spend their time in an objective manner, refraining from including any emotional descriptions or opinions of the events. In session 1, participants were told they would be writing about how they use their time and that each day they would receive different writing assignments on the way they spend their time. For the first writing session, participants were instructed to describe what they did the day before in as much detail as possible. On the second day of writing, participants were asked to write about what they have done that day since waking up. Finally, on the third day of writing, participants were reminded that it was the final day of writing and were asked to describe what they planned to do over the next week.

Procedure

Session 1. Participants read and signed the informed consent agreement. All participants were assured that their written work would be kept confidential, and their names would not be attached to their data. First, they completed self-report questionnaires collecting demographic information and information about post-traumatic, depression, physical, and mood symptoms to establish baseline levels of psychological and physical functioning. Then, participants assigned to response-training or stimulus-training underwent the training procedures described above. There was also brief training in diaphragmatic breathing for all subjects, with the instruction to use this during the baseline and recovery periods (see Appendix A). Participants assigned to the no-training condition only completed the self-report measures, physiological data collection, and writing portion of the session. Participants completed the writing in the same room where the imagery training was conducted. Before beginning the writing task, electrodes were attached to measure heart rate (HR) and skin conductance (SC) continuously for a ten- minute baseline period prior to writing, throughout the 20 minute writing session, and for a five-minute recovery

43

period post-writing in accordance with previous research (Epstein, Sloan, & Marx, 2005). Participants who received response or stimulus training were asked to use the imagination techniques they were just taught to become more fully involved in recalling and writing about their experiences. After completing 20 minutes of writing about a traumatic event or about a neutral topic, participants completed short versions of post-traumatic symptom and mood questionnaires. Before leaving, participants were asked to schedule their second and third writing sessions, which occurred on different days within a two week timeframe.

Session 2. Participants completed the assigned writing task for a second time. Before beginning to write, participants who received response or stimulus training were reminded to use the imagination techniques they had learned to more fully involve themselves in their writing. Physiological data was not collected. Participants completed short versions of post-traumatic symptom and mood questionnaires before and after writing.

Session 3. This session was the same as Session 2, except that physiological data was collected for a second time. Again, response and stimulus trained participants were asked to use the imagination techniques they were taught in the first session to become more fully involved in their writing.

Follow-Up. Participants were contacted one month following Session 3 and asked to complete follow-up measures. They completed the self-report outcome measures of post-traumatic, depression, physical, and mood symptoms for a second time to assess psychological and physical functioning following the writing intervention. Finally, participants were fully debriefed about the purpose of the study and were directed to appropriate mental health resources if necessary.

Dictionary Development

Linguistic analysis was performed using custom and LIWC2007 default dictionaries developed or currently available to capture the three types of emotional propositions: response, stimulus, and meaning. Overall emotional tone was also analyzed using LIWC2007 default dictionaries designed to capture affective content, positive emotion, negative emotion, and specific types of negative emotion (anxiety, anger, and sadness). Response and stimulus dictionaries were developed using empirically validated procedures employed by the creators of Linguistic Inquiry and Word Count (LIWC) (Pennebaker et al., 2001) and further elaborated in a widely used quantitative content analysis manual, *The Content Analysis Guidebook* (Neuendorf, 2002). These procedures represent the most widely used quantitative methods in the psychological literature for establishing dictionary categories at the single-word level for analysis of psychologically meaningful word usage (Pennebaker et al., 2003; Neuendorf, 2002). The LIWC2007 Cognitive Process dictionary (described in detail below) aligns with Lang's (1979) definition for meaning propositions; thus, it was used to analyze the frequency of meaning propositions.

Custom response and stimulus word dictionaries were created using procedures similar to those used to establish the LIWC2007 default dictionaries, including Cognitive Process, and by following Neuendorf's (2002) recommendations for creating custom dictionaries for computer-based analysis. For each dictionary, the following steps were followed:

Word Collection. First, a team of three undergraduate research assistants, led by the primary investigator, generated a list of words to capture the target category (see Appendix C for instructions and definitions used in this phase). This deductive, theory-based process involved consultation of theoretical descriptions, examples, and response and stimulus training scripts created by Lang and colleagues (1977; 1979; 1980; 1983). Following the initial word collection,

45

brainstorming sessions were held in which additional words were added to the list based on theoretical definitions and mutual consensus of the primary investigator and undergraduate research assistants. If a majority of the group agreed that a certain word should be included, then the word was added to the list. In addition to the deductive word collection method described above, a more data-driven, inductive method was also employed. A frequency list of all words used at a frequency of at least .01% was generated from the entire sample of trauma and neutral essays. The undergraduate research assistants and the primary investigator each independently reviewed this word list and selected words for the target category based on theoretical definitions. Finally, the primary investigator combined the selected words from each member of the team to create the final word list for the target category. Judgment about suitability and selection for the final dictionary was postponed until after this initial word collection stage.

It is important to note that, although separate lists were created for the response and stimulus dictionary categories, these lists were not required to be mutually exclusive because there are words that can have meanings as a stimulus or a response word, depending on the context. Because we cannot capture context using the single-word approach, the primary investigator decided that it was better to capture these words in both categories than to arbitrarily place them in one category and not the other. This approach was selected to maximize sensitivity, while sacrificing some specificity. Although some overlap in response and stimulus words was expected and would be consistent with the overlap of words in established LIWC2007 dictionary categories (Pennebaker, Francis, & Booth, 2001), it was anticipated that the selection criteria differed enough that these categories would be generally independent. Finally, it should also be noted that different forms of words (e.g. talk, talked, talking) were included as separate words in this phase. LIWC2007 allows the entry of word stems (talk*) in order to capture all

forms of that word within a given dictionary category; however, it was determined that all forms of a given word stem should first be individually considered for inclusion in a target category.

Judges' Rating Phase. The word lists for each target category were submitted to an independent group of three judges for verification. The three judges included one clinical psychology faculty member (SRV), one PhD level community researcher and clinician who was the principal investigator of the initial study (AK), and one graduate student in clinical psychology (EC). Using established inclusion and exclusion criteria for the response and stimulus categories (described below), each judge was asked to determine whether each word should be retained in the category or omitted. Judges were also encouraged to generate additional words deemed suitable for including in the categories. A "two out of three" rule was used such that inclusion, exclusion, and additions of words were based on the approval of two out of the three judges. For the response dictionary category, judges were also asked to further categorize selected words into sub-categories, based on Lang's (1979) list of types of response propositions (described below). The creators of the default LIWC2007 dictionary categories reported percentages of judges' agreement on word inclusion and exclusion ranging from 86% to 100% (Pennebaker, Francis, & Booth, 2001).

The following paragraphs summarize the specific inclusion and exclusion criteria and instructions provided to judges in rating words generated during the word collection phase for inclusion in the custom response and stimulus dictionaries (see Appendices D and E for complete inclusion/exclusion criteria and judges' instructions). The rationale and criteria for using the LIWC2007 Cognitive Process default dictionary to capture meaning propositions is also provided below.

Response Proposition Dictionary Inclusion/Exclusion Criteria. As defined by Lang (1979), response propositions consist of expressive language, behavioral acts, and bodily responses. Thus, inclusion criteria for the response proposition dictionary were words indicative of verbal exclamation, behavioral activation, or physiological arousal. It was expected that the parts of speech most likely to meet inclusion criteria would be action verbs (e.g. run, jump, shout), gerunds referring to bodily responses, expressive language, or behavioral acts (e.g. trembling, crying, jumping), nouns referring to bodily responses (e.g. heartbeat, sweat, pulse), and exclamations (e.g. "Help!", "Stop!", "Darn!"). Lang (1979) also described five sub-categories of response propositions, which included verbal responses (e.g. overt and covert vocalizations), somatomotor events (e.g. muscle tension, uncontrolled gross motor behavior, organized motor acts), visceral events (e.g. heart rate and pulse, pilomotor response, etc.), processor characteristics (e.g. perception, loss of control over thoughts, disorientation), and sense organ adjustments (e.g. postural changes, eye and head movements) (see Appendix D for complete list of response sub-categories and word exemplars). Judges were encouraged to further categorize selected words into these sub-categories during the judge's rating phase. Exclusion criteria for the response proposition dictionary were words unrelated to these specific concepts. Specifically, other parts of speech such as articles, adverbs/adjectives, verbs indicative of external sensory perception, nouns not referring to bodily responses or body parts nouns, and non-exclamatory verbalizations (e.g. "Hey", "Yep", "Whatever") were expected to be excluded.

Stimulus Proposition Dictionary Inclusion/Exclusion Criteria. Lang (1979) referred to stimulus propositions as descriptions of contextual stimuli. Thus, stimulus words included adjectives, adverbs, and gerunds referring to sensory or contextual details, including physical details such as color, size, shape, smell, sound, and orientation, as well as nouns, especially

object nouns, indicative of setting, presence of objects, physical place, or location, and prepositions signaling object configuration, location, and the presence or absence of others. Lang (1979) described different types of stimulus words as auditory, visual, tactile, cutaneous, olfactory, vestibular, kinesthetic, physical details of objects or situations, changes in object configuration, object movement, physical place or general location, presence or absence of others, and the location and quality of physical pain (see Appendix E for complete description of stimulus word criteria and exemplars of stimulus words). Words that did not meet these specific criteria, especially articles, action verbs, gerunds referring to bodily responses, expressive language, or behavioral acts, exclamations, and nouns referring to bodily responses were excluded.

Meaning Proposition Dictionary Inclusion/Exclusion Criteria. Because Lang (1979) focused on response and stimulus imagery training programs, meaning propositions were not as clearly defined in bio-informational theory. The definition provided was that meaning propositions should be understood generally as semantic information about stimulus and response or as interpretations about inputs and outputs. More recent definitions (Foa & Kozak, 1986) have expanded the meaning concept to include specific cognitions about stimuli and responses. From this conceptualization, the Insight and Causal subcategories of the LIWC2007 Cognitive Process dictionary appropriately tap the meaning construct (see Appendix H for LIWC2007 dictionary words). Insight words include "discovered", "realized", "thought", while Causal words are those that imply causality such as "cause", "affect", "therefore" and "because". Previous research has concluded that the increasing use of Insight and Causal words indicates the formation of a coherent narrative or "meaning-making," and that this process facilitates better treatment outcomes (Smyth et al., 2001).

Psychometric Evaluation. Evaluation of the psychometric properties of the LIWC2007 standard dictionaries is ongoing (Pennebaker et al., 2003). Thus far, Pennebaker and his colleagues have applied the dictionaries to a sample of over 8 million words, drawn from expressive writing studies, online text samples, and various other text mediums (Pennebaker 2001). In this initial evaluation, words used at a base rate of .005 or lower were excluded. Additionally, words not found in Francis and Kucera's (1982) *Frequency Analysis of English Usage* were removed from LIWC2007's standard dictionary categories. For the current project, the response and stimulus dictionary categories were subjected to one form of psychometric evaluation by using them to analyze the effects of response and stimulus training on word usage. Neuendorf (2002) recommends evaluating the validity of custom dictionaries by analyzing word usage frequencies against available text samples. It was expected that the hypothesized effects of response and stimulus training on word usage in the traumatic and neutral essay sample would serve as an initial validation of the custom response and stimulus dictionary categories.

One oft cited critique of LIWC is that word frequencies fail to capture psychologically meaningful language in context. For example, in the current study, the word "run" will always be counted as a response word, whether it is used as part of a response proposition as in, "I run away screaming", or not, as in, "I run participants in a study of word usage". Word count programs are not yet "smart" enough to act like a human coder and distinguish between the two uses to appropriately count the first instance of "run" and not the second. Thus, a necessary tradeoff in using word frequency software is that researchers must assume a certain amount of error in frequencies. Because of this, word count analyses may be best suited to group-level studies with large sample sizes, such as the current proposed study, to guarantee that detected differences cannot be exclusively explained by categorization error.

Results

Dictionary Development

Two custom word dictionaries, a response word dictionary and a stimulus word dictionary, were developed using the procedures outlined above (see Dictionary Development under Method section and Appendices C-E for specific procedures). For the response words, judges were also instructed to further categorize words into the following sub-categories, which included Verbal Responses, Somatomotor Events, Visceral Events, Processor Characteristics, and Sense Organ Adjustments. Inter-rater reliability was assessed for each version of the two custom dictionaries and for the sub-categories of the response dictionary using both a simple calculation of average percent agreement among the three judges as well as calculation of the intraclass correlation coefficient (ICC), which is an index of the consistency of multiple raters on a single measure (MacLennon, 1993). As previously mentioned, the developers of LIWC reported percent agreement ranging from 86% to 100% for judges' inclusion and exclusion decisions for various default LIWC2007 dictionaries (Pennebaker, Francis, & Booth, 2001). Additional, more conservative measures of inter-rater reliability (ICC, Cohen's kappa, etc.) statistics for LIWC2007 have not been reported in the literature. For this study, the ICC was also calculated in order to control for inflation of inter-rater reliability due to chance agreement. The specific reliability results for the custom response and stimulus dictionaries are described in the following paragraphs.

Response dictionary. A total of 769 words were collected during the Word Collection phase from a frequency list of the entire traumatic and neutral essay text sample as well as from articles, response training materials, and conceptual definitions provided by Lang and colleagues.

The response dictionary containing words selected for inclusion by two out of three judges included 632 words. The response dictionary containing words selected for inclusion by all three judges included 253 words. Two out of three of the judges agreed on sub-category designations for 513 words. These words were categorized into the following sub-categories: Verbal Responses ($n=89$), Somatomotor Events ($n=328$), Visceral Events ($n=56$), Processor Characteristics ($n=11$), and Sense Organ Adjustments ($n=29$). (See Appendix F for complete list of response dictionary and sub-category words). Average percent agreement, which was calculated by averaging the percent agreement of each set of judges, was 33%, indicating slightly better than what would be expected by chance (25% for 3 raters). Pairwise analyses of agreement between each of the raters revealed that raters EC and AK agreed 87% of the time, whereas rater SRV agreed only 48% with AK and 42% of the time with EC. The ICC was .34 for all three judges' ratings of the response words, indicating fair agreement. Percent agreement and the ICC were also calculated for each of the five sub-categories. Average percent agreement among the three judges on sub-category designation was 78%. The ICC was .88 for all three judges' categorization of response words into sub-categories, indicating almost perfect agreement. Pairwise analyses of agreement between each of the raters revealed that raters EC and AK agreed 58% of the time, whereas rater SRV agreed only 26% with AK and 24% of the time with EC.

Based on these reliability data and in accordance with the previous literature, analyses evaluating response word usage are reported below for the response 2 out of 3 dictionary and sub-categories. These versions of the response word dictionary and sub-categories were selected in order to be consistent with the development process for the default LIWC2007 dictionaries (Pennebaker, Francis, & Booth, 2001). Furthermore, given that judges AK and EC showed a high degree of agreement (87%), it is likely that the response 2 out of 3 dictionary represents

words agreed upon by the majority of judges, whereas the response unanimous dictionary represents a more restricted selection of words. [1]

Stimulus dictionary. A total of 1055 words were collected during the Word Collection phase from a frequency list of the entire traumatic and neutral essay text sample as well as from articles, stimulus training materials, and conceptual definitions provided by Lang and colleagues. The stimulus dictionary containing words selected by two out of three judges included 803 words. The stimulus dictionary containing words selected for inclusion by all three judges included 439 words. (See Appendix G for complete stimulus dictionary word list). Average percent agreement among the three judges was 42%, indicating greater agreement than what would be expected by chance alone (25% for 3 raters). Pairwise analyses of agreement between each of the judges revealed that judge SRV agreed 64% of the time with judge AK and 50% of the time with judge EC, whereas judges EC and AK agreed only 9% of the time. Inter-rater reliability using the ICC was .52, indicating moderate agreement among the three judges.

Based on these reliability data and in accordance with the previous literature, analyses evaluating stimulus word usage are reported below for the stimulus 2 out of 3 dictionary. This version was selected in order to be consistent with the development process for the default LIWC2007 dictionaries (Pennebaker, Francis, & Booth, 2001). Furthermore, given that judges AK and EC showed a much lower percent agreement (9%) compared to the agreement between SRV and the other judges (64% for AK and 50% for EC), it is likely that the stimulus 2 out of 3

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[1] Response word usage analyses were also performed using the unanimously chosen response words. Results were comparable to the results found using the response words chosen by 2 out of 3 judges; therefore, the unanimously chosen response word results are not reported in this paper.

dictionary represents words agreed upon by the majority of judges, whereas the stimulus

unanimous dictionary would be overly restricted by the lack of agreement between AK and EC. [2]

Data Preparation

Following dictionary development, custom response and stimulus word dictionaries were

programmed into LIWC2007 using procedures outlined in the LIWC2007 manual (Pennebaker,

Francis, & Booth, 2001). Word count analyses were performed using the two custom and

selected default dictionaries in the LIWC2007 software package. For the primary analyses, each

participant's essays were analyzed individually for total word count, custom response word and

response sub-category frequency, LIWC2007 dictionaries and sub-categories with conceptual

similarity to the response construct, stimulus word frequency, LIWC2007 dictionaries and sub-

categories with conceptual similarity to the stimulus construct, meaning word frequency

(LIWC2007 Cognitive Process dictionary, and Insight and Causal word sub-categories of the

Cognitive Process dictionary), and emotional word usage (LIWC2007 affective process

dictionary and sub-categories) at each of the three writing sessions.

Word count analyses performed with LIWC2007 software automatically calculate a word

count frequency by dividing the word count for each dictionary category by the total number of

words in a given text sample. This ratio is then converted to a percent by multiplying the value

by 100. Therefore, all numeric data, with the exception of the total word count for each writing

session, which is presented as a raw score, should be interpreted as a percentage of the total word

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[2] Stimulus word usage analyses were also performed using the unanimously chosen stimulus
words. Results were comparable to the results found using the stimulus words chosen by 2 out of
3 judges; therefore, the unanimously chosen stimulus word results are not reported in this paper.

count.

Primary Analyses

To test each of the five primary study hypotheses, a 2 (Writing condition) x 3 (Training condition) x 3 (Writing session) mixed ANOVA was performed for each of the dependent variables (DV): response words (custom response dictionary and 'verbal responses', 'somatomotor events', 'visceral events', 'processor characteristics', and 'sense organ adjustments' sub-categories, LIWC2007 'verbs', 'feeling' sub-category of 'perceptual' dictionary, 'biological', 'body' sub-category of 'biological', and 'motion' default dictionaries); stimulus words (custom stimulus dictionary, LIWC2007 'perceptual' dictionary and 'seeing' and 'hearing' sub-categories of 'perceptual' dictionary), and meaning words ('cognitive process' dictionary and 'insight' and 'causal' sub-categories). Post-hoc comparison analyses for all significant effects of training condition and for all significant interaction effects were also performed using Tukey's Honestly Significant Difference (HSD). The Greenhouse-Geisser correction for violation of the sphericity assumption is reported for all analyses involving repeated measures. An analysis of total word count across the conditions and writing sessions is also reported below. Results are organized below by tests of each hypothesis on the corresponding DVs.

Total word count. Overall, participants wrote an average of 459.79 (SE=6.16) words per session. A significant main effect of session was found, $F(2, 452)=29.32$, $p<.001$, $\varepsilon=.970$, with significant decreases in total number of words from session 1 ($M=482.61$, $SE=6.49$) to session 3 ($M=441.68$, $SE=7.28$). No other significant main effects or interactions were detected for total word count.

Hypothesis 1: Custom Response Dictionaries. It was hypothesized that response word frequencies would be higher for response-trained participants than for stimulus-trained and untrained participants across the three writing sessions, regardless of writing condition. The hypothesized main effect of training condition was not significant, $F(2, 225) = .059$, $p = .943$ (see Table 4 below for marginal means and standard errors for response word usage by training and writing condition). As can be seen in Table 4, there was a significant main effect for writing condition, with greater response word usage for neutral than for trauma writers, $F(1, 225) = 90.07$, $p < .001$. There was a significant main effect for session such that response word usage decreased across sessions (see Table 5), $F(2, 450) = 20.93$, $p < .001$, $\varepsilon = .959$. Finally, there was a significant two-way interaction of writing condition and session, with significant reductions in response word usage from session 1 to session 3 for neutral writers but not for trauma writers, $F(2, 450) = 19.25$, $p < .001$, $\varepsilon = .959$ (see Table 5).

Table 4.

Custom response dictionary word usage training condition X writing condition

	Neutral writing	Trauma writing	Total
Response training	12.99 (.30)	10.51 (.29)	11.75 (.21)
Stimulus training	12.78 (.26)	10.89 (.32)	11.83 (.21)
No training	13.01 (.27)	10.66 (.29)	11.84 (.20)
Total	12.92 (.16)	10.68 (.17)	11.80 (.12)

Table 5.

Custom response dictionary word usage writing condition X writing session

	Session 1	Session 2	Session 3	Total
Neutral writing	13.70 (.21)	13.30 (.20)	11.56 (.24)	12.92 (.16)
Trauma writing	10.66 (.23)	10.71 (.21)	10.65 (.26)	10.67 (.17)
Total	12.18 (.15) [b]	12.10 (.15) [b]	11.10 (.18) [a]	11.80 (.12)

Note: Different superscripts in the columns indicating significant differences between writing sessions (p<.05)

These analyses were also performed separately for each of the five response word sub-categories: verbal responses, somatomotor events, visceral events, processor characteristics, and sense organ adjustments. The hypothesized main effect of training condition was not significant for any of these sub-categories, all Fs < 1.70, ps >.184. There was a significant main effect for session on somatomotor events, visceral event, processor characteristics, and sense organ adjustment word usage, all Fs > 3.68, ps < .05, εs < .984. However, these effects were in opposite directions: usage increased over the three sessions for processor characteristics words but decreased for somatomotor events, visceral events, and sense organ adjustments words (see Table 6 below).

Table 6.

Custom response sub-category word usage by session

	Session 1	Session 2	Session 3	Total
Verbal responses	1.84 (.08)	1.91 (.06)	1.95 (.07)	1.90 (.05)
Somatomotor events	7.02 (.13) [a]	6.96 (.13) [b]	5.75 (.16) [b]	6.57 (.10)
Visceral events	.08 (.01) [a]	.06 (.01) [b]	.04 (.01) [c]	.06 (.01)
Sense organ adjustments	.62 (.03) [a]	.63 (.03) [a]	.53 (.03) [b]	.59 (.02)
Processor characteristics	.29 (.02) [b]	.31 (.02) [b]	.54 (.04) [a]	.38 (.02)

Note: Different superscripts in the rows indicating significant differences between sessions (p<.05)

Table 7.

Custom response sub-category word usage writing condition X training condition

Writing condition	Training condition	Verbal responses	Somato-motor events	Processor character	Visceral events	Sense organ adjustments
Neutral writing	Response training	1.03 (.13)	8.82 (.26)	.35 (.04)	.05 (.02)	.60 (.06)
	Stimulus training	0.90 (.12)	8.86 (.23)	.32 (.04)	.05 (.02)	.68 (.05)
	No training	1.02 (.12)	8.90 (.24)	.39 (.04)	.04 (.02)	.62 (.05)
Total		.98 (.07)	8.86 (.14)	.36 (.02)	.05 (.01)	.63 (.03)
Trauma writing	Response training	2.68 (.13)	4.24 (.26)	.36 (.04)	.08 (.02)	.57 (.06)
	Stimulus training	2.85 (.14)	4.33 (.28)	.39 (.05)	.05 (.02)	.57 (.06)
	No training	2.92 (.13)	4.30 (.26)	.45 (.04)	.09 (.02)	.53 (.06)
Total		2.82 (.08)	4.29 (.15)	.40 (.03)	.07 (.01)	.55 (.03)

There was a significant main effect for writing condition on verbal responses and somatomotor events, but the effects were in the opposite direction, such that trauma writers used more verbal response words, but neutral writers used more somatomotor event words. Thus, there were no predicted or consistent effects on the custom response proposition dictionary sub-categories (see Table 7 above).

Hypothesis 1: LIWC2007 Default Dictionary Categories. These analyses were also performed for each of the LIWC2007 default dictionary categories with conceptual similarity to the response construct (biological, body, feeling, verb, and motion). Predicted effects of response training on word usage were found for biological, body sub-category, and feeling word categories. Response-trained participants used more biological words than untrained participants, with stimulus-trained participants falling non-significantly between the other two groups, $F(2, 226)=3.03$, $p=.050$. Response-trained and stimulus-trained participants both used significantly more body words than untrained participants, with no differences between response-trained and stimulus-trained participants in body word usage, $F(2, 226)=6.76$, $p=.001$. Similarly, response-trained and stimulus-trained participants also used significantly more feeling words than untrained participants, with no differences in feeling word usage between response-trained and stimulus-trained participants, $F(2, 226)=4.84$, $p=.009$. Contrary to prediction, verb usage was highest among untrained participants, an effect that was marginally significant, $F(2, 226)=2.76$, $p=.066$. Finally, for motion words, the hypothesized main effect of training condition was not significant, $F(2, 226)=.15$, $p=.865$ (see Table 8 below for means and standard errors of LIWC2007 default dictionary word usage by training and writing condition).

59

Table 8.

LIWC2007 response-oriented dictionary word usage writing condition X training condition

	Response training			Stimulus training			No Training		
	Neutral writing	Trauma writing	Total	Neutral writing	Trauma writing	Total	Neutral writing	Trauma writing	Total
Verb	13.13	16.57	14.85	12.99	16.95	14.97	13.90	17.22	15.56
	(.33)	(.33)	(.23)	(.30)	(.36)	(.23)	(.31)	(.33)	(.23)
Feel	1.09	.89	.99 [a]	.98	.87	.92 [a]	.63	.80	.72 [b]
	(.09)	(.09)	(.07)	(.08)	(.10)	(.07)	(.09)	(.09)	(.06)
Biological	3.19	2.51	2.85 [a]	2.96	2.22	2.59 [c]	2.62	2.28	2.45 [b]
	(.17)	(.17)	(.12)	(.15)	(.18)	(.12)	(.16)	(.17)	(.11)
Body sub-category	1.51	0.79	1.15 [a]	1.49	0.76	1.12 [a]	1.05	0.55	.80 [b]
	(.11)	(.11)	(.08)	(.10)	(.12)	(.08)	(.10)	(.11)	(.07)
Motion	4.38	2.43	3.40	4.23	2.45	3.34	4.28	2.35	3.31
	(.18)	(.18)	(.12)	(.16)	(.19)	(.12)	(.16)	(.18)	(.12)

Note: Different superscripts across rows indicate significant differences between training conditions (p<.05)

Hypothesis 2. It was hypothesized that stimulus word frequencies would be higher for stimulus-trained participants than for response-trained and untrained participants across the three writing sessions, regardless of writing condition. The hypothesized main effect of training condition was significant and confirmed that stimulus-trained individuals used more stimulus

words than response-trained and untrained individuals across the three writing sessions, F (2, 225) =6.88, p = .001 There was also a significant main effect of writing condition, with greater usage of stimulus words among neutral writers compared to trauma writers, F (1, 225) =348.90, $p < .001$. The two-way interaction of Writing condition X Training condition was also significant, with the highest stimulus word usage found among stimulus-trained neutral writers, F(2, 225)=3.05, p=.049 (see Table 9 below for means and standard deviations of stimulus word usage by training and writing condition).

Table 9.

Custom stimulus dictionary word usage training condition X writing condition

	Neutral writing	Trauma writing	Total
Response training	18.45 (.36)[b]	13.42 (.35)	15.94[b] (.25)
Stimulus training	19.93 (.32)[a]	13.64 (.38)	16.78[a] (.25)
No training	17.84 (.33)[c]	13.20 (.35)	15.52[b] (.24)
Total	18.74 (.19)	13.42 (.21)	16.08 (.14)

Note: Different superscripts in the columns indicating significant differences between training conditions (p<.05)

Stimulus word usage significantly decreased from session 1 to session 3, F (2, 450) =39.57, $p < .001$, ε=.996. The two-way interaction of Session X Training condition was also significant, with greater decreases in stimulus word usage from session 1 to session 3 for stimulus-trained participants, F (4, 450) =2.88, p = .023, ε=.996. Finally, a significant two-way interaction of Session X Writing condition revealed greater reductions in stimulus word usage across the three writing sessions for neutral writers compared to trauma writers, F (2, 450) =7.68,

p < .001, ε=.996 (see Table 10 below for stimulus word usage means and standard errors by training and writing condition and session).

Table 10.

Custom stimulus dictionary word usage training condition X writing condition X session

		Session 1	Session 2	Session 3	Total
Neutral writing	Response training	18.70 (.50)	19.21 (.48)	17.46 (.46)	18.46 (.36)
	Stimulus training	20.35 (.44)	21.13 (.43)	18.30 (.40)	19.93 (.32)
	No training	17.89 (.46)	18.01 (.44)	17.64 (.42)	17.84 (.33)
	Total	18.98 (.27)	19.45 (.26)	17.80 (.25)	18.74 (.19)
Trauma writing	Response training	14.36 (.49)	13.67 (.48)	12.22 (.45)	13.42 (.35)
	Stimulus training	15.27 (.53)	13.66 (.51)	12.00 (.49)	13.64 (.38)
	No training	14.30 (.49)	13.14 (.48)	12.17 (11.28)	13.20 (.35)
	Total	14.64 (.29)	13.49 (.28)	12.13 (.27)	13.42 (.21)
Total		16.81 (.20)[b]	16.47 (.19)[b]	14.97 (.18)[a]	16.08 (.14)

Note: Different superscripts in the columns indicating significant differences between training conditions (p<.05)

These analyses were also performed for each of the LIWC2007 default dictionary categories with conceptual similarity to the stimulus construct (perceptual dictionary, and seeing and hearing sub-categories). It was hypothesized that stimulus-trained participants would use a higher frequency of perceptual dictionary and seeing and hearing sub-category words than

response-trained and untrained participants across the three writing sessions, regardless of writing condition. Perceptual dictionary as well as seeing and hearing sub-category word usage was highest among stimulus-trained participants and significantly differed from response-trained and untrained participants, all Fs >3.55, all ps<.030, (see Table 11 below for means and standard errors of LIWC2007 perceptual, seeing, and hearing word usage).

Table 11.

LIWC2007 perceptual dictionary, seeing and hearing sub-category word usage by training condition

	Perceptual dictionary	Seeing sub-category	Hearing sub-category
Response trained	2.66 (.14) [b]	.94 (.09) [b]	.49 (.04) [b]
Stimulus trained	3.10 (.13) [a]	1.39 (.09) [a]	.55 (.04) [a]
Untrained	2.04 (.13) [b]	.75 (.09) [b]	.41 (.04) [b]
Total	2.60 (.08)	1.02 (.05)	.48 (.02)

Hypothesis 3. It was hypothesized that cognitive process word frequencies would increase more from session 1 to session 3 for trauma writers than for neutral writers. The hypothesized Writing condition X Session interaction was significant, $F (2, 452) =14.00$, $p <$ .001, $\varepsilon=.934$. As can be seen in Figure 1 below, trauma writers showed significant increases from

session 1 to session 3 in cognitive process word usage, linear component $F(1, 105)=38.65$, p<.001, $\varepsilon=.953$, whereas neutral writers did not, $F(1, 125)=1.05$, p=.308, $\varepsilon=.888$.
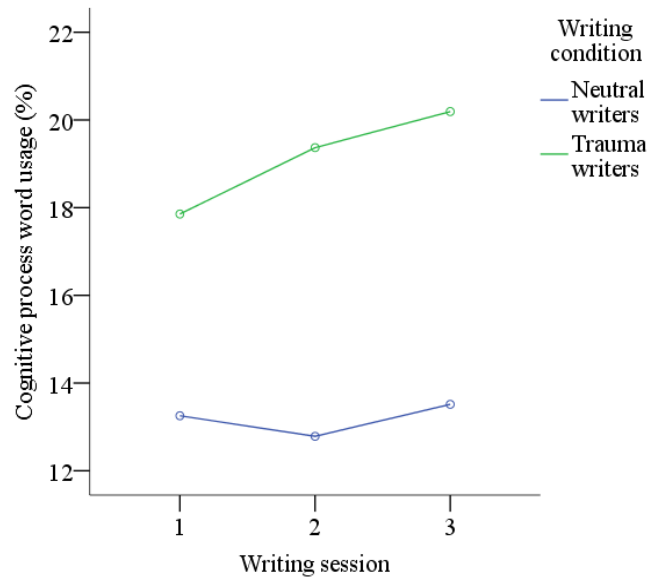
Figure 1. LIWC2007 cognitive process word usage writing condition X session

The same effects reported above were found when the insight word and causal word sub-categories of the cognitive process dictionary were analyzed separately, all Fs > 16.27, ps< .001, εs < .989.

Hypothesis 4a. It was hypothesized that response word frequencies would decrease more from session 1 to session 3 for response-trained, trauma writers than for all other groups. The hypothesis was not confirmed: The three way interaction of session, training condition, and writing condition was not significant, $F (4, 450) =.51$, $p = .726$, $\varepsilon=.959$ (see Table 12 below for response word means and standard deviations by condition and session).

Table 12.

Custom response dictionary word usage writing condition X training condition X session

	Neutral writing	Trauma writing
Response training		
Session 1	13.73 (2.05)	10.44 (2.16)
Session 2	13.77 (2.14)	10.50 (1.93)
Session 3	11.53 (2.81)	10.58 (2.20)
Stimulus training		
Session 1	13.58 (3.00)	10.93 (2.28)
Session 2	13.17 (2.07)	11.20 (2.69)
Session 3	11.50 (3.35)	10.52 (2.43)
No training	13.90 (2.43)	10.67 (1.84)
Session 1		
Session 2	13.74 (2.55)	10.57 (1.72)
Session 3	11.56 (2.88)	10.73 (1.99)

These analyses were also performed separately for each of the five response word sub-categories: verbal responses, somatomotor events, visceral events, processor characteristics, and sense organ adjustments. No significant three way interactions were found for any of the response word sub-categories, all Fs < 2.08, all ps > .10, ε < .984.

These analyses were also performed separately for the default LIWC2007 dictionary categories, 'verbs', 'feeling', 'biological', 'body', and 'motion', due to their conceptual

similarity to the response construct. A significant three way interaction of Writing Condition X Training Condition X Session was found for 'feeling', $F(4, 452)= 3.68$, $p=.007$, $\varepsilon=.961$, but not for 'verbs', 'biological', 'body', or 'motion' dictionaries (see Figure 2 below for effects of three way interaction on feeling word usage). However, as can be seen in Figure 2, the effects were not in the expected pattern.

Neutral writers   Trauma writers
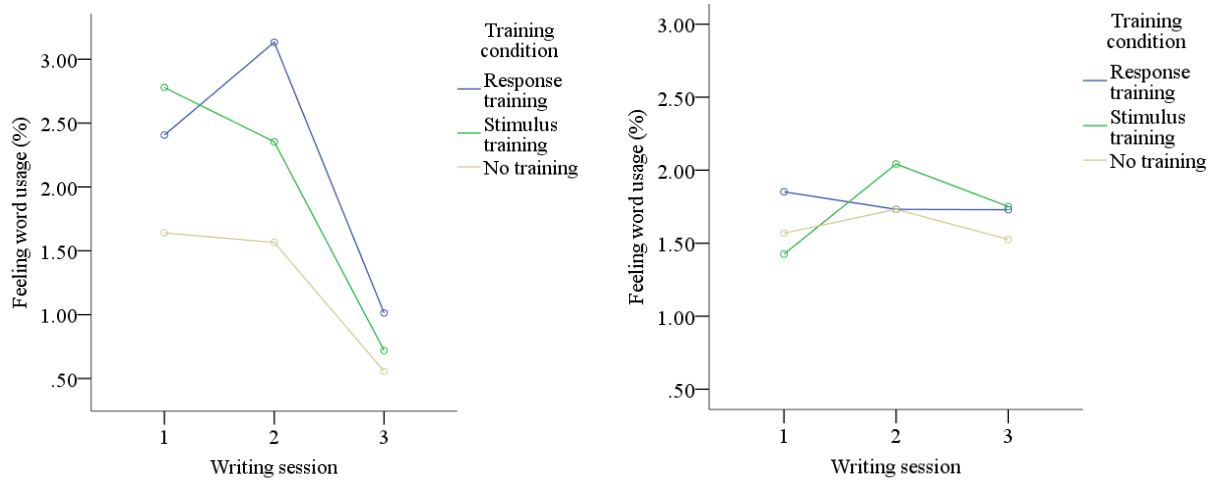
Figure 2. LIWC2007 feeling word usage writing condition X training condition X session

There were significant two-way interactions of writing condition and session for 'verbs', 'feeling', 'body', and 'motion', but none of them supported the expected effect of trauma writing and writing session on reduced usage of verbs, feeling, body, and motion words. Verb usage increased more for neutral writers from session 1 to session 3 than for trauma writers, $F(2, 452)= 25.72$, $p<.001$, $\varepsilon=.926$. Feeling word and body word usage decreased more for neutral writers from session 1 to session 3, $F(2,452)=27.00$, $p<.001$, $\varepsilon=.961$ and in body word usage, $F(2, 452)=7.49$, $p=.001$, $\varepsilon=.982$, respectively. Motion word usage significantly increased from session 1 to session 2 for neutral writers but not for trauma writers, $F(2, 452)=13.89$, $p<.001$, $\varepsilon=.974$ (see

Table 13 for means and standard errors of LIWC2007 default dictionary word usage by writing

condition and session).

Table 13.

LIWC2007 default dictionary word usage writing condition X session

Writing condition	Writing session	Verbs	Feeling	Biological	Body	Motion
Neutral writing	1	12.39 (.22)	1.14 (.08)	3.38 (.13)	1.56 (.09)	4.18 (.12)
	2	12.11 (.22)	1.18 (.08)	2.99 (.13)	1.58 (.08)	4.81 (.12)
	3	15.51 (.26)	.38 (.05)	2.41 (.11)	.90 (.07)	3.90 (.13)
Trauma writing	1	16.24 (.24)	.81 (.08)	2.60 (.14)	.82 (.10)	2.65 (.13)
	2	16.86 (.24)	.92 (.09)	2.31 (.14)	.73 (.09)	2.34 (.13)
	3	17.63 (.28)	.83 (.05)	2.09 (.12)	.54 (.07)	2.23 (.14)
Total	1	14.32 (.16)	.97 (.05)	2.99 (.10)	1.19 (.07)	3.42 (.09)
	2	14.49 (.16)	1.05 (.06)	2.65 (.09)	1.16 (.06)	3.58 (.09)
	3	16.57 (.19)	.61 (.04)	2.25 (.08)	.72 (.05)	3.06 (.10)

Hypothesis 4b. It was hypothesized that cognitive process word frequencies would

increase more from session 1 to session 3 for response-trained, trauma writers than for all other

groups. The hypothesized three way interaction of session, training condition, and writing

condition was not significant, $F (4, 452) =.869$, $p = .482$, $\varepsilon=.934$.

The insight and causal word sub-categories were analyzed separately to determine

whether response training and trauma writing affected these sub-categories of the cognitive

process dictionary in the expected manner. None of the expected interaction effects were found for the insight or causal word usage sub-categories. For the insight sub-category, the hypothesized three way interaction was marginally significant, $F (4, 452) =2.03$, $p = .092$, $\varepsilon=.966$ and post hoc analyses showed that effects were not the expected direction. A significant two way interaction of session and training condition, $F(4, 452)=3.90$, $p=.004$, $\varepsilon=.966$, also did not support the predicted effect of response training on change in insight word usage, with increases in insight word usage for stimulus trained individuals but decreases for response-trained individuals. For causal word usage, the hypothesized three way interaction was also marginally significant, $F (4, 452) =2.01$, $p = .092$, $\varepsilon=.991$. However, post hoc tests did not reveal any consistent or predicted effects of training or session on causal word usage.

Hypothesis 5. It was expected that, compared to neutral writers, trauma writers would use a greater frequency of emotion words defined as the LIWC2007 default dictionary categories 'affective process' (with subcategories 'positive emotion', 'negative emotion' and negative emotion sub-categories of 'anxiety', 'anger', and 'sadness') and the 'feeling' sub-category of the 'perceptual' dictionary. As predicted, trauma writers used significantly more affective process dictionary, positive emotion, negative emotion, anxiety, anger, and sadness sub-category words than did neutral writers, all Fs> 47.82, all ps<.001 (see Table 14 below for means and standard errors of affective process and its sub-categories by writing condition). No significant differences between trauma and neutral writers were found for feeling word usage, $F (1, 226)= .35$, $p=.553$.

Table 14.

LIWC2007 affective process dictionary and sub-category word usage by writing condition

	Affective process	Positive emotion sub-category	Negative emotion sub-category	Anxiety sub-sub-category	Anger sub-sub-category	Sadness sub-sub-category
Trauma writers	5.87 (.12)	2.77 (.09)	3.02 (.08)	.64 (.03)	.78 (.04)	.81 (.03)
Neutral writers	2.67 (.11)	1.93 (.08)	.73 (.07)	.28 (.03)	.17 (.04)	.11 (.03)
Total	4.27 (.08)	2.35 (.06)	1.88 (.05)	.46 (.02)	.48 (.03)	.46 (.02)

Hypothesis 6. It was expected that, compared to neutral writers, trauma writers would show greater increases in affective process sub-category 'positive emotion' word and greater decreases in affective process sub-category 'negative emotion' word and 'negative emotion' sub-categories 'anxiety', 'anger', and 'sadness' word usage from session 1 to session 3. These predicted effects were not found. Instead, positive emotion word usage increased for both trauma and neutral writers from session 1 to session 3, Session $F(2, 452) = 51.57$ $p < .001$, $\varepsilon=.883$, and neutral writers showed larger increases in positive emotion word usage from session 1 to session 3 than did trauma writers, Writing condition x Session $F(2, 452)= 8.48$, $p<.001$, $\varepsilon=.883$ (see Figure 3 below). For negative emotion words, trauma writers significantly increased, while neutral writers significantly decreased, usage from session 1 to session 3, resulting in a significant interaction effect in the opposite of the predicted direction, $F(2, 452)= 4.45$, $p=.012$, $\varepsilon=.986$ (see Figure 4 below).

The above analyses were also performed separately on each of the negative emotion sub-categories, which included anxiety, anger, and sadness sub-categories. Contrary to expectation, anxiety word usage significantly decreased from session 1 to session 3 for neutral writers, but not for trauma writers, $F(2, 452)= 5.34$, $p=.005$, $\varepsilon=.968$. The predicted effect of trauma writing and writing session on anger words was not significant, $F(2, 452)= 1.63$, $p=.196$, $\varepsilon=.975$. For sadness words, the hypothesized effects of trauma writing and writing session were reversed in that sadness words significantly increased for trauma writers, but only from session 1 to session 2, and sadness word usage did not change for neutral writers, $F(2, 452)= 3.19$, $p=.042$, $\varepsilon=.980$. (See Table 15below for means and standard errors of negative emotion and sub-category word usage by writing session and writing condition).
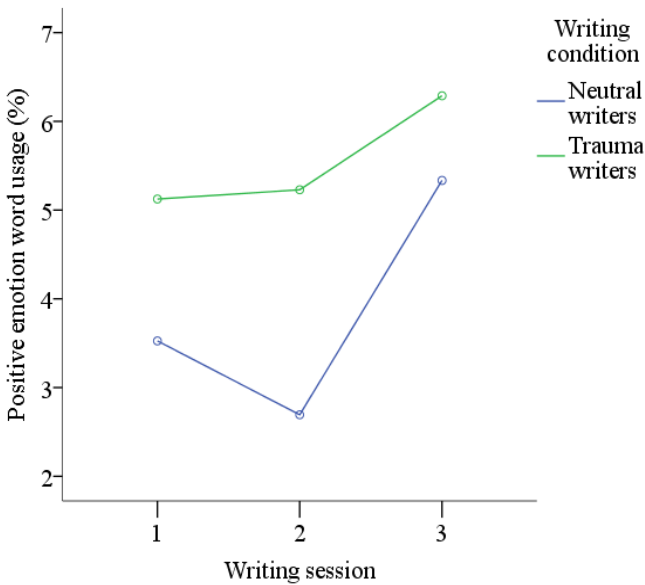
Figure 3. LIWC2007 positive emotion sub-category word usage writing condition X session
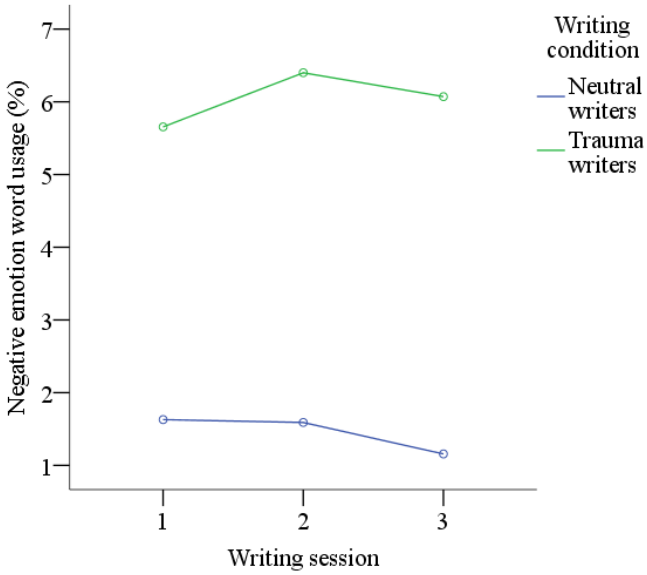
Figure 4. LIWC2007 negative emotion sub-category word usage writing condition X session

Table 15.

Negative emotion sub-category word usage writing session X writing condition

	Writing session	Trauma writing	Neutral writing	Total
Anxiety	Session 1	.58 (.04)	.31 (.04)	.44 (.03)
	Session 2	.65 (.04)	.35 (.04)	.50 (.03)
	Session 3	.69 (.05)	.18 (.05)	.43 (.04)
Anger	Session 1	.75 (.06)	.21 (.05)	.48 (.04)
	Session 2	.85 (.06)	.18 (.05)	.52 (.04)
	Session 3	.75 (.05)	.12 (.05)	.43 (.03)
Sadness	Session 1	.71 (.05)	.12 (.04)	.42 (.03)
	Session 2	.90 (.05)	.10 (.04)	.50 (.03)
	Session 3	.81 (.04)	.11 (.04)	.46 (.03)

Negative emotion	Session 1	2.83 (.10)	.82 (.10)	1.82 (.07)
	Session 2	3.20 (.10)	.80 (.09)	2.00 (.07)
	Session 3	3.04 (.11)	.58 (.10)	1.81 (.08)

Discussion

This study evaluated the effects of two imagery training procedures on specific types of word usage in essays written by college students about personally traumatic or neutral topics. The theoretical basis for this investigation came from Lang's (1977; 1979) bio-informational theory of language. This theory postulated that the three units of an emotional network—response units, stimulus units, and meaning units— could be described in natural language as a series of linked propositions (Lang, 1979). The results of this study cannot be viewed as confirming or disconfirming this theory but rather as offering specific evidence that supports certain assumptions while calling others into question. Specifically, these findings bear upon four different types of hypothesized effects, each of which was experimentally manipulated in this study: (1) the effects of response training on response-oriented language, (2) the effects of stimulus training on stimulus-oriented language, (3) the effects of trauma and neutral writing on cognitive and emotional language, and (4) the combined effects of response-training and trauma writing on changes in language over the course of writing. Overall, the results supported effects of stimulus training and trauma writing, with individuals assigned to these groups showing the pattern of word usage that would be expected based on the previous literature and theoretical assumptions. On the other hand, the anticipated effects of response-training were inconsistent, and the combined effects of response-training and trauma writing on specific types of language

72

were not supported by the results. These mixed results indicate that initial assumptions about the effects of trainings and instructions may require revision. In the paragraphs below, the specific results are discussed in the context of their implications for current theoretical assumptions and other studies of training and language. Finally, future research directions are proposed.

Effects of Response Training

It was hypothesized that because response training has taught subjects to use response-oriented words to describe their imagery, that response trained participants would produce a greater proportion of total written response words (defined as words indicative of behavioral action, physiological responding, or verbal expression) than would stimulus trained or untrained participants. The results only partially supported this hypothesis. Response word usage, when evaluated using custom response dictionaries, did not differ across the three training conditions. However, significant effects of response-training did emerge for the LIWC2007 default feeling, biological, and body word dictionaries. In sum, it appears that existing, previously-validated dictionaries better captured the effects of response-training than custom dictionaries specifically developed to measure the effects of response-training.

One possible explanation for these mixed results is that the underlying theoretical assumption, that processing of response information should be represented in response-oriented language, is not valid. Discrepancies between self-reported emotionality or thought processes and other indicators of emotional experiences, such as physiological response or behavior, have been previously established (Hoehn-Saric & McLeod, 2000; Gross & Levenson, 1993). Expressive writing can be conceptualized as a form of self-report, in which participants are given an open-ended, emotionally-evocative question to which they respond. Expressive writing shares

73

with other self-report measures the potential for participants to engage in self-regulation and impression management. Thus, it is possible that the response unit of the emotional network can be activated in the absence of explicit, written use of response language. Perhaps response training amplifies the efferent response node of the emotional network by directly stimulating brain regions associated with autonomic response, such that engagement in any activity would augment physiological responding, regardless of the individual's conscious perceptions and self-report of response unit activation. The current study did not evaluate this competing hypothesis that response training activates physiological response unit mobilization directly rather than through the mechanism of increased response-oriented language. However, an investigation of the relationship between response word usage and physiological response is likely to be a fruitful future direction in this area.

Although the argument above explains why response-training failed to increase usage of custom response dictionary and response sub-category words, it fails to explain why response-training did increase usage of feeling, biological, and body words in LIWC2007 default dictionaries. Taking these conflicting findings into account, a different picture emerges. Rather than calling into question the assumption that response-training effects language, these results suggest that response-training effects language, but not in the expected manner. Development of the custom response dictionary and its sub-categories were based on definitions and examples of response propositions provided by Lang (1979) and his colleagues (1980) that were expected to be affected by the response-training protocol. Thus, the validity of the dictionary measures developed in this study largely depended on the validity of these conceptualizations and definitions. If the conceptual and operational definitions for response propositions were flawed in the first place, then it is unlikely that a measure based on these definitions would capture the

effects of response-training. For example, Lang's (1979) definition of response-training

emphasizes that there are three response classes: internal and external verbal responses,

behavioral actions, and physiological responses. The response-training protocol (see Appendix

A) heavily emphasizes certain types of behavioral actions and physiological responses. The

training scripts involve emotionally-neutral scenes in which the participant is asked to physically

involve him or herself by tensing muscles and moving eyelids. The broader definition of

response propositions and response-oriented language in the context of exposure to feared

stimuli proposed in the literature (Lang et al., 1983; Foa & Kozak, 1986) and used in this study

may have departed from the more physical, emotionally-neutral effects of the response-training

protocol. The detected effects of response-training on feeling, biological, and body language

words in the LIWC2007 dictionaries matches this more limited operational definition of response

language (see Table 1 above for examples from each category). This interpretation of the results

could be further tested in future work using a more exclusively inductive approach to dictionary

development. If response-training systematically altered word usage in specific ways within the

trauma and neutral essays, then these differences could be captured by generating word

frequency lists by training condition. Presumably, words used more frequently by response-

training individuals than stimulus-trained or untrained individuals were produced in response to

the training. Qualitative examination of these lists could allow for comparison to and revision of

existing conceptual and operational definitions for response propositions.

Issues related to the internal reliability of the response dictionary and sub-categories also

may have contributed to the null findings for these analyses. In the dictionary development

process, low inter-rater reliability of the judges (33% for overall selection of response words;

78% for categorization of response words into sub-categories) in selecting response words for

the response dictionary could explain why analyses using this dictionary failed to capture possible differences in response language usage. In describing the development of the default LIWC2007 dictionary categories, Pennebaker, Francis, and Booth (2001) reported between 86% and 100% inter-rater agreement among judges during the word rating phase. It is possible that selecting response words as defined by Lang's theory was a more challenging task than selecting words for the LIWC2007 dictionary categories. Anecdotally, when questioned about the word rating process, each of the three judges reported that the process was more difficult than expected and that they were prone to second-guessing their selections and reevaluating selection criteria throughout the task. Each of the LIWC2007 dictionary categories was developed and refined over a longer period of time and were subjected to more stringent psychometric evaluation. Thus, the current response dictionary and sub-categories may require further revision in order to better capture the construct of interest. However, insufficient reliability does not account for the null results for several of the LIWC2007 dictionary categories (verbs, motion), each of which fell between 86% and 100% agreement among the judges. In other words, even when internal reliability of the dictionary was high, the results did not consistently show an effect of response training on response-oriented word usage. This indicates that a lack of internal consistency for the custom response dictionary and sub-categories might not fully explain the results. Alternatively, the null results found for verbs and motion words could indicate that, as with the custom response dictionary and sub-categories, verbs and motion words are not affected by response training. This interpretation further implies that Lang's (1977; 1979) definition of response propositions may have been overly inclusive or too general and that his definition fails to capture the types of language that response-training affects.

An alternative explanation that could account for the null results found for both custom and several default dictionaries is that response language may not be well suited for analyses at the single word level. All of the language analyses performed in this study used single words as the unit of analysis. As acknowledged by LIWC researchers (Tausczik & Pennebaker, 2010), word count methods have distinct advantages (e.g. efficiency, ability to provide a unique "helicopter" view of the data) as well as important disadvantages (e.g. failure to capture context, low base rates of certain words). These results indicate that response language may be more context-dependent and/or more rarely used (lower base rate) than expected. As an example of context dependence, the word "report", which was included in the custom response dictionary and in the somatomotor events sub-category, could be found in a response proposition such as "I reported everything to the police as quickly as possible" or in a non-response proposition such as "My report received an F". In terms of low base rate, the visceral events sub-category, which includes many exemplar response proposition words including "breathe" and "sweat" represented only .06% of word usage overall and was not significantly higher for response-trained individuals, suggesting that encouraging participants to use these words in their imagery descriptions during response training did not result in frequent usage of them during writing. Thus, it is possible that response language would be better captured at the phrase level or even at the level of a global rating applied to an entire text sample, both of which might be more likely to capture context and infrequent usage.

On the other hand, the effect of response-training on feeling, biological, and body word usage shows promise and lends support for the use of word count programs to capture the response proposition construct. To this author's knowledge, this study is the first to evaluate the effects of response and stimulus training on word choice in traumatic and neutral essays. Based

on these results, it is possible to conclude that response-training increases use of feeling, biological, and body words, but does not affect words specifically chosen for being consistent with the response proposition construct (custom response dictionary and sub-categories), nor does it affect usage of verbs and motion words, which also would have been expected based on theoretical definition. These findings indicate that response-training does have specific linguistic effects but that these effects do not entirely conform to the theoretical definition of response propositions as internal and external verbal behavior, overt motor behavior, and physiological responses. Rather, a more restricted definition of response propositions would better describe the effects of response training on word usage. Specifically, usage of feeling (e.g. caress, scratch, feel), biological (e.g. headache, hugs, pain), and body (e.g. mouth, sensation, sleep) words were affected by response-training. These categories are similar in their emphasis on physical experience and are most consistent with the definition of response propositions as "physiological or bodily responses". Thus, despite the inclusion of verbal and motor behaviors in the response-training protocol, the effects on language appear to be limited to bodily experiences. Because this is the first study to evaluate these categories in response to an experimental manipulation, the feeling, biological and body categories should be used in future studies evaluating the linguistic effects of response training in order to determine whether these results can be replicated and extended beyond the expressive writing paradigm to other treatment modalities (i.e. oral trauma narratives, imaginal exposure scripts). Future work in this area could shed light on whether the observed effects of response training on word usage are limited to the writing modality or if response training has similar linguistic effects in other modalities. Examining the effects of response training on other modalities will test another assumption of Lang's (1979)

theory that the principles of the bio-informational theory of emotion can be applied universally and are not dependent upon the modality used to access emotional imagery in the brain.

Effects of Stimulus Training

It was expected that because stimulus training has taught subjects to use and process stimulus-oriented words, that stimulus trained participants would produce a greater proportion of stimulus words (defined as words indicative of contextual description or detail) than would response or untrained participants. The results supported this hypothesis; use of stimulus words was higher among stimulus-trained participants compared to response-trained and untrained participants. Analyses using LIWC2007 default dictionaries consistent with the stimulus construct definition ('perceptual' dictionary and its 'seeing' and 'hearing' sub-categories) strengthen these findings and provide converging evidence that stimulus training affected word usage in the expected manner. The LIWC2007 perceptual dictionary contains primarily adjectives and adverbs indicative of sensory experiences (i.e. touch, taste, smell, sight, and hearing) (see Table 2 for word exemplars from each category). Because Lang's (1977; 1979) definition more broadly defined stimulus propositions as any descriptive detail or environmental factor, the perceptual dictionary represents a more limited operationalization of the concept. Furthermore, the perceptual dictionary contains the feeling sub-category which was used to capture the effects of response-training. The feeling sub-category seems to represent an area of overlap between the response and stimulus proposition definitions, with some words related to physical movements or responses (caress, scratch, feel) and others more indicative of sensory description (smooth, soft, heavy, cold). Yet, whether stimulus propositions were defined more broadly as with the custom stimulus dictionary or more narrowly as with the perceptual dictionary and its seeing and hearing sub-categories, the effects of stimulus training were

consistent. This study was the first to evaluate the types of word usage that were affected by stimulus training and provides initial evidence that stimulus training effects word usage in the manner that would be expected based on the existing theoretical definition.

Taken in combination with the mixed results for the effects of response training on response word usage, the stimulus training results suggest several possibilities. First, it is possible that selection of words for the custom stimulus dictionary was a more straightforward task for judges than selection of response words for the response dictionary. Because stimulus words are, by definition, words that describe the context of a situation or setting, these words may be easier to identify and less context dependent. Better inter-rater reliability for judges' ratings of words for the stimulus dictionary than for the response dictionary supports this explanation. Judges' agreement on selection of words for the stimulus dictionary, measured using the ICC, was 'moderate', whereas agreement was only 'fair' for judges' agreement on selection of words for the response dictionary. The differences in reliability of the custom response dictionary and the custom stimulus dictionary may help to explain why the expected effect of stimulus training on custom stimulus dictionary word usage was detected, while the hypothesized effect of response training on custom response dictionary word usage was not.

A second possibility is that activation of the response and stimulus nodes of an emotional network produce different effects. Perhaps activation of the response unit primes the brain for immediate physiological mobilization, whereas activation of the stimulus unit encourages observation, reflection, and description in words. These potential theoretical distinctions might explain why stimulus-training effected stimulus word usage but response-training did not consistently alter response word usage. Future work in this area should explore the brain regions implicated in response-training and stimulus-training to clarify their mechanisms of action. If the

brain regions involved in response-training and stimulus-training differ, then it may be necessary to revise Lang's (1979) assumption that the modality used to activate a particular node of the emotional network is irrelevant. Improving activation of response, stimulus, and meaning units remains an important issue for optimizing exposure-based and cognitive processing therapeutic interventions which rely upon successful activation of these emotional units.

A final possibility is that usage of response and stimulus words, as defined in this study, does not result in activation of response and stimulus units in the brain. Although this interpretation cannot be directly evaluated because discreet response and stimulus units in the brain have not been functionally identified, it is important to consider that even if training altered word usage, it is still possible that word usage does not alter activation of the emotional network. An assumption of this study was that changes in language were indicative of changes in internal emotional experience. However, it remains possible that response or stimulus training could affect word usage without affecting other aspects of emotional experience, such as behavior, brain activity, or physiological response. As mentioned above, different measures of the same emotional experience can produce inconsistent results (Hoehn-Saric & McLeod, 2000; Gross & Levenson, 1993), suggesting that no single measure can fully capture the multidimensional nature of emotions. In order to better understand which aspects of emotional experience were captured by the observed changes in word usage in this study, it may be useful in future work to examine the relationship between word usage and other measures of emotion, including physiological response, self-reported valence of emotion, and symptoms of emotional distress.

Effects of Trauma Writing

It was hypothesized that because previous research has established a link between changes in cognitive processing and therapeutic outcomes in both traditional exposure therapy and writing about traumatic events, that from Session 1 to Session 3 trauma writers would show a greater increase in the proportion of total written meaning words (defined as LIWC2007 default cognitive process dictionary and its causal and insight sub-categories) than would trivial topic writers. The results confirmed that trauma writers increased their frequency of cognitive process, insight, and causal words from session 1 to session 3 more than neutral writers. Neutral writers decreased their use of insight words from session 1 to session 3 and showed no change in cognitive processing and causal word usage. These results are consistent with previous studies that have established that trauma writing leads to better health outcomes than neutral writing, and that cognitive process word usage, is an important linguistic mediator of those effects (Pennebaker, Mehl, & Niederhoffer, 2003). These results add to the current literature by demonstrating that these same adaptive changes occur for trauma writers and not for neutral writers, even when response-training and stimulus-training procedures are used.

Analyses using the LIWC2007 affective process dictionary and its subcategories also revealed higher usage of emotion words for trauma writers compared to neutral writers. These results are consistent with other linguistic analyses of expressive writing studies (i.e. Pennebaker, Mayne, & Francis, 1997; Pennebaker & Francis, 1996; Ullrich & Lutgendorf, 2002), which have shown that the standard instructions to write about a personally traumatic experience with as much emotion and feeling as possible produces higher levels of emotional and cognitive processing compared to trivial topic writing instructions. This provides evidence that the manipulation of writing condition in this study represents a valid replication of other expressive writing studies using the standard trauma writing and trivial topic writing instructions.

From a theoretical standpoint, this finding adds to the existing literature which supports cognitive assimilation (Pennebaker & Francis, 1996) and emotional expression (Pennebaker & Beall, 1986), as important mechanisms of action in expressive writing. It is unknown in the current investigation whether observed increases in cognitive or emotional word usage from session 1 to session 3 were associated with positive physical and mental health outcomes. However, in previous research, increases in cognitive words, high use of positive emotion words, and moderate use of negative emotion words over the course of writing led to better health outcomes (Pennebaker, Mehl, Niederhoffer, 2003). Future analyses with these data can verify whether the observed effects of writing instructions on cognitive and emotional word usage are associated with changes in mental and physical health functioning. In light of the extant literature, it is expected that change in cognitive and emotion word usage will mediate health outcomes for trauma writers but not for neutral writers.

Effects of Response Training and Trauma Writing across Writing Sessions

The final primary hypothesis predicted that because theory and the relevant empirical evidence suggest that expressive writing works through a combination of activation of and exposure to response information in memory and cognitive assimilation, and response-training enhanced trauma writing is the condition most likely to stimulate these processes, that response-trained trauma writers would show a pattern of linguistic habituation in which response words would be highest in Session 1 and would be significantly reduced by Session 3, in line with patterns of physiological and emotional habituation observed in exposure treatment. In addition, meaning propositions would be lowest in Session 1 and significantly increased by Session 3, consistent with theories of exposure to corrective information, cognitive assimilation, and cognitive processing word usage observed in expressive writing.

Neither of these hypotheses was confirmed. Response-trained trauma writers did not differ in their use of response words or cognitive processing words from session 1 to session 3 compared to stimulus-trained or untrained, neutral or trauma writers. As stated above, the null results for response word usage may be due in part to low construct validity due to inadequate inter-rater reliability for judges' selection of response words. However, the null results for the cognitive processing word usage cannot be due to low construct validity produced by a lack of agreement of judges in the development of these dictionary categories. Pennebaker, Francis, and Booth (2001) reported 93% agreement for the insight word sub-category and between 86% and 100% agreement for all other categories. This discrepancy supports a theoretical rather than methodological explanation for the lack of effects of response training on changes in response word usage. Because the cognitive processing, insight, and causal word usage dictionaries have previously responded to writing instructions and other experimental manipulations aimed at altering word usage, then it is more likely that response training does not affect this type of word usage than it is that these dictionaries failed to capture the effects of response training on word usage. As described above, these findings suggest that response training does not amplify the exposure and cognitive assimilation effects of trauma writing through the predicted mechanisms of reductions in response language and increases in cognitive process word usage. Rather, the previously observed effects of response-training and of expressive writing on physiological output and on physical and mental health outcomes may be explained by some other mechanism of action, such as direct activation of certain adaptive brain regions and/or through changes in behavior during writing (e.g. tensing muscles, changes in breathing), changes in brain processes (e.g. revision of memorial representation of traumatic event), or changes in behavior following writing (e.g. increased contact with feared stimuli).

The explanation above fits with the literature showing large discrepancies between patients' and participants' subjective self-report of their own emotions and thoughts and more objective measures of these constructs, such as physiological response and observed behaviors (Hoehn-Saric & McLeod, 2000; Gross & Levenson, 1993). Because response-training is designed to specifically activate units of the emotional network associated with verbal responses, behavioral actions, and physiological response, it is possible that response-training primes implicit performance of these specific responses but does not promote the introspection required to write about these responses.

Neuroscience researchers have broadly conceptualized the systems involved in emotional experience as those responsible for an emotional response to a situation (bottom-up processing) and those responsible for cognitive appraisal of a situation (top-down processing) and have implicated the amygdala in bottom-up processing and the neocortex and hippocampus in top-down processing (LeDoux, 1989; 2000). These systems can operate independently of one another but can also interact with one another to create full emotional experiences that occur when representations of stimuli, affective response, and cognitive appraisal coincide in working memory (LeDoux, 1989). This conceptualization has striking similarity to Lang's (1977; 1979) description of the brain's emotional network and the need for activation of response, stimulus, and meaning units in order for an emotion to be fully processed. However, the neuroscience perspective adds that response, stimulus, and meaning representations may operate at different levels of processing (top down vs. bottom up).

Conceptualized in these terms, bottom-up processing is likely to be responsible for activation of the response node of the emotional network described in bio-informational theory. Thus, response-training may enact its effects at this more automatic, unconscious level of

processing. If this is the case, then the effects of response-training would be unlikely to manifest in the types of linguistic changes that are captured using a top-down analytic approach.

Stimulus information is likely to be processed at both levels and the processing level may depend upon the type of stimulus or manner in which it is presented. Recent research has demonstrated that presenting a stimulus in a bottom-up (viewing aversive images) or in a top-down (instructing an individual to interpret neutral images as aversive) manner changes the brain areas involved, such that bottom-up presentation activated areas involved in encoding perceptual and affective information, whereas top-down presentation activated areas involved in higher cognition (Ochsner et al., 2009).

Meaning information is more likely to be processed from the top down. Research in emotion regulation has shown that cognitive reappraisal can be experimentally induced and leads to corresponding activation of top-down brain regions (Gross, 1998). Cognitive reappraisal has been described as "a cognitive-linguistic strategy that alters the trajectory of emotional responses by reformulating the meaning of a situation" (Goldin, McRae, Ramel, & Gross, 2008). However, no researchers to date have systematically evaluated whether the language used by participants assigned to engage in cognitive reappraisal is consistent with existing theories of meaning-making or cognitive processing. Application or adaptation of existing cognitive reappraisal strategies in the form of a meaning training procedure with the goal of effecting meaning-oriented language in writing is an area for future study.

In sum, a more sophisticated understanding of the relationship between language and emotion demands greater attention to complementary work in other fields, such as neuroscience and linguistics. Neuroscience allows us to connect self-report of emotion to activation of

86

biological systems, while linguistics provides a link between psychological constructs and appropriate linguistic measurement. Infusing the ideas and innovations from these fields will serve to revitalize existing methodologies and assumptions in psychological emotion research. When faced with results that fail to conform to expectation in our own field as with the current project, it behooves us to examine our findings in the larger scientific literature.

Conclusion

This study adds to the current literature in a number of important ways. First, the development of custom response and stimulus dictionaries offers a novel approach to measuring the effects of imagery training on language. The low to moderate reliability for the response dictionary indicates that the response construct may be more difficult to operationalize at the single-word level. Better reliability for the response sub-categories and the stimulus dictionary indicates that the judges were able to follow the instructions and reach an adequate level of consistency for some constructs. Overall, the response and stimulus dictionaries offer a potentially useful tool for future investigations of response and stimulus oriented language. As with the LIWC2007 default dictionaries, it is likely that continued psychometric evaluation and adaptation of the response and stimulus dictionaries will improve their validity and reliability for capturing these constructs. Alternatively, other linguistic analysis methods, such as LSA, may be better suited for capturing the effects of response-training on language. The analyses of the Cognitive Process, and Insight and Causal sub-categories from the LIWC2007 default dictionary to test the effects of the writing instructions replicated previous work and strengthened the assumption that trauma writing promotes increases in cognitive assimilation.

In addition to the initial validation of these measurement tools, this project was the first to linguistically evaluate one of the underlying assumptions of Lang's (1977; 1979) theory of emotional imagery: that response and stimulus training procedures enact their effects by increasing access to response and stimulus information. A basic assumption of this project was that increased access to response and stimulus information would be reflected in greater usage of response and stimulus language. This assumption was supported in the case of stimulus training and stimulus language usage but was inconsistently supported for response training and response language usage. Some types of response oriented language (feeling, biological, and body words) were used more frequently by response-trained individuals. However, words selected based on theoretical definitions of the response construct were not used more frequently by response-trained participants. Thus, one important implication of these findings is that stimulus training and response training may work through different mechanisms of action than those proposed by a strict information-processing perspective. Alternative mechanisms, such top-down versus bottom-up processing, should be examined in future research.

Finally, this study sought to examine linguistic evidence for theories of exposure and cognitive assimilation within imagery training enhanced expressive writing. The results bolstered support for the theory of cognitive assimilation in trauma writing (Pennebaker & Francis, 1996). However, no consistent linguistic markers of exposure were detected within the response-trained, trauma writing condition, which was the group expected to experience the most intense levels of exposure from a theoretical standpoint. No changes in response-oriented word usage that would have been indicative of exposure to response information about trauma memories were found for response-trained, trauma writers.

In sum, it appears that language remains an important method for assessing certain types of internal emotional experience, but that measurement of language poses a unique set of challenges for the emotion researcher. Some aspects of language, such as stimulus and meaning information, may be more receptive to measurement using existing linguistic tools, while others, like response information, may require more specialized techniques. Given the importance of emotional response information for exposure-based therapeutic techniques, future research should endeavor to develop and apply appropriate tools for measuring this more elusive aspect of emotional experience.

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Appendix A

Imagery Training Protocols

"Today we'll begin by teaching you to relax through the use of a breathing technique. This technique, called diaphragmatic breathing, has been found to be effective for reducing feelings of tension. Essentially, there are two ways of breathing-- from the chest, or from the diaphragm. With chest breathing, the chest expands with each inhalation, while the abdomen remains relatively motionless. When breathing from the diaphragm, the stomach or abdomen expands as the diaphragm moves downward to allow air to fill the lungs. We now know that when we breathe predominantly from our chest that this can create bodily tension, and that when we breathe with our diaphragm we can create feelings of relaxation. I will teach you this technique so you can use it later to relax before writing.

"**Now I would like for you to practice this breathing technique. First, place one hand on your chest and the other on your abdomen, like this (*demonstrate*). Next, inhale slowly through your nose and try to make the hand on your abdomen rise. Try to push up your hand as much as it feels comfortable. Your chest should move slightly, but not more than your abdomen. After you've taken a full breath, pause for a second, and then exhale slowly and fully through your nose or mouth and count to one to yourself as you exhale. As you practice this procedure, imagine that there is a balloon in your stomach, and that each time you inhale, the balloon inflates and each time you exhale, the balloon deflates**." (*Demonstrate this breathing technique for 30s*).

"Do you have any questions?"

"Now I would like for you to practice this technique for a few minutes with your eyes closed. Again, try to imagine a balloon inflating and deflating in your stomach as you practice this technique. Concentrate on your abdomen moving up and down, the air moving in and out of your lungs, and the feelings of relaxation that deep breathing gives you."

Have subject practice for 3 minutes. Watch, and provide feedback (minimal) about whether he/she is doing the procedure correctly.
After 3 minutes, if the subject is not doing the procedure correctly, additional practice may be needed. Thus, explain the procedure again reading from the bolded paragraph above. If the

subject is breathing correctly, continue with the next part of the experiment. For every subject, say the following line before continuing to the next part.

How did that feel?
(For some people it is not relaxing. If it is not relaxing for you, you can just close your eyes and breathe when you are instructed to relax.)
"You will be asked to use this breathing technique later in the experiment. Do you have any questions?"

As mentioned earlier, I will ask you to write about an event in your life and we will do this in a little while. When you write you will be calling upon memories of the experience. I want to share with you a technique that I want you to use that will help you recall and visualize the experience. I would like to help you learn to be able to vividly recall the feelings of the actual experience.

Imagery Response Training

"As I mentioned earlier, visualization, or vividly imagining scenes and events, is part of our experimental procedure. We will begin this phase of the experiment now. I'd like you to practice visualizing some commonplace scenes. It is like daydreaming, but I'd like you to bring this more under your control, to imagine specific events, for a given period of time. It will help you to do this if you remain relaxed, as you've learned.

As you are sitting there, deeply relaxed, completely calm, I'd like you to try some scenes. Try to imagine these situations as vividly as you can. Involve yourself fully in the image as an active participant in the imagined scene. For example, the first scene I will ask you to imagine involves reading a book. I want you to try to move your eyes in the image just as if you were actively scanning the words and lines of a real book. The idea of a vivid image is that you get the feeling of a real, actual experience.

As I describe the scenes, create the image in your mind, doing exactly what you would do in the real situation. When I finish the description, keep imagining the scene until I tell you to stop and focus on relaxation. Now I will present the first scene. Please close your eyes and keep them closed until I tell you to open them."

"**You are sitting in a chair reading a popular science magazine. Your eyes dart from word to word and from line to line down the page as you make rapid progress through the text. You shift to a full page illustration of the muscles of the arm, and you look up and down all over the page, noting first the hand on the upper right corner of the page, then inspecting the elbow in the center, and finally the upper arm muscles in the lower left part of the page. You turn the page, and your eyes follow the text into the next chapter**."

Have subject imagine scene for 20s

"Now open your eyes."

"How were you able to imagine the scene?"

"Did you move your eyes in the image?"

"Did you move your hand in the image?"

"Remember, it is important to scan the book with your eyes in the image just as if you were looking at a real book. A vivid image depends on making the scene like a real, actual experience. You must do in the image what you would do in the real situation."

"Alright, now that we've reviewed the idea of vividness, let's try another scene. Don't worry if the first scene wasn't very vivid. Some people are initially better than others at this, but practice will help everyone to imagine events as if they are really happening. We're ready to try again."

"Close your eyes and take a few seconds to get in a comfortable position and relax again. (*20s*).

"Remember, what we are trying to learn is vivid imagery through your active participation in what you imagine. Just like with the last scene, this means doing just what the image requires. For example, the next image involves muscle tension you feel while you are reading. I want you to actually tense your muscles in imagining this. This will make the image more vivid, that is, more like an actual experience of the scene I present.

Now I will present the scene. Create the image in your mind, doing exactly what you would do in the real situation. When I finish the description, keep imagining the scene until I tell you to stop. Here is the next scene. Please close your eyes and keep them closed until I tell you to open them."

"**You are in the language laboratory listening to an assignment over headphones, and following the conversation with your book. You listen to the words and follow the script from line to line down the page. Your neck and shoulder muscles are tense and stiff from being held so long in the same position. Trying to concentrate, you tense the muscles in your forehead and around your eyes, and you feel a full headache. Taking off the headphones, you breathe deeply and get up from the desk for a break**."

Have subject imagine scene for 20s

"Now open your eyes."

"How were you able to imagine the scene?"

"Did you tense your muscles in the image?"

"Did you move your eyes in the image?"

"Did you take the deep breath?"

"It is important to do in the scene what you would do in the real situation. This means things like tensing your muscles, moving your eyes, and breathing deeply. Many of us are not used to this type of vivid imagery, and the point of this portion of the experiment is for you to learn to practice this kind of active involvement in your images."

"Let's practice another scene again. Sit back, close your eyes, and get relaxed. Try to focus on breathing deeply from your diaphragm." (*20s*)

"Now that you are sitting there, deeply relaxed, completely calm, I'd like you to imagine another situation. Try to imagine the scene as vividly as you can."

"**You are standing at the base of an observation tower as some of your friends ascend the stairs. Your eyes follow their hands, gliding upwards on the handrails, as they slowly climb the metal staircase. You tense the muscles on your face, squinting to avoid the sun, which glints through the metalwork of the tower. Craning your neck, you continue to watch closely, following with your eyes their steady upward progress toward the observation deck. They reach the top, and you look up as someone drops a hat. You follow the hat with your eyes while it sails gently down to the ground at you feet**."

Have subject imagine scene for 20s

"Now open your eyes."

"How were you able to imagine the scene?"

"Did you move your eyes in the image?"

"Did you use the muscle in your face and neck?"

"Recall that I want you to move your eyes in the image just as if you were looking up and down a real tower. Likewise, you are to tense the muscles used in the image. Actually do what you would do in the real situation."

"Close your eyes and relax. We'll do another scene. I'll give you a few seconds to get relaxed, and then we'll go into the next scene." (*20s*)

"You are doing some isometric exercises and you look at the diagram in your exercise book. It is a schematic diagram, showing only the muscles themselves. It shows the face and the neck muscles, and you glance up and down the whole page, while you note the muscles involved in the exercise. You breathe deeply and tense all the muscles in your face and neck.   Your heart races and sweat beads up on your forehead with strain."

<u>Have subject imagine scene for 20s</u>

"Open your eyes."

"How were you able to imagine the scene?"

"Did your heart beat change any? How about sweating?"

"Did you tense your muscles? Which ones? Did you breathe deeply?"

"This scene was a little different than the other ones we did, in that you were asked to imagine heart rate and perspiration changes. It may not be obvious that you can actually do these things in the images like you can with eye movements, muscle tension, and breathing changes, but don't let this concern you. The practice here with imagining these responses can help you to increase your skill."

"Okay, you have practiced a relaxation technique, and a way of achieving vivid imagery by doing in the scene what you would do in the real situation. The next part of this experiment will involve writing and I ask that you use the techniques you were just taught in order to more fully involve yourself in your writing.

How to reinforce the participant:

Reinforce response statements i.e. muscle movement, actions and perceptual movements. Ignore stimulus descriptions.

When response statements are reported you can say you did a good job with that. If the description did not involve response statements ask the participant if they experienced X. If they report that they did say "good, that will make your image more vivid." If they did not experience X provide corrective feedback i.e. in future images try to imagine that you are actually in the

101

scene doing what is described. For example, if the scene states that your muscles are tense, actually tense your muscles as if you were experiencing the scene.

You can ask prompting questions such as "What did you do when the hat fell down?" If the participant reports several response statements you can say, "It sounds like you had a very vivid image."

After the participant has described their image, the experimenter should summarize the image and provide reinforcement and corrective feedback when appropriate.

Avoid interrupting the participant because interruption can be a punisher.

Imagery Stimulus Training Protocol

"Today we'll begin by teaching you to relax through the use of a breathing technique. This technique, called diaphragmatic breathing, has been found to be effective for reducing feelings of tension. Essentially, there are two ways of breathing-- from the chest, or from the diaphragm. With chest breathing, the chest expands with each inhalation, while the abdomen remains relatively motionless. When breathing from the diaphragm, the stomach or abdomen expands as the diaphragm moves downward to allow air to fill the lungs. We now know that when we breathe predominantly from our chest that this can create bodily tension, and that when we breathe with our diaphragm we can create feelings of relaxation. I will teach you this technique so you can use it later to relax before writing.

"**Now I would like for you to practice this breathing technique. First, place one hand on your chest and the other on your abdomen, like this (*demonstrate*). Next, inhale slowly through your nose and try to make the hand on your abdomen rise. Try to push up your hand as much as it feels comfortable. Your chest should move slightly, but not more than your abdomen. After you've taken a full breath, pause for a second, and then exhale slowly and fully through your nose or mouth and count to one to yourself as you exhale. As you practice this procedure, imagine that there is a balloon in your stomach, and that each time you inhale, the balloon inflates and each time you exhale, the balloon deflates**." (*Demonstrate this breathing technique for 30s*).

"Do you have any questions?"

"Now I would like for you to practice this technique for a few minutes with your eyes closed. Again, try to imagine a balloon inflating and deflating in your stomach as you practice

102

this technique. Concentrate on your abdomen moving up and down, the air moving in and out of your lungs, and the feelings of relaxation that deep breathing gives you."

Have subject practice for 3 minutes. Watch, and provide feedback (minimal) about whether he/she is doing the procedure correctly.

After 3 minutes, if the subject is not doing the procedure correctly, additional practice may be needed. Thus, explain the procedure again reading from the bolded paragraph above. If the subject is breathing correctly, continue with the next part of the experiment. For every subject, say the following line before continuing to the next part.

How did that feel?
(For some people it is not relaxing. If it is not relaxing for you, you can just close your eyes and breathe when you are instructed to relax.)

"You will be asked to use this breathing technique later in the experiment. Do you have any questions?"

As mentioned earlier, I will ask you to write about an event in your life and we will do this in a little while. When you write you will be calling upon memories of the experience. I want to share with you a technique that I want you to use that will help you recall and visualize the experience. I would like to help you learn to be able to vividly recall the feelings of the actual experience.

"As I mentioned earlier, visualization, or vividly imagining scenes and events, is part of our experimental procedure. We'll begin this phase of the experiment now. I'd like you to imagine some situations. I'll be reading descriptions of the events to help you imagine them. It is like daydreaming, but I'd like you to bring this more under your control, to imagine specific events, for a given period of time. It will help you to do this if you remain relaxed, as you've learned.

As you sit there, relaxed and calm, I'd like you to imagine some events. Try to imagine the situations as vividly as you can. Picture the scene in your mind as clearly as possible. For example, the first scene I will ask you to imagine involves reading a magazine. I want you to visualize the picture of the magazine with as much detail as you can, just as if the book were real. The idea of a vivid image is that you get a realistic picture of the scene in your mind.

Now I'll set up the image. As I describe the situation, create the image in your mind, getting a detailed picture of what the real situation would be like. When I finish the description, keep imagining the scene until I tell you to stop and focus on relaxation. Now I will present the first scene. Please close your eyes and keep them closed until I tell you to open them."

"You are sitting in a chair reading a popular science magazine. You see the words in paragraphs in black ink. You shift to a full page illustration of the muscles of the arm, and you notice that different colors are used to illustrate different parts of the arm, noting first the hand, which is yellow, then inspecting the elbow which is green, and finally the upper arm muscles which are shown in orange. You notice the fine detailed lines of the muscles in each part of the arm.

Have subject imagine scene for 20s

"Now open your eyes."

"How were you able to imagine the scene?"

"Were you able to see the words in paragraphs in black ink?"

"Were you able to see the different muscles of the arm in the different colors?"

"Were you able to see the fine detailed lines of the muscles in each part of the arm?"

"Remember, it's very important to include in the picture all the details that you can, and to visualize the scene just as if it were really happening. A vivid image depends on your having a realistic picture in your mind. Many of us aren't used to this way of imagining things vividly, and the point of these group sessions is for you to learn and practice this kind of active involvement with your imagery. A vivid image depends on your making the picture look as real as possible. You must include in the image colors, shapes, sizes, and relationships. This can help you to have more realistic images.

All right, now that we've reviewed the ideas of vividness, let's try another scene. Don't worry if the first scene wasn't very vivid. Some people are initially better than others at this, but practice will help everyone to imagine events as if you were really seeing them. We are ready to try again."

"Close your eyes and take a few minutes to get in a comfortable position and relaxed again (20s)."

"Remember, what we're trying to learn is vivid imagery by your including as many details as possible in the picture in your mind. Just like in the last scene this means including colors, textures, and relationships, in the picture. For example, be involved in the next situation by attending carefully to the details of situation just as if they were right in your line of sight. This will make the image more vivid. Now I will present the scene. When I finish the description, keep imagining the scene until I tell you to stop. Here is the next scene. Please close your eyes and keep them closed until I tell you to open them. Here is the next scene."

"You are in the language laboratory listening to an assignment over headphones and following the conversation with your book. The words flow too fast and the lines of text are a gray blur against the creamy white surface of the page. A color photograph of a farm on the adjoining page distracts you from the text. The texture of the page with the color plate is smooth looking and glossy, while the page with the text is rough and dull."

Have subject imagine scene for 20s

"Now open your eyes."

"What did you see in the image?"

"Were you able to see gray blurred lines on the page?"

"Did you see colors in the photograph?"

"Did you see the glossy vs. dull textures?"

"It is important to include lots of details in the image, picturing the situation in your mind as if it were a real situation. Many of us are not used to this type of vivid imagery, and the point of this portion of the experiment is for you to learn to practice including details in your images.

"Let's practice another scene again. Sit back, close your eyes, and get relaxed. Try to focus on breathing deeply from your diaphragm." (*20s*)

"Now that you are sitting there, deeply relaxed, completely calm, I'd like you to imagine another situation. Try to imagine the scene as vividly as you can."

"You are at the base of an observation tower as some of your friends ascend the stairs. The sun glints through the metal staircase. Slowly they make upward progress toward the tower's observation deck. They reach the top and wave to you from the platform. One of your friends drops a white hat, which gently sails down to the ground at your feet."

Have subject imagine scene for 20s

"Now open your eyes."

"What did you see in the image?"

"Did you see the gray tower, the sun, the platform?"

"Did you see the white hat falling?"

"It is important to include lots of details in the image, picturing the situation in your mind as if it were a real situation. Many of us are not used to this type of vivid imagery, and the point of this portion of the experiment is for you to learn to practice including details in your images. "Let's practice another scene. Sit back, close your eyes, and get relaxed. Try to focus on breathing deeply from your diaphragm."(20s)

"Now that you're sitting there, deeply relaxed, completely calm, I'd like you to imagine another situation. Try to imagine the scene as vividly as you can."
"Try to picture in your mind as much detail as you can, as if the situation were real."

Close your eyes and relax again. An interesting thing about this training is that you can apply what you have learned to your images in a variety of settings. For example, the experiences you have when you watch a film or see a play are like the pictures you imagine here. If you are willing to focus on as many details as possible, the action on screen or on stage helps you to believe in the situation and picture it as if it were real. My picturing as many details as possible in your mind, you can experience situations as if they were real."

"Close your eyes and relax. We'll do another scene. I'll give you a few seconds to get relaxed, and then we'll go into the next scene." (20s)

Close your eyes and relax again. (20 seconds) Let's do another image now.

"You are flying a kite on the beach on a bright summer day. Your red kite shows clearly against the cloudless blue sky, and whips quickly up and down in spirals with the wind. The sun glares at you from behind the kite and makes the white sandy beach sparkle with reflection. The long white tail dances from side to side beneath the soaring kite."

Have subject imagine scene for 20s

"Open your eyes."

"What did you see in the image?"

"What colors did you see?"

"Did you see the texture of the beach?"

"What shape was the kite?"

"I want to remind you again of the purpose of the imagery practice. You let yourself see situations as real by including lots of details about colors, shapes, sizes, etc., in your images. You have practiced a relaxation technique, and a way of achieving vivid imagery by including rich detail in the pictures in your mind. The next part of this experiment will involve writing and I ask that you use the techniques you were just taught in order to more fully involve yourself in your writing."

How to reinforce the participant:
Reinforce descriptive statements i.e. the sky is blue, or the sun is shining   Ignore response statements i.e. muscle movement, actions and perceptual movements.

When stimulus statements are reported you can say you did a good job with that. If the description did not involve stimulus statements ask the participant if they experienced X. If they report that they did say "good, that will make your image more vivid." If they did not experience X provide corrective feedback i.e. in future images try to let yourself see situations as real by including lots of details about colors, shapes, sizes, etc., in your images.

You can ask prompting questions such as "What did the hat look like?"
If the participant reports several stimulus statements, you can say, "It sounds like you had a very vivid image."

After the participant has described their image, the experimenter should summarize the image and provide reinforcement and corrective feedback when appropriate.

Avoid interrupting the participant because interruption can be a punisher.

Appendix B

Writing Instructions
Overview of Writing Instructions Given to All Participants

This study is an extremely important project looking at writing. During the next three lab sessions, you will be asked to write about one of several different topics for 20 minutes each day.

The only rule we have about your writing is that you write continuously for the entire time. If you run out of things to say, just repeat what you have already written. In your writing, don't worry about grammar, spelling, or sentence structure. Just write. Different people will be asked to write about different topics. Because of this, I ask that you not talk with anyone about the experiment. Because we are trying to make this a tight experiment, I can't tell you what other people are writing about or anything about the nature or predictions of the study. Once the study is complete, however, we will tell you everything. Another thing is that sometimes people feel a little sad or depressed after writing. If that happens, it is completely normal. Most people say that these feelings go away in an hour or so. If at any time over the course of the experiment you feel upset or distressed, please tell your experimenter or contact Dr. Vrana immediately. [Note: All participants will receive a sheet with contact information for Dr. Vrana.]

Another thing. Your writing is completely anonymous and confidential. Your writing is coded with an ID number. Please do not include your name in your writing. Some people in the past have felt that they didn't want anyone to read them. That's OK, too. If you don't feel comfortable turning in your writing samples, you may keep/delete them. We would prefer if you turned them in, however, because we are interested in what people write. I promise that none of the experimenters, including me, will link your writing to you. The one exception is that if your writing indicates that you intend to harm yourself or others, we are legally bound to match your ID with your name. Above all, we respect your privacy. Do you have any questions at this point? Do you still wish to participate?

Experimental Condition Instructions
(Do Not state the next sentence to participants in the no training group) I would like you to use the imagination techniques you were just taught in order to more fully involve yourself in recalling and writing about your experiences.

What I would like to have you write about for the next three days is the most traumatic, upsetting experience of your entire life—the same experience that you identified when you filled out a questionnaire earlier about posttraumatic symptoms. In your writing, I want you to really

let go and explore your very deepest emotions and thoughts. It is critical that you really delve into your deepest emotions and thoughts. Ideally, we would like you to write about significant experiences or conflicts that you have not discussed in great detail with others. Remember that you have three days to write. You might tie your personal experiences to other parts of your life. How is it related to your childhood, your parents, people you love, who you are, or who you want to be. Again, in your writing, examine your deepest emotions and thoughts and remember to use the techniques you were just taught in order to more fully involve yourself in your writing.

On the Second Day of Writing

How did yesterday's writing go? Today, I want you to continue writing about the most traumatic experience of your life using the techniques you were taught in the first session in order to more fully involve yourself in your writing. While you are recalling your experience, remember to [actually do in your recollection what you were doing in the actual situation] or [involve yourself fully in the sights, sounds, and smells of the actual situation]. I really want you to explore your very deepest emotions and thoughts…and remember to use the techniques you were taught in the first session in order to more fully involve yourself in your writing.

On the Third Day of Writing

Today is the last writing session. In your writing today, I again want you to explore your deepest thoughts and feelings about the most traumatic experience of your life using the techniques you were taught in the first session in order to more fully involve yourself in your writing. While you are recalling your experience, remember to [actually do in your recollection what you were doing in the actual situation] or [involve yourself fully in the sights, sounds, and smells of the actual situation].   Remember that this is the last day and so you might want to wrap everything up. For example, how is this experience related to your current life and your future? But feel free to go in any direction you feel most comfortable with and delve into your deepest emotions and thoughts…and remember to use the techniques you were taught in the first session in order to more fully involve yourself in your writing.

Control Condition Instructions
(Do Not state the next sentence to participants in the no training group) I would like you to use the imagination techniques you were just taught in order to more fully involve yourself in recalling and writing about your experiences.

What I would like you to write about over the next three days is how you use your time. Each day, I will give you different writing assignments on the way you spend your time. In your writing, I want you to be as objective as possible. I am not interested in your emotions or opinions. Rather I want you to try to be completely objective. Feel free to be as detailed as possible. In today's writing, I want you to describe what you did yesterday from the time you got up until the time you went to bed. For example, you might start when your alarm went off and you got out of bed. You could include the things you ate, where you went, which buildings

or objects you passed by as you walked from place to place. The most important thing in your writing, however, is for you to describe your days as accurately and as objectively as possible and remember to use the techniques you were just taught in order to more fully involve yourself in your writing.

On the Second Day of Writing

How did your writing go yesterday? Today, I would like you to describe what you have done today since you woke up using the techniques you were taught in the first session in order to more fully involve yourself in your writing. While you are recalling your experience, remember to [actually do in your recollection what you were doing in the actual situation] or [involve yourself fully in the sights, sounds, and smells of the actual situation]. Again, I want you to be as objective as possible to describe exactly what you have done up until coming to this experiment… and remember to use the techniques you were taught in the first session in order to more fully involve yourself in your writing.

On the Third Day of Writing

This is the last day of the writing sessions. In your writing today, I would like you to describe what you will be doing over the next week and remember to use the techniques you were taught in the first session in order to more fully involve yourself in your writing. While you are recalling your experience, remember to [actually do in your recollection what you were doing in the actual situation] or [involve yourself fully in the sights, sounds, and smells of the actual situation].

Word Collection Phase Instructions and Definitions

Response Proposition Definitions and Criteria:

From Lang, 1979:

- Response is the output information:

    - Reports of feelings, over acts, and somatic physiology.

- Information about responding in the context (the narrative), including expressive verbal behavior, overt acts, and the visceral and somatic events that mediate arousal and action.

- Overt and covert responses made in the context, including avoidance, self-referent verbal statements (e.g. God, I'm scared!), and the visceral and somatic response of physiological arousal (e.g. tachycardia, sweating).

- Assertions about behavior (e.g. my palms are sweating, my heart is racing, I scream, I run away.)

- Three response classes: verbal responses, overt motor acts, and response of physiological organs (visceral), as well as that which define characteristics of the subjects thinking process and sense organ adjustments or postural response that determine point of view.

As defined by Lang (1979), response propositions consist of expressive language, behavioral acts, and bodily responses. Thus, inclusion criteria for the response proposition dictionary will be words that are indicative of verbal exclamation, behavioral activation, or physiological arousal. It is expected that the parts of speech most likely to meet inclusion criteria will be action verbs (e.g. run, jump, shout), nouns referring to bodily responses (e.g. heartbeat, sweat, pulse), and exclamations (e.g. "Help!", "Stop!", "Darn!"). Exclusion criteria for the response proposition dictionary will be words unrelated to these specific concepts. Words likely to be excluded would be articles, descriptive words such as adverbs and adjectives, passive verbs, other types of nouns, and verbalizations that are not exclamatory. Examples of words that would meet inclusion criteria for this dictionary include: flee, strain, cry, ouch, and perspiration. A random selection of words that would be excluded include: beautiful, hard, table, hello, and behind.

Stimulus Proposition Definitions and Criteria:

From Lang, 1979:

- Stimuli is the input information:

    o Social (facial expression, sexual postures).

    o Nonsocial (bright colors, spiders, high places).

- Information about prompting external stimuli and the context in which they occur.

- Code information critical to the recognition of the frightening object, including the relevant context of its appearance (e.g. the snake's skin has a diamond patter; it's moving toward me; no one else is here.)

- Stimulus information defines the direction of approach or avoidance and is as pertinent to emotional cognition as the response code.

- Descriptors or assertions about stimuli (e.g. a black snake writhing on the path, an auditorium of staring faces)

Lang (1979) referred to stimulus propositions as descriptions of contextual stimuli. Thus, stimulus propositions inclusion criteria can be defined as adjectives, adverbs, and gerunds that describe aspects of the environment. Words that are not adjectives, adverbs, or gerunds as well as adjectives, adverbs, and gerunds that are not descriptors of environmental or contextual stimuli would be excluded. Examples of words that meet inclusion criteria for this category would include: softly, small, bright, dark, green, shiny, and shining. The following are examples of words that would be excluded: run, the, looked, it, pulse.

Instructions for brainstorming:

"Please use the conceptual definitions and examples provided above of response and stimulus propositions to brainstorm as many single words as possible for each category list. It is possible that a word would be included on both lists, but only work on generating words for one category at a time. First, create a list for each category on your own, without communicating with your classmates. Then, we will all meet to combine our lists and create our final collection of words for each category."

Research assistant instructions for selecting response and stimulus words from frequency list:

"Attached is an excel file containing all words used at a frequency of .01 or higher from all the transcribed essays. Your job is to categorize all applicable words as response words or stimulus words, using the definitions and inclusion/exclusion criteria below. Many words will not fit in either category, and some words may fit in both categories. Use the color coding system and the definitions above to categorize words. E-mail me the excel file when you are done. It's best if you don't talk to each other about this project because the goal is to see how well people's categorizations correspond with one another."

Response Word Custom Dictionary
Word Judging Instructions

Judges: Please use the conceptual and operational definitions below to guide you in deciding whether words should be added, included, or excluded from the response word dictionary. Please consider the sub-categories below in making your selections and in further classifying included words whenever possible into sub-categories. You may include words that meet the conceptual and operational definitions but do not fit into one of the sub-categories.

Conceptual: the response units of an information processing network in the brain which consists of expressive language, behavioral acts, and bodily responses, can be understood as "the output" of this network, and can be described in propositional language

Operational: single words judged to be indicative of expressive language, behavioral acts, or bodily responses, words that most likely indicate the presence of a response proposition, words that can be appropriately categorized into the sub-categories listed below, words that serve as the parts of speech listed below

Sub-categories

1. Verbal responses

Overt vocalization- loud comments, expressive cries (e.g. "Help!", cried, yelled, responded)

Covert verbalization- emotional labeling, self-evaluative statements, attribution of attitudes to others (e.g. thought, felt)

2. Somatomotor events

Muscle tension (e.g. tensed, flexed)

Uncontrolled gross motor behavior (e.g. trembled, reacted)

Organized motor acts, freezing, approach, avoidance (e.g. froze, fled, ran, avoided)

3. Visceral Events

Heart rate and pulse (e.g. pulsed, beat, raced)

Body or palmar sweat (e.g. perspired, sweating)

Vascular changes, blanching, or flushing (e.g. flushed, blushed)

Pilomotor response (e.g. goosebumps, tingle)

Salivary response, mouth dry (e.g. mouth, salivated, swallowed)

Respiratory change (e.g. breathing, gasped)

Intestinal upset- vomiting, incontinence (e.g. vomited, churning, threw-up, excreted)

Urinary dysfunction (e.g. urinated, peed)

4. Processor characteristics

Perception unclear or unusually vivid or distorted (e.g. hallucinating, dreaming)

Loss of control over thoughts, cannot think clearly (e.g. racing, going)

Disoriented in time or space (e.g. searching, losing)

5. Sense organ adjustments

General postural changes (e.g. moved, shifted)

Eye and head movements (e.g. strained, turned, glanced)

Parts of speech

Inclusion- action verbs; gerunds referring to bodily responses, expressive language, or behavioral acts; exclamations; nouns referring to bodily responses

Exclusion- articles, adverbs/adjectives, verbs indicative of external sensory perception, nouns not referring to bodily responses or body parts, non-exclamatory verbalizations

Stimulus Word Custom Dictionary
Word Judging Instructions

Judges: Please use the conceptual and operational definitions below to guide you in deciding whether words should be added, included, or excluded from the stimulus word dictionary. Please consider the examples of types of stimulus words below in judging words to be included, excluded, or added to the general stimulus dictionary. You may include words that meet the conceptual and operational definitions but that do not correspond to one of the examples of types of stimulus words below.

Conceptual: descriptions of contextual stimuli, descriptions of environment and/or setting, cues that might stimulate a response, "the input", can be described in propositional language

Operational: single words judged to be indicative of description, details of contexts, environments, settings, or cues that might stimulate a response, words that most likely indicate the presence of a stimulus proposition, words that are indicative of the examples listed below, words that serve as the parts of speech listed below

Examples of types of stimulus words

      Auditory (e.g. loud, soft, slowly)

      Visual (e.g. blurry, clear, bright)

      Tactile (perceptible to the sense of touch) (e.g. tangible, touchable, soft)

      Cutaneous (of or relating to affecting the skin) (e.g. infection, rash, supple)

      Olfactory (e.g. pungent, fragrance, smelly)

      Vestibular (relating to the sense of equilibrium) (e.g. unstable, stable)

      Kinesthetic (of or relating to the sense that detects bodily position, weight, or movement of the muscles, tendons and joints) (e.g. weight, heavy, lightly, left, right)

      Physical details of the object or situation (e.g. beautiful, tall, thin)

      Changes in object configuration (e.g. melted, evaporated, disappeared)

      Object movement (approach or withdrawal) (e.g. toward, away)

Physical place or general location (e.g. home, city, office, outside, inside)

Presence or absence of others as observers or participants (e.g. crowd, presence, absence, observers, people)

Pain, location on the body, sharp dull (e.g. painful, searing, sharp, dull)

Parts of speech

Inclusion:

Adjectives and adverbs referring to sensory or contextual details, including physical details such as color, size, shape, smell, sound, orientation

Gerunds referring to sensory or contextual details, including physical details such as color, size, shape, smell, sound, and orientation that are unlikely to refer to the subjects' own bodily responses

Nouns, especially object nouns indicative of setting, presence of objects, physical place or location

Prepositions signaling object configuration, location, and presence or absence of others

Exclusion:

Articles

Action verbs

Gerunds referring to bodily responses, expressive language, or behavioral acts (i.e. trembling)

Exclamations

Nouns referring to bodily responses

Appendix F

Response word dictionary and sub-categories

Response word dictionary
(* unanimously selected words)

accelerate*	bought	coming	dreaming*
accept	break	communicate	dressed
accepted	breathe*	constriction*	dried
act	breathing*	contact	drink*
acting	bring	continue	drinking*
afraid	broke	continued	drinks*
agreed	brought	contract*	drive*
anger	brush	control	drives*
angry	brushed	cook	drop
answer*	burn	cooked	dropped
answered*	buy	cover	drove*
anxiety	call*	covers	drunk
anxious	called*	cramps*	dry
applied	calling*	craning*	ducked*
approached*	calls*	crash	dying
arrive	calm	crawled*	eat*
arrived	came	cried*	email
ashamed	cast	crossed	embarrassed
ask*	catch*	cry*	ended
asked*	caught*	crying*	enjoy
ate*	chat*	cut	enter*
attempted	chatted*	dance*	entered*
avoid*	check*	dart*	escape*
avoided*	checked*	deal	excited
awoke	chew*	decide	excreted*
backed	chill	decided	exercise*
barf*	churning*	depressed	exercises*
barfed*	clammy*	died	exit*
beat*	clean	dilate*	expected
bike	cleaned	dilated*	explain
bit	clenched*	disappeared	explained
bite*	climb*	discuss*	express*
blame*	close	discussed*	faint*
bleeding*	closed	display	fainted*
blocks	come	dizzy*	fall
blushed*	comes	drank*	feared

117

fed
feed
feel*
feeling*
feels*
fell
felt*
fight*
fighting*
filled
find
finish
finished
fix
fixed
fled*
flee*
fleeing*
flew*
flexed*
flexed*
flip
flushed*
focused*
follow
followed
following
force
forced
found
frightened
froze*
frustrated
fuck*
gasped*
gasping*
gasps*
gather
gathered
gave
get
getting
give
gives
giving
glance*

glanced*
glancing*
gliding
go*
goes*
going*
goosebumps*
got
grab*
grabbed*
granted
grew
grit
grow
hallucinating*
hang
happy
hate
hated
having
headed
hear
heard
hearing
heat
held
help
helped
helping
helps
hid*
hide*
hit*
hitting*
hold*
holding*
hope
hoping
hopped*
hot
howling*
hugging
hung
hungry
hurt
hurting

hurts
hyperventila
hysterics
imagine*
inspecting*
jerked*
jittery*
jump*
jumped*
keep
keeps
kept
kicked*
kill
killed
kiss*
kissed*
knotted*
laid
laugh*
laughing*
lay
learn
learned
leave*
leaves*
leaving*
lecture
led
let
lick*
lie
lied
lift*
lightheaded*
listen
listened
listening
live
lived
lives
load
located
lock
locked
logged

look*
looked*
looking*
looks*
lose
losing
lost
love
loved
made
mail
make
makes
making
managed
married
meet
mention
mentioned
met
miss
move*
moved*
name
named
nap
nauseous*
need
needed
nervous
note
notice
noticed
numb
nurse
offered
oh
ooze
open
opened
order
ordered
pack
packed
paid
pale

paled*
panic*
panting*
paralyzed*
park
parked
pass
passed
pay
peed*
perspiration
perspire*
perspired*
pick
picked
pisses*
placed
places
play
played
point*
pop
pound*
pounds*
pour*
poured*
practice
pray
praying
prepare
prepared
preparing
pressed
print
printed
proceeded
process
project
promised
protect
proud
puked*
pull*
pulled*
pulsed*
punched*

pushed*
questioned*
quicken*
quit
race*
raced*
races*
racing*
raised
ran*
rate*
reach*
reached*
reacted
read
realize*
realized*
recall
receive
received
record
refused
relax*
relaxing*
release
relief
remember
remembered
repeat
replied
report
research
responded*
rest
restless
return
returned
review
ride
rinsed
rode
rolled
run*
running*
rush*
rushed*

rushing*
sad
said
salivate*
salivated*
sat
save
saw*
say*
saying*
scan*
scared
scheduled
scream*
screamed*
screaming*
searched*
searching*
see*
sense*
sent
set
settle
shake*
share
shave
shift*
shifted*
shock
shocked
shop
shot
shout*
shoved*
show
showed
shower
showing
shows
shrieked*
shudder*
shut*
sign
sit*
sitting*
skip

skipped
slam
slammed
slapped*
sleep
slept
smacked*
smash
smell
smelled
smile*
smoke
smoked
snooze
soaking
sober
sore
speak*
spend
spent
split
spoke*
spot
spread
squinting*
stand*
standing*
stare*
start
started
starts
stay
stayed
step*
stepped*
stiffened
stood*
stop
stopped
stopping
strain*
strained*
stress
stressed
strikes
struggled

studied	tells	try	wanted
study	tense*	trying	wanting
stumble	tensed*	turn*	wash
subject	tension*	turned*	washed
suffer	terrified	turns*	watch*
suffering	texting	twitch*	watched*
surprised	thank	twitched*	watching*
surrounded	think*	understand*	watering
survive	thought*	uneasy	wave
swallow*	threw*	unlocked	wear
swallowed*	threw-up*	unsure	went
sweat*	throw*	urinated*	wet
sweating*	thudding	use	whisper*
sweaty	tighten*	used	whispered*
swerve	tingle	using	wish
switched	tingling	view	wished
swung	tired	visit	woke
tachycardia	told	visiting	wonder*
take	took	volunteer	wore
takes	touch*	vomit*	work*
talk*	trace	vomited*	worked*
talked*	track	wait	works*
talking*	tracking	waited	worried*
talks*	travel	waiting	worry*
taught	treat	wake	wrap
teach	treated	waking	write
tears*	trembled*	walk*	wrote
tease	trembling*	walked*	yell*
tell	tried	walking*	yelled*
telling	trip	want	yelling*

Verbal response sub-category
(* unanimously selected word)

accept	called*	enjoy	hated
accepted	calling*	excited	hope
afraid	calls*	expected	hoping
agreed	calm	feared	hurt
anger	chat*	feel*	hurting
angry	chatted*	feeling*	hurts
answer*	cried*	feels*	love
answered*	cry*	felt*	loved
anxious	crying*	frightened	mention
ashamed	discuss*	frustrated	mentioned
blame*	discussed*	happy	miss
call*	embarrassed	hate	need

needed	scared	talking*	unsure
nervous	scream*	talks*	whisper*
panic*	screamed*	tell	whispered*
proud	screaming*	telling	worried*
questioned*	shout*	tells	worry*
relief	shrieked*	terrified	yell*
responded*	speak*	think*	yelled*
restless	spoke*	thought*	yelling*
sad	surprised	told	
say*	talk*	understand*	
saying*	talked*	uneasy	

Somatomotor event words
(* unanimously selected words)

accelerate*	cleaned	ducked*	following
applied	climb*	eat*	force
approached*	close	email	forced
arrive	closed	ended	found
arrived	come	enter*	froze*
ask*	comes	entered*	fuck*
asked*	coming	escape*	gather
ate*	communicate	exercise*	gathered
attempted	contact	exercises*	gave
avoid*	continue	exit*	get
avoided*	continued	express*	getting
awoke	cook	fall	give
beat*	cooked	fed	gives
bike	cover	feed	giving
bit	covers	fell	gliding
bite*	crash	fight*	go*
blocks	crawled*	fighting*	goes*
bring	cut	filled	got
broke	dance*	finish	grab*
brought	dart*	finished	grabbed*
brush	deal	fix	granted
brushed	drank*	fixed	grew
buy	dressed	fled*	grow
came	drink*	flee*	hang
cast	drinking*	fleeing*	headed
catch*	drinks*	flew*	held
caught*	drive*	flexed*	helped
check*	drives*	flexed*	helping
checked*	drop	flip	helps
chew*	dropped	follow	hid*
clean	drove*	followed	hide*

hit*	ordered	relaxing*	smile*
hitting*	pack	release	smoke
hold*	packed	repeat	smoked
holding*	paralyzed*	replied	snooze
hopped*	park	report	soaking
howling*	parked	research	spend
hugging	pass	rest	split
hung	passed	return	spread
jerked*	pay	returned	stand*
jump*	pick	review	standing*
jumped*	picked	ride	start
kicked*	placed	rinsed	started
kill	places	rode	starts
killed	play	rolled	stay
kiss*	played	run*	stayed
kissed*	point*	running*	step*
knotted*	pound*	rush*	stepped*
laid	pounds*	rushed*	stood*
laugh*	pour*	rushing*	stop
laughing*	poured*	sat	stopped
lay	practice	scheduled	stopping
learn	pray	sent	strikes
learned	praying	set	studied
leave*	prepare	shake*	study
leaves*	prepared	share	surrounded
leaving*	preparing	shave	switched
led	pressed	shop	swung
lick*	print	shot	take
lift*	printed	shoved*	takes
load	proceeded	show	tense*
located	project	showed	tensed*
lock	protect	shower	tension*
locked	pull*	showing	texting
logged	pulled*	shows	threw*
mail	punched*	shut*	throw*
managed	pushed*	sign	thudding
meet	quicken*	sit*	tighten*
met	quit	sitting*	took
move*	raised	skip	touch*
moved*	ran*	skipped	trace
note	reach*	slam	trembled*
nurse	reached*	slammed	trembling*
offered	reacted	slapped*	tried
open	read	slept	trip
opened	record	smacked*	turn*
order	relax*	smash	turned*

turns*	waited	wash	worked*
twitch*	waiting	washed	works*
twitched*	walk*	wave	wrap
unlocked	walked*	went	write
wait	walking*	work*	wrote

Visceral events words
(* unanimously selected words)

barf*	dizzy*	ooze	salivated*
barfed*	excreted*	paled*	shudder*
bleeding*	faint*	panting*	swallow*
blushed*	fainted*	peed*	swallowed*
breathe*	flushed*	perspire*	sweat*
breathing*	gasped*	perspired*	sweating*
churning*	gasping*	pisses*	tachycardia
clammy*	gasps*	puked*	tears*
clenched*	goosebumps*	pulsed*	threw-up*
constriction*	hungry	race*	tingle
contract*	hyperventilate	raced*	tingling
cramps*	jittery*	races*	urinated*
dilate*	lightheaded*	racing*	vomit*
dilated*	nauseous*	salivate*	vomited*

Processor characteristics
(* unanimously selected words)

dreaming*	imagine*	lost	searched*
going*	lose	realize*	searching*
hallucinating*	losing	realized*	

Sense organ adjustments
(* unanimously selected words)

craning*	listen	scan*	stumble
focused*	listened	see*	view
glance*	listening	shift*	watch*
glanced*	look*	shifted*	watched*
glancing*	looked*	squinting*	watching
hear	looking*	stare*	
heard	looks*	strain*	
hearing	saw*	strained*	

Appendix G

Stimulus word dictionary

Stimulus word dictionary
(*unanimously selected words)

abundantly	bag	energy	messages
across	bagel*	entire*	metal*
adult	bags	entrance*	mile
against*	ball*	especially	milk*
air	banana*	essay	mind
aircraft	band	evaporated*	mirror*
alcohol	dorms*	evening	mom*
alleyway*	down*	event	Monday
alone*	downstairs*	events	money
amazing	downtown	everybody*	month
ambulance*	drawer*	everyone*	morning
America	dream	exact*	mornings
American	dreams	exactly*	mother*
annoying	dresser*	exam	mouth*
anyone	driver	exams	movie*
apartment	driveway*	lunch*	movies*
apple*	driving	machine	moving
application	drug	makeup*	music*
approximately	drugs	making	muted*
April	drunk	mall*	natural
area*	dry*	man*	nature
arm*	dull*	manager*	near*
arms*	ear*	market*	negative
around*	earlier	material	neighborhood
arriving*	early	math	snake
art*	earth*	meal	snow*
August	edge*	medical	soap
aunt*	education	medicine*	soaring
away*	eggs*	meeting	social
awful	elevator*	melted*	socks
awkward	emails	memories	soft*
baby*	emergency	memory	someone*
back*	emotionally	men*	son*
backpack*	empty*	menacing*	song*
bacon*	ending	mess*	soon

124

sore*	beneath*	favorite	oldest*
sound*	beside*	feet*	omelet*
space	big*	fiancé*	online
spade	biggest*	field*	orange*
spare	bills*	figure*	out
sparkle*	bizarre	final	outfit
special	black*	finals	outside*
spectacle	blanket*	fire*	oven*
spider	bleeding*	fish*	packed*
spirals*	block	fishing	page
sports	blood*	fit	painful*
spring	blue*	floor*	pair*
stable	blur*	flower*	pan*
stairs	blurred*	following	pants*
Starbucks	blurry*	food*	papa*
state	boat*	football*	paper*
station	body*	forever	papers*
statistics	book*	form*	parent
stature	books*	forward*	parents
stepfather*	bottle*	fragrance*	party
steps	bowl*	freaking	path*
stomach	box*	free	patient
store	boy*	fresh*	pavement
stories	boyfriend*	Friday	peaceful
story	brain	fridge*	stupid
straight*	bread*	friend*	successful
strange	breakfast*	new*	suit
street	brick*	news	summer
strong*	exhibition	next*	sun*
stronger*	experiment	night*	Sunday
stubborn	exposed*	noise*	sunlight*
students*	extremely	noon	sunny*
studies	face*	note	supple*
bang*	facebook	notebook*	surgery
bank*	faces*	notes	surrounds*
bar*	facing*	notice*	sweet*
barely	fair*	November	table
barking*	falling	numb	tail
basketball*	familiar	nurses	talking
bathroom*	families	observers	tall*
beach*	family	odd	tan*
beautiful*	far*	office	tangible*
bed*	fast*	officer	tank*
bedroom*	faster*	oil*	tea
behind*	fat*	old*	teacher*
belongings*	father*	older*	team*

125

teeth*	cellphone*	grandmother*	professor
television*	center*	grandpa*	psychology
tests	cereal*	grandparents*	pungent*
texture*	chair*	gray*	purple*
Thanksgiving	chapters	great	purse
therapy	cheese*	green*	quick
thin*	chemistry	grey*	quickly
thoughts	chicken*	grocery*	quiet*
throbbing	child*	gross	quiz
Thursday	childhood	grotesque	radio*
ticket	children*	ground	rain*
tickets	chocolate*	group	raining
time	Christmas	guitar*	random
toast	church*	guy*	towel
together	cigarette*	guys*	town
toilet	cigarettes*	people*	traffic
toothbrush	city*	perfect	tragedy
toothpaste	friends*	person*	trash
top	fries*	phone*	traumatic
touchable*	from	physical	treatment
tough	front*	physics	tree*
toward*	full*	picture*	trees*
bright*	fully	pictures*	truck
broken*	funeral	pieces*	tubes
brother*	further*	pillow*	Tuesday
brothers*	future	pills*	ugly
brown*	game	pink*	uncle
bug*	games	pizza*	uncles
building*	garage*	plastic*	uncomfortable
buildings*	gas	plate*	under*
bus*	gently	points	unsafe
business	Georgia	police	unstable*
busy	gift	pool	up*
butter*	girl*	porch*	upstairs
buzzing*	girlfriend*	portion	usual
calm	girls*	position	usually
campus	glass*	positive	vacation
cancer	glasses*	pounds	van*
car*	glints*	prescription	vehicle*
cards*	gloomy*	presence	video
Carolina	glossy*	present	Virginia
carpet*	God	presentation	vivid*
cars*	grades	pressure	voice*
cash*	graduation	pretty*	wall*
cat*	grandfather*	problem	wallet*
cell*	grandma*	problems	warm*

watching
water*
weak
weather
web
wedding
Wednesday
weekend
weekends
weight*
west*
class
classes
classroom*
clear*
clearly*
clock*
close*
closer*
closet*
clothes*
cloudless*
club
coach
coat*
coffee*
cold*
college
color*
colored*
colors*
comfortable
community
company
computer*
computers*
conditioner
contacts
conversation*
cooking
cool*

cop*
corner*
cotton*
couch*
counselor
counter*
country
court*
cousin
cousins
covered*
gym*
hair*
hall*
hallway*
hand*
hands*
hanging
hard*
harder*
hardest*
hat*
hazardous
head*
heading
health
healthy*
heart
heavy*
hell
here*
high*
highway*
history
home
homework
hoodie*
hospital*
hot*
hotel*
house*

houses*
huge*
human
husband*
ice*
identification
illustration
image
immediate
in
Indian
infection
insect*
inside*
rash*
real
realistic
red*
reflection*
refrigerator*
relationship
relationships
restaurant*
restroom*
resume
rice*
Richmond
right
ring
river*
road*
roadside*
room*
roommate*
rooms*
rough*
safe
salad*
salty*
sandwich*
sandy*

Saturday
scene
schedule
school*
science
searing*
season
seat
secret
security
self
semester
senior
serious
seriously
session
setting
wet*
white*
wife*
wind
window
windows
windshield
winter
woman*
women*
wooded*
woods*
word
words
worker
workers
workout
world
yard
yellow*
young*
younger*
youngest*

LIWC2007 Dictionary Categories

Cognitive processes

abandon*	alot	banned	brake*
abandon*	altogether	banning	bridle*
absolute	always	bans	but
absolutely	ambigu*	barely	came
abstain*	anal	barrier*	careful*
accept	analy*	based	categor*
accepta*	and	bases	caus*
accepted	answer*	basis	caut*
accepting	any	became	cease*
accepts	anybod*	because	ceasing
accura*	anyhow	become	certain*
acknowledg*	anyone*	becomes	chance
activat*	anything	becoming	change
add	anything	becoming	changed
addit*	anytime	belief*	changes
adjust*	anywhere	believe	changing
admit	apparent	believed	choice*
admit	apparently	believes	choos*
admits	appear	believing	clarif*
admits	appeared	besides	clear
admitted	appearing	besides	clearly
admitted	appears	bet	close
admitting	appreciat*	bets	closure
affect	approximat*	betting	cohere*
affected	arbitrar*	binding	come
affecting	around	blatant*	commit
affects	around	block	commitment*
afterthought*	assum*	blocked	commits
aggravat*	assur*	blocker*	committ*
aggravat*	attent*	blocking	compel*
all	attribut*	blocks	complete
allot	avert*	blur*	completed
allow*	avoid*	borderline*	completely
almost	avoid*	boss*	completes
along	aware*	both	complex*
alot	ban	bound*	compliance

complica*	decid*	duty	forgave
complie*	decis*	each	forgave
comply*	deduc*	effect*	forget*
compreh*	defenc*	either	forgiv*
compulsiv*	defenc*	elicit*	forgiv*
concentrat*	defens*	enclos*	forgot*
conclud*	defens*	enlighten*	found
conclus*	define	entire*	foundation*
confess*	defined	essential	founded
confidence	defines	evaluat*	founder*
confident	defining	ever	frankly
confidently	definite	every	fundamental
confin*	definitely	everybod*	fundamentalis*
conflict*	definitive*	everything*	fundamentally
confus*	delay*	evident*	fundamentals
confus*	denia*	exact*	fuzz*
conscious*	denie*	examin*	general
consequen*	deny*	except	generally
conserv*	depend	exclu*	generate*
consider	depended	expect*	generating
considered	depending	experiment	generator*
considering	depends	explain	grasp*
considers	desir*	explain	guarant*
constrain*	determina*	explained	guard*
constrict*	determine	explained	guess
contain*	determined	explaining	guessed
contemplat*	determines	explains	guesses
contingen*	determining	explains	guessing
contradic*	difference*	explanat*	halfass*
control*	differentiat*	explicit*	halt*
correct*	directly	explor*	hangup*
correlat*	discern*	extremely	hardly
cos	disciplin*	fact	harness*
could	disclo*	facts	hazie*
could	discourag*	factual*	hazy
couldnt	discourag*	fairly	held
couldn't	discover*	feel	hence
couldve	disorient*	feeling*	hesita*
could've	disregard*	feels	hesita*
coz	distinct*	felt	hold*
create*	distinguish*	fenc*	hope
creati*	doubt*	figur*	hoped
curb*	doubt*	find*	hopeful
curio*	dubious*	forbid*	hopefully
curtail*	dunno	force*	hopefulness
cuz	duti*	forever	hopes

hoping	inhib*	lotsa	necessar*
how	inquir*	lotta	need
how	inside	luck	needed
hows	insight*	lucked	needing
how's	inspir*	lucki*	neednt
hypothes*	intend*	luckless*	needn't
hypothetic*	intent*	lucks	need'nt
idea	interfer*	lucky	needs
ideal*	interpret*	made	neglect*
ideas	into	mainly	neglect*
identif*	invariab*	make	never
if	irrational*	make	news
ignit*	irrational*	maker*	normal
ignor*	irrefu*	makes	normal
imagin*	issue	making	not
implica*	just	manipul*	notice*
implicit*	justif*	marginal*	noticing
implie*	keep	matter*	obedien*
imply*	keeping*	may	obey*
impossib*	keeps	maybe	obscur*
inact*	kept	mean	obstac*
inadequa*	kinda	meaning*	obvious*
inclu*	kindof	means	occasional*
incomplet*	knew	meant	often
indecis*	know	memor*	open
indecis*	knowab*	might	opinion
indeed	knower*	mightve	oppos*
indefinit*	knowing	mightve	option
independ*	knowledg*	might've	or
indetermin*	known	might've	organiz*
indirect*	knows	mind	origin
induc*	lack*	misle*	originat*
inevitab*	launch*	mistak*	origins
infallib*	law	misunder*	ought
infer	lead*	most	oughta
inferr*	learn*	mostly	oughtnt
infers	led	motiv*	oughtn't
influenc*	lesson*	must	ought'nt
info	liabilit*	mustnt	oughtve
inform	likel*	mustn't	ought've
information	limit*	must'nt	out
informative*	link*	mustve	outcome*
informed	logic*	must've	outstanding
informing	lot	myster*	overall
informs	lotof	name	partly
inhib*	lots	nearly	perceiv*

130

percept*	rearrang*	save	spose
perfect*	reason*	secret	standard
perhaps	recall*	secrets	statement*
permit*	reckon*	secur*	stiff*
pick	recogni*	seem	stimul*
plus	recollect*	seemed	stop
plus	reconcil*	seeming*	stopped
ponder*	reconsider*	seems	stopper*
positiv*	reconstruct*	sense	stopping
possib*	reevaluat*	sensed	stops
practically	refer*	senses	stories
precis*	reflect*	sensing	story
prefer*	refrain*	shaki*	stubborn*
presum*	refus*	shaki*	stubborn*
pretty	regardless	shaky	subdue*
prevent*	regret*	shaky	suppose
probable	regret*	should	supposed
probablistic*	rein*	shouldnt	supposes
probably	relate*	shouldn't	supposing
problem*	relating	should'nt	supposition*
produc*	relation	shoulds	suppress*
prohib*	reluctan*	shouldve	sure*
proof	reluctan*	should've	suspect*
protect*	rememb*	sign	suspicio*
prove*	reorgani*	since	suspicio*
proving	repress*	solution*	taboo*
provoc*	repress*	solve	tempora*
provok*	requir*	solved	tentativ*
prude	reserved	solves	theor*
prudes	resolu*	solving	therefor*
prudish*	resolv*	some	think
pure*	response*	somebod*	thinker*
purpose*	responsib*	somehow	thinking*
puzzl*	restrain*	someone*	thinks
quer*	restrict*	something*	thought
question*	restructur*	something*	thoughts
quite	result*	sometime	thus
random*	retain*	sometimes	tidi*
rather	rethink*	somewhat	tidy
rational*	reveal*	somewhere	tight*
react*	revelat*	sort	total
real	rigid*	sorta	totally
realis*	rigid*	sortof	trigger*
reality	root*	sorts	truest
realiz*	safe*	sortsa	truly
really	same	source*	truth*

typically
unaccept*
unambigu*
unaware*
uncertain*
uncertain*
unclear*
undecided*
undeniab*
understand
understandab*
understanding*
understands
understood
undesire*
undetermin*
undo
undoubt*
unknow*
unless
unless
unlikel*

unluck*
unneccess*
unneed*
unquestion*
unrelat*
unresolv*
unsettl*
unsure*
unsure*
unwant*
uptight*
uptight*
use
used
uses
using
usually
vague*
variab*
varies
vary
versus

veto
vs
wait
waited
waiting
waits
wanna
want
wanted
wanting
wants
wariness
wary
we
whether
wholly
why
wish
wished
wishes
wishing
with

withheld
withhold*
without
without
wonder
wondered
wondering
wonders
word*
would
wouldnt
wouldn't
wouldve
would've
write
writing
wrote
yearn*
yearn*
yield*

Insight sub-category

accept
accepta*
accepted
accepting
accepts
acknowledg*
adjust*
admit
admits
admitted
admitting
afterthought*
analy*
answer*
appreciat*
assum*
attent*
aware*
became
become

becomes
becoming
belief*
believe
believed
believes
believing
categor*
choice*
choos*
clarif*
closure
cohere*
complex*
complica*
compreh*
concentrat*
conclud*
conclus*
confess*

conscious*
consider
considered
considering
considers
contemplat*
correlat*
curio*
decid*
decis*
deduc*
define
defines
defining
determina*
determine
determined
determines
determining
differentiat*

discern*
disclo*
discover*
distinguish*
effect*
enlighten*
evaluat*
examin*
explain
explained
explaining
explains
explanat*
explor*
feel
feeling*
feels
felt
figur*
find*

forgave	knowledg*	reason*	sensed
forgiv*	known	recall*	senses
found	knows	reckon*	sensing
grasp*	learn*	recogni*	solution*
idea	lesson*	recollect*	solve
ideas	link*	reconcil*	solved
identif*	logic*	reconsider*	solves
imagin*	mean	reconstruct*	solving
induc*	meaning*	reevaluat*	statement*
infer	means	refer*	suspect*
inferr*	meant	reflect*	suspicio*
infers	memor*	relate*	think
info	misunder*	relating	thinker*
inform	motiv*	relation	thinking*
information	notice*	rememb*	thinks
informative*	noticing	reorgani*	thought
informed	perceiv*	resolu*	thoughts
informing	percept*	resolv*	unaccept*
informs	ponder*	restructur*	unaware*
inquir*	prefer*	rethink*	understand
insight*	presum*	reveal*	understandab*
inspir*	prove*	revelat*	understanding*
interpret*	proving	secret	understands
justif*	quer*	secrets	understood
knew	question*	seem	unrelat*
know	rational*	seemed	wonder
knowab*	realis*	seeming*	wondered
knower*	realiz*	seems	wondering
knowing	rearrang*	sense	wonders

Causal sub-category

activat*	boss*	control*	elicit*
affect	caus*	cos	experiment
affected	change	coz	force*
affecting	changed	create*	foundation*
affects	changes	creati*	founded
aggravat*	changing	cuz	founder*
allow*	compel*	deduc*	generate*
attribut*	compliance	depend	generating
based	complie*	depended	generator*
bases	comply*	depending	hence
basis	conclud*	depends	how
because	consequen*	effect*	hows

how's	launch*	origins	solution*
ignit*	lead*	outcome*	solve
implica*	led	permit*	solved
implie*	made	pick	solves
imply*	make	produc*	solving
inact*	maker*	provoc*	source*
independ*	makes	provok*	stimul*
induc*	making	purpose*	therefor*
infer	manipul*	rational*	thus
inferr*	misle*	react*	trigger*
infers	motiv*	reason*	use
influenc*	obedien*	response*	used
intend*	obey*	result*	uses
intent*	origin	root*	using
justif*	originat*	since	why

Affective process dictionary

abandon*	agreeing	assur*	bitter*
abuse*	agreement*	attachment*	blam*
abusi*	agrees	attack*	bless*
accept	alarm*	attract*	bold*
accepta*	alone	aversi*	bonus*
accepted	alright*	avoid*	bore*
accepting	amaz*	award*	boring
accepts	amor*	awesome	bother*
ache*	amus*	awful	brave*
aching	anger*	awkward*	bright*
active*	angr*	bad	brillian*
admir*	anguish*	bashful*	broke
ador*	annoy*	bastard*	brutal*
advantag*	antagoni*	battl*	burden*
adventur*	anxi*	beaten	calm*
advers*	aok	beaut*	care
affection*	apath*	beloved	cared
afraid	appall*	benefic*	carefree
aggravat*	appreciat*	benefit	careful*
aggress*	apprehens*	benefits	careless*
agitat*	argh*	benefitt*	cares
agoniz*	argu*	benevolen*	caring
agony	arrogan*	benign*	casual
agree	asham*	best	casually
agreeab*	assault*	better	certain*
agreed	asshole*	bitch*	challeng*

134

champ*
charit*
charm*
cheat*
cheer*
cherish*
chuckl*
clever*
comed*
comfort*
commitment*
compassion*
complain*
compliment*
concerned
confidence
confident
confidently
confront*
confus*
considerate
contempt*
contented*
contentment
contradic*
convinc*
cool
courag*
crap
crappy
craz*
create*
creati*
credit*
cried
cries
critical
critici*
crude*
cruel*
crushed
cry
crying
cunt*
cut
cute*

cutie*
cynic
damag*
damn*
danger*
daring
darlin*
daze*
dear*
decay*
defeat*
defect*
defenc*
defens*
definite
definitely
degrad*
delectabl*
delicate*
delicious*
deligh*
depress*
depriv*
despair*
desperat*
despis*
destroy*
destruct*
determina*
determined
devastat*
devil*
devot*
difficult*
digni*
disadvantage*
disagree*
disappoint*
disaster*
discomfort*
discourag*
disgust*
dishearten*
disillusion*
dislike
disliked

dislikes
disliking
dismay*
dissatisf*
distract*
distraught
distress*
distrust*
disturb*
divin*
domina*
doom*
dork*
doubt*
dread*
dull*
dumb*
dump*
dwell*
dynam*
eager*
ease*
easie*
easily
easiness
easing
easy*
ecsta*
efficien*
egotis*
elegan*
embarrass*
emotion
emotional
emotions
empt*
encourag*
enemie*
enemy*
energ*
engag*
enjoy*
enrag*
entertain*
enthus*
envie*

envious
envy*
evil*
excel*
excit*
excruciat*
exhaust*
fab
fabulous*
fail*
faith*
fake
fantastic*
fatal*
fatigu*
fault*
favor*
favour*
fear
feared
fearful*
fearing
fearless*
fears
feroc*
festiv*
feud*
fiery
fiesta*
fight*
fine
fired
flatter*
flawless*
flexib*
flirt*
flunk*
foe*
fond
fondly
fondness
fool*
forbid*
forgave
forgiv*
fought

fought	grace	heartless*	importan*
frantic*	graced	heartwarm*	impress*
freak*	graceful*	heaven*	improve*
free	graces	heh*	improving
freeb*	graci*	hell	inadequa*
freed*	grand	hellish	incentive*
freeing	grande*	helper*	indecis*
freely	gratef*	helpful*	ineffect*
freeness	grati*	helping	inferior*
freer	grave*	helpless*	inhib*
frees*	great	helps	innocen*
friend*	greed*	helps	insecur*
fright*	grief	hero*	insincer*
frustrat*	griev*	hesita*	inspir*
fuck	grim*	hilarious	insult*
fucked*	grin	hit	intell*
fucker*	grinn*	hoho*	interest*
fuckin*	grins	homesick*	interrup*
fucks	gross*	honest*	intimidat*
fume*	grouch*	honor*	invigor*
fuming	grr*	honour*	irrational*
fun	guilt*	hope	irrita*
funn*	ha	hoped	isolat*
furious*	haha*	hopeful	jaded
fury	handsom*	hopefully	jealous*
geek*	happi*	hopefulness	jerk
genero*	happy	hopeless*	jerked
gentle	harass*	hopes	jerks
gentler	harm	hoping	joke*
gentlest	harmed	horr*	joking
gently	harmful*	hostil*	joll*
giggl*	harming	hug	joy*
giver*	harmless*	hugg*	keen*
giving	harmon*	hugs	kidding
glad	harms	humiliat*	kill*
gladly	hate	humor*	kindly
glamor*	hated	humour*	kindn*
glamour*	hateful*	hurra*	kiss*
gloom*	hater*	hurt*	laidback
glori*	hates	ideal*	lame*
glory	hating	idiot*	laugh*
goddam*	hatred	ignor*	lazie*
good	hazy	immoral*	lazy
goodness	heartbreak*	impatien*	liabilit*
gorgeous*	heartbroke*	impersonal	liar*
gossip*	heartfelt	impolite*	libert*

lied	merr*	optimal*	precious*
lies	mess	optimi*	prejudic*
likeab*	messy	original	pressur*
liked	miser*	outgoing	prettie*
likes	miss	outrag*	pretty
liking	missed	overwhelm*	prick*
livel*	misses	pain	pride
lmao	missing	pained	privileg*
lol	mistak*	painf*	prize*
lone*	mock	paining	problem*
longing*	mocked	painl*	profit*
lose	mocker*	pains	promis*
loser*	mocking	palatabl*	protest
loses	mocks	panic*	protested
losing	molest*	paradise	protesting
loss*	mooch*	paranoi*	proud*
lost	mood	partie*	puk*
lous*	moodi*	party*	punish*
love	moods	passion*	radian*
loved	moody	pathetic*	rage*
loved	moron*	peace*	raging
lovely	mourn*	peculiar*	rancid*
lover*	murder*	perfect*	rape*
loves	nag*	personal	raping
loves	nast*	perver*	rapist*
loving*	neat*	pessimis*	readiness
low*	needy	petrif*	ready
loyal*	neglect*	pettie*	reassur*
luck	nerd*	petty*	rebel*
lucked	nervous*	phobi*	reek*
lucki*	neurotic*	piss*	regret*
luckless*	nice*	piti*	reject*
lucks	numb*	pity*	relax*
lucky	nurtur*	play	relief
ludicrous*	obnoxious*	played	reliev*
lying	obsess*	playful*	reluctan*
mad	offence*	playing	remorse*
maddening	offend*	plays	repress*
madder	offens*	pleasant*	resent*
maddest	ok	please*	resign*
madly	okay	pleasing	resolv*
magnific*	okays	pleasur*	respect
maniac*	oks	poison*	restless*
masochis*	openminded*	popular*	revenge*
melanchol*	openness	positiv*	revigor*
merit*	opport*	prais*	reward*

rich*	sicken*	stupid*	tensing
ridicul*	sigh	stutter*	tension*
rigid*	sighed	submissive*	terribl*
risk*	sighing	succeed*	terrific*
rofl	sighs	success*	terrified
romanc*	silli*	suck	terrifies
romantic*	silly	sucked	terrify
rotten	sin	sucker*	terrifying
rude*	sincer*	sucks	terror*
ruin*	sinister	sucky	thank
sad	sins	suffer	thanked
sadde*	skeptic*	suffered	thankf*
sadly	slut*	sufferer*	thanks
sadness	smart*	suffering	thief
safe*	smil*	suffers	thieve*
sarcas*	smother*	sunnier	thoughtful*
satisf*	smug*	sunniest	threat*
savage*	snob*	sunny	thrill*
save	sob	sunshin*	ticked
scare*	sobbed	super	timid*
scaring	sobbing	superior*	toleran*
scary	sobs	support	tortur*
sceptic*	sociab*	supported	tough*
scream*	solemn*	supporter*	traged*
screw*	sorrow*	supporting	tragic*
scrumptious*	sorry	supportive*	tranquil*
secur*	soulmate*	supports	trauma*
selfish*	special	suprem*	treasur*
sentimental*	spite*	sure*	treat
serious	splend*	surpris*	trembl*
seriously	stammer*	suspicio*	trick*
seriousness	stank	sweet	trite
severe*	startl*	sweetheart*	triumph*
shake*	steal*	sweetie*	trivi*
shaki*	stench*	sweetly	troubl*
shaky	stink*	sweetness*	trueness
shame*	strain*	sweets	truer
share	strange	talent*	truest
shared	strength*	tantrum*	truly
shared	stress*	tears	trust*
shares	strong*	teas*	truth*
sharing	struggl*	tehe	turmoil
shit*	stubborn*	temper	ugh
shock*	stunk	tempers	ugl*
shook	stunned	tender*	unattractive
shy*	stuns	tense*	uncertain*

138

uncomfortabl*	vain	warfare*	wins
uncontrol*	valuabl*	warm*	wisdom
uneas*	value	warred	wise*
unfortunate*	valued	warring	witch
unfriendly	values	wars	woe*
ungrateful*	valuing	weak*	won
unhapp*	vanity	wealth*	wonderf*
unimportant	vicious*	weapon*	worr*
unimpress*	victim*	weep*	worse*
unkind	vigor*	weird*	worship*
unlov*	vigour*	welcom*	worst
unpleasant	vile	well	worthless*
unprotected	villain*	wept	worthwhile
unsavo*	violat*	whine*	wow*
unsuccessful*	violent*	whining	wrong*
unsure*	virtue*	whore*	yay
unwelcom*	virtuo*	wicked*	yays
upset*	vital*	willing	yearn*
uptight*	vulnerab*	wimp*	
useful*	vulture*	win	
useless*	war	winn*	

Positive emotion word sub-category

accept	aok	bright*	comfort*
accepta*	appreciat*	brillian*	commitment*
accepted	assur*	calm*	compassion*
accepting	attachment*	care	compliment*
accepts	attract*	cared	confidence
active*	award*	carefree	confident
admir*	awesome	careful*	confidently
ador*	beaut*	cares	considerate
advantag*	beloved	caring	contented*
adventur*	benefic*	casual	contentment
affection*	benefit	casually	convinc*
agree	benefits	certain*	cool
agreeab*	benefitt*	challeng*	courag*
agreed	benevolen*	champ*	create*
agreeing	benign*	charit*	creati*
agreement*	best	charm*	credit*
agrees	better	cheer*	cute*
alright*	bless*	cherish*	cutie*
amaz*	bold*	chuckl*	daring
amor*	bonus*	clever*	darlin*
amus*	brave*	comed*	dear*

definite
definitely
delectabl*
delicate*
delicious*
deligh*
determina*
determined
devot*
digni*
divin*
dynam*
eager*
ease*
easie*
easily
easiness
easing
easy*
ecsta*
efficien*
elegan*
encourag*
energ*
engag*
enjoy*
entertain*
enthus*
excel*
excit*
fab
fabulous*
faith*
fantastic*
favor*
favour*
fearless*
festiv*
fiesta*
fine
flatter*
flawless*
flexib*
flirt*
fond
fondly

fondness
forgave
forgiv*
free
freeb*
freed*
freeing
freely
freeness
freer
frees*
friend*
fun
funn*
genero*
gentle
gentler
gentlest
gently
giggl*
giver*
giving
glad
gladly
glamor*
glamour*
glori*
glory
good
goodness
gorgeous*
grace
graced
graceful*
graces
graci*
grand
grande*
gratef*
grati*
great
grin
grinn*
grins
ha
haha*

handsom*
happi*
happy
harmless*
harmon*
heartfelt
heartwarm*
heaven*
heh*
helper*
helpful*
helping
helps
hero*
hilarious
hoho*
honest*
honor*
honour*
hope
hoped
hopeful
hopefully
hopefulness
hopes
hoping
hug
hugg*
hugs
humor*
humour*
hurra*
ideal*
importan*
impress*
improve*
improving
incentive*
innocen*
inspir*
intell*
interest*
invigor*
joke*
joking
joll*

joy*
keen*
kidding
kindly
kindn*
kiss*
laidback
laugh*
libert*
likeab*
liked
likes
liking
livel*
lmao
lol
love
loved
lovely
lover*
loves
loving*
loyal*
luck
lucked
lucki*
lucks
lucky
madly
magnific*
merit*
merr*
neat*
nice*
nurtur*
ok
okay
okays
oks
openminded*
openness
opport*
optimal*
optimi*
original
outgoing

painl*	reliev*	sunshin*	truest
palatabl*	resolv*	super	truly
paradise	respect	superior*	trust*
partie*	revigor*	support	truth*
party*	reward*	supported	useful*
passion*	rich*	supporter*	valuabl*
peace*	rofl	supporting	value
perfect*	romanc*	supportive*	valued
play	romantic*	supports	values
played	safe*	suprem*	valuing
playful*	satisf*	sure*	vigor*
playing	save	surpris*	vigour*
plays	scrumptious*	sweet	virtue*
pleasant*	secur*	sweetheart*	virtuo*
please*	sentimental*	sweetie*	vital*
pleasing	share	sweetly	warm*
pleasur*	shared	sweetness*	wealth*
popular*	shares	sweets	welcom*
positiv*	sharing	talent*	well
prais*	silli*	tehe	well
precious*	silly	tender*	win
prettie*	sincer*	terrific*	winn*
pretty	smart*	thank	wins
pride	smil*	thanked	wisdom
privileg*	sociab*	thankf*	wise*
prize*	soulmate*	thanks	won
profit*	special	thoughtful*	wonderf*
promis*	splend*	thrill*	worship*
proud*	strength*	toleran*	worthwhile
radian*	strong*	tranquil*	wow*
readiness	succeed*	treasur*	yay
ready	success*	treat	yays
reassur*	sunnier	triumph*	
relax*	sunniest	trueness	
relief	sunny	truer	

Negative emotion word sub-category

abandon*	aggravat*	anger*	appall*
abuse*	aggress*	angr*	apprehens*
abusi*	agitat*	anguish*	argh*
ache*	agoniz*	annoy*	argu*
aching	agony	antagoni*	arrogan*
advers*	alarm*	anxi*	asham*
afraid	alone	apath*	assault*

141

asshole*	decay*	embarrass*	gloom*
attack*	defeat*	emotional	goddam*
aversi*	defect*	empt*	gossip*
avoid*	defenc*	enemie*	grave*
awful	defens*	enemy*	greed*
awkward*	degrad*	enrag*	grief
bad	depress*	envie*	griev*
bashful*	depriv*	envious	grim*
bastard*	despair*	envy*	gross*
battl*	desperat*	evil*	grouch*
beaten	despis*	excruciat*	grr*
bitch*	destroy*	exhaust*	guilt*
bitter*	destruct*	fail*	harass*
blam*	devastat*	fake	harm
bore*	devil*	fatal*	harmed
boring	difficult*	fatigu*	harmful*
bother*	disadvantage*	fault*	harming
broke	disagree*	fear	harms
brutal*	disappoint*	feared	hate
burden*	disaster*	fearful*	hated
careless*	discomfort*	fearing	hateful*
cheat*	discourag*	fears	hater*
complain*	disgust*	feroc*	hates
confront*	dishearten*	feud*	hating
confus*	disillusion*	fiery	hatred
contempt*	dislike	fight*	heartbreak*
contradic*	disliked	fired	heartbroke*
crap	dislikes	flunk*	heartless*
crappy	disliking	foe*	hell
craz*	dismay*	fool*	hellish
cried	dissatisf*	forbid*	helpless*
cries	distract*	fought	hesita*
critical	distraught	frantic*	hit
critici*	distress*	freak*	homesick*
crude*	distrust*	fright*	hopeless*
cruel*	disturb*	frustrat*	horr*
crushed	domina*	fuck	hostil*
cry	doom*	fucked*	humiliat*
crying	dork*	fucker*	hurt*
cunt*	doubt*	fuckin*	idiot*
cut	dread*	fucks	ignor*
cynic	dull*	fume*	immoral*
damag*	dumb*	fuming	impatien*
damn*	dump*	furious*	impersonal
danger*	dwell*	fury	impolite*
daze*	egotis*	geek*	inadequa*

142

indecis*	messy	pettie*	scaring
ineffect*	miser*	petty*	scary
inferior*	miss	phobi*	sceptic*
inhib*	missed	piss*	scream*
insecur*	misses	piti*	screw*
insincer*	missing	pity*	selfish*
insult*	mistak*	poison*	serious
interrup*	mock	prejudic*	seriously
intimidat*	mocked	pressur*	seriousness
irrational*	mocker*	prick*	severe*
irrita*	mocking	problem*	shake*
isolat*	mocks	protest	shaki*
jaded	molest*	protested	shaky
jealous*	mooch*	protesting	shame*
jerk	moodi*	puk*	shit*
jerked	moody	punish*	shock*
jerks	moron*	rage*	shook
kill*	mourn*	raging	shy*
lame*	murder*	rancid*	sicken*
lazie*	nag*	rape*	sin
lazy	nast*	raping	sinister
liabilit*	needy	rapist*	sins
liar*	neglect*	rebel*	skeptic*
lied	nerd*	reek*	slut*
lies	nervous*	regret*	smother*
lone*	neurotic*	reject*	smug*
longing*	numb*	reluctan*	snob*
lose	obnoxious*	remorse*	sob
loser*	obsess*	repress*	sobbed
loses	offence*	resent*	sobbing
losing	offend*	resign*	sobs
loss*	offens*	restless*	solemn*
lost	outrag*	revenge*	sorrow*
lous*	overwhelm*	ridicul*	sorry
low*	pain	rigid*	spite*
luckless*	pained	risk*	stammer*
ludicrous*	painf*	rotten	stank
lying	paining	rude*	startl*
mad	pains	ruin*	steal*
maddening	panic*	sad	stench*
madder	paranoi*	sadde*	stink*
maddest	pathetic*	sadly	strain*
maniac*	peculiar*	sadness	strange
masochis*	perver*	sarcas*	stress*
melanchol*	pessimis*	savage*	struggl*
mess	petrif*	scare*	stubborn*

stunk	terrified	uncontrol*	violent*
stunned	terrifies	uneas*	vulnerab*
stuns	terrify	unfortunate*	vulture*
stupid*	terrifying	unfriendly	war
stutter*	terror*	ungrateful*	warfare*
submissive*	thief	unhapp*	warred
suck	thieve*	unimportant	warring
sucked	threat*	unimpress*	wars
sucker*	ticked	unkind	weak*
sucks	timid*	unlov*	weapon*
sucky	tortur*	unpleasant	weep*
suffer	tough*	unprotected	weird*
suffered	traged*	unsavo*	wept
sufferer*	tragic*	unsuccessful*	whine*
suffering	trauma*	unsure*	whining
suffers	trembl*	unwelcom*	whore*
suspicio*	trick*	upset*	wicked*
tantrum*	trite	uptight*	wimp*
tears	trivi*	useless*	witch
teas*	troubl*	vain	woe*
temper	turmoil	vanity	worr*
tempers	ugh	vicious*	worse*
tense*	ugl*	victim*	worst
tensing	unattractive	vile	worthless*
tension*	uncertain*	villain*	wrong*
terribl*	uncomfortabl*	violat*	yearn*

Anxiety word sub-category

afraid	disturb*	humiliat*	pressur*
alarm*	doubt*	impatien*	reluctan*
anguish*	dread*	inadequa*	repress*
anxi*	dwell*	indecis*	restless*
apprehens*	embarrass*	inhib*	rigid*
asham*	emotional	insecur*	risk*
aversi*	fear	irrational*	scare*
avoid*	feared	irrita*	scaring
awkward*	fearful*	miser*	scary
confus*	fearing	nervous*	shake*
craz*	fears	neurotic*	shaki*
desperat*	frantic*	obsess*	shaky
discomfort*	fright*	overwhelm*	shame*
distract*	guilt*	panic*	shook
distraught	hesita*	petrif*	shy*
distress*	horr*	phobi*	sicken*

startl*	tense*	terror*	uneas*
strain*	tensing	timid*	unsure*
stress*	tension*	trembl*	upset*
struggl*	terrified	turmoil	uptight*
stunned	terrifies	uncertain*	vulnerab*
stuns	terrify	uncomfortabl*	worr*
suspicio*	terrifying	uncontrol*	

Anger word sub-category

abuse*	cynic	fury	maddening
abusi*	damn*	goddam*	madder
aggravat*	danger*	greed*	maddest
aggress*	defenc*	grouch*	maniac*
agitat*	defens*	grr*	mock
anger*	despis*	harass*	mocked
angr*	destroy*	hate	mocker*
annoy*	destruct*	hated	mocking
antagoni*	disgust*	hateful*	mocks
argh*	distrust*	hater*	molest*
argu*	domina*	hates	moron*
arrogan*	dumb*	hating	murder*
assault*	dump*	hatred	nag*
asshole*	enemie*	heartless*	nast*
attack*	enemy*	hell	obnoxious*
bastard*	enrag*	hellish	offence*
battl*	envie*	hit	offend*
beaten	envious	hostil*	offens*
bitch*	envy*	humiliat*	outrag*
bitter*	evil*	idiot*	paranoi*
blam*	feroc*	insult*	pettie*
bother*	feud*	interrup*	petty*
brutal*	fiery	intimidat*	piss*
cheat*	fight*	jealous*	poison*
confront*	foe*	jerk	prejudic*
contempt*	fought	jerked	prick*
contradic*	frustrat*	jerks	protest
crap	fuck	kill*	protested
crappy	fucked*	liar*	protesting
critical	fucker*	lied	punish*
critici*	fuckin*	lies	rage*
crude*	fucks	lous*	raging
cruel*	fume*	ludicrous*	rape*
cunt*	fuming	lying	raping
cut	furious*	mad	rapist*

rebel*	smother*	temper	violat*
resent*	snob*	tempers	violent*
revenge*	spite*	terrify	war
ridicul*	stubborn*	threat*	warfare*
rude*	stupid*	ticked	warred
sarcas*	suck	tortur*	warring
savage*	sucked	trick*	wars
sceptic*	sucker*	ugl*	weapon*
screw*	sucks	vicious*	wicked*
shit*	sucky	victim*	
sinister	tantrum*	vile	
skeptic*	teas*	villain*	

Sadness word sub-category

abandon*	empt*	lost	sobbing
ache*	fail*	low*	sobs
aching	fatigu*	melanchol*	solemn*
agoniz*	flunk*	miser*	sorrow*
agony	gloom*	miss	suffer
alone	grave*	missed	suffered
broke	grief	misses	sufferer*
cried	griev*	missing	suffering
cries	grim*	mourn*	suffers
crushed	heartbreak*	neglect*	tears
cry	heartbroke*	overwhelm*	traged*
crying	helpless*	pathetic*	tragic*
damag*	homesick*	pessimis*	unhapp*
defeat*	hopeless*	piti*	unimportant
depress*	hurt*	pity*	unsuccessful*
depriv*	inadequa*	regret*	useless*
despair*	inferior*	reject*	weep*
devastat*	isolat*	remorse*	wept
disadvantage*	lame*	resign*	whine*
disappoint*	lone*	ruin*	whining
discourag*	longing*	sad	woe*
dishearten*	lose	sadde*	worthless*
disillusion*	loser*	sadly	yearn*
dissatisf*	loses	sadness	
doom*	losing	sob	
dull*	loss*	sobbed	

Verbs dictionary

accepted	cared	explains	havent
admit	cares	fed	haven't
admits	carried	feel	having
admitted	carries	feels	hear
affected	carry	felt	heard
aint	caught	fled	hears
ain't	changed	flew	hed
am	come	follow	he'd
appear	comes	followed	held
appeared	could	follows	he'll
appears	couldnt	forgot*	helped
are	couldn't	fought	helps
arent	couldve	found	heres
aren't	could've	fuck	here's
arrive	cried	fucked*	hes
arrived	depended	fucks	he's
arrives	depends	gave	hope
ask	describe	get	hoped
asked	described	gets	hopes
asks	describes	give	hows
ate	did	given	how's
be	didnt	gives	id
became	didn't	go	i'd
become	died	goes	i'll
becomes	dies	gone	im
becoming	dislike	gonna	i'm
been	disliked	got	i'm
began	dislikes	gotta	is
begin	do	gotten	isnt
begins	does	guess	isn't
being	doesnt	guessed	itd
believe	doesn't	guesses	it'd
believed	doing	had	itll
believes	done	hadnt	it'll
bought	dont	hadn't	it's
bring	don't	happen	ive
brings	drank	happened	i've
brought	driven	happens	i've
called	drove	has	keep
came	eaten	hasnt	keeps
can	emailed	hasn't	kept
cannot	ended	hate	knew
cant	entered	hated	know
can't	explain	hates	knows
care	explained	have	let

lets	owe	sucks	turned
let's	owed	suffered	turns
lied	owes	support	understand
liked	paid	supported	understands
listen	played	supports	understood
listened	ran	suppose	use
listens	said	supposed	used
lived	sat	supposes	uses
look	saw	take	using
looked	see	taken	viewed
looks	seem	takes	wait
lost	seemed	taking	waited
love	seems	talked	waits
loved	seen	taught	walked
loves	sees	tend	want
made	sensed	tended	wanted
make	sent	tends	wants
makes	shall	thank	was
may	shant	thanked	wasnt
mean	shan't	thanks	wasn't
means	shared	thatd	we'd
meant	she'd	that'd	we'll
met	she'll	thatll	went
might	shes	that'll	were
mightve	she's	thats	we're
might've	should	that's	weren't
miss	shouldnt	theres	weve
missed	shouldn't	there's	we've
misses	should'nt	theyd	whats
moved	shouldve	they'd	what's
must	should've	theyll	wheres
mustnt	showed	they'll	where's
mustn't	slept	theyre	whod
must'nt	sold	they're	who'd
mustve	spent	theyve	wholl
must've	spoke*	they've	who'll
need	start	think	whos
needed	started	thinks	who's
needs	starts	thought	will
ought	stayed	threw	wish
oughta	stood	told	wished
oughtnt	stopped	took	wishes
oughtn't	stuck	tried	woke
ought'nt	studied	tries	woken
oughtve	suck	try	won
ought've	sucked	turn	wonder

148

wondered	would	wrote	youre
wont	wouldnt	wrote	you're
won't	wouldn't	youd	youve
wore	wouldve	you'd	you've
worked	would've	youll	
worn	written	you'll	

Biological word dictionary

abdomen*	bake*	bulimi*	congest*
abortion*	baking	burp*	constipat*
abs	bald	butt	contag*
ache*	bandage*	butts	cook*
aching	bandaid	butt's	cornea*
acne	bar	caf*	coronar*
addict*	bars	cancer*	cough*
advil	beer*	candie*	cramp*
aids	bellies	candy	crap
alcohol*	belly	cardia*	crotch
alive	bi	cardio*	cuddl*
allerg*	bicep*	checkup*	cyst*
amput*	binge*	cheek*	deaf*
anal	binging	chest*	decongest*
ankle*	bipolar	chew*	dentist*
anorexi*	bladder*	chills	derma*
antacid*	bleed*	chiropract*	dessert*
antidepressant*	blind*	chlamydia	detox*
anus*	blood	chok*	diabet*
appendic*	bloody	cholester*	diagnos*
appendix	bodi*	chow*	diarr*
appeti*	body*	chronic*	dick
arch	boil*	cigar*	dicks
arm	bone	clinic*	diet*
armpit*	boner*	clothes	digest*
arms*	bones	cock	dine
arous*	bony	cocks*	dined
arse	boob*	cocktail*	diner
arses	booz*	codeine	diners
arter*	bowel*	coffee*	dines
arthr*	brain*	coke*	dining
asleep	bread	colon	dinner*
aspirin*	breakfast*	colono*	disease*
ass	breast*	colons	dish
asses	breath*	coma*	dishes
asthma*	bronchi*	condom	dizz*
ate	brunch*	condoms	doctor*

dosage
dose*
dosing
dr
drank
drink*
drool*
drows*
drs
drug*
drunk*
dx
dyke*
ear
ears
eat
eaten
eating
eats
egg*
elbow*
emphysem*
enema*
erectile
erection*
erotic*
espresso*
estrogen*
exercis*
exhaust*
eye*
face
faces
facial*
faint*
farsighted
fat
fatigu*
fats
fatt*
fed
feed
feeder*
feeding*
feeds
feet

fever*
finger*
flesh*
flu
food*
foot
forearm*
forehead*
foreplay
fries
fruit*
fry*
fuck
fucked*
fucker*
fuckin*
fucks
gay
gays
genital*
gland*
glaucoma
glutton*
gobble*
gobbling
gonorrhea
gonorrhoea
goosebump*
grocer*
gulp*
gums
gut
guts
gynaecolog*
gynecolog*
gyno*
hair*
hallucinat*
hamstring*
hand
hands
hangover*
head
headache*
heads
heal

healed
healer*
healing
heals
health*
heart
heartburn*
hearts
heel*
helpings
hemor*
herpes
hiccup*
hip
hips
hiv
ho
homo
homos
homosexual*
hormone*
hornie*
horny
hospital*
hug
hugg*
hugs
hump*
hunger*
hungover
hungr*
hyperten*
hypotherm*
ibuprofen
icu
ill
illness*
immun*
incest*
indigestion
infect*
inflam*
ingest*
injur*
insomnia*
insulin

intestin*
intox*
itch*
iv
jaw*
jissom
jizz
joints
kidney*
kiss*
kitchen*
knee*
knuckle*
leg
legs*
lesbian*
leuke*
libid*
life
lip
lips*
liquor*
liver*
living
love
loved
lover*
loves
lozenge*
lump
lunch*
lung*
lust*
lymph*
makeout*
mammogram
manicdep*
meal*
medic*
migrain*
milk*
miscar*
mono
mouth*
mri
mucous*

muscle*
muscular
myopi*
naked
nasal
nause*
nearsighted
neck
nerve*
neural*
neurolog*
neuron*
nipple*
nose*
nostril*
nude*
nudi*
numb*
nurse*
nutrition*
obes*
ocd
optometr*
orgasm*
orgies
orgy
orthodon*
orthoped*
ovar*
overate
overeat*
overweight
pain
pained
painf*
paining
painl*
pains
palm
palms
pap
paraly*
passion*
pasta*
patholog*
pediatr*

pee
pelvi*
penis*
perspir*
perver*
pharmac*
phobi*
physical*
physician*
pill
pills
pimple*
piss*
pizza*
pms
podiatr*
poison*
poop*
porn*
pregnan*
prescri*
prick*
prognos*
prostat*
prostitu*
prozac
prude
prudes
prudish*
pubic
puk*
pulse
puss
pussies
pussy*
queas*
queer*
rape*
raping
rapist*
rash*
rehab*
restau*
retina*
rib
ribs

ritalin
rx
salad*
saliv*
sandwich*
scab*
scalp
schizophren*
scrape*
screw*
seduc*
seizure*
sensation
sensations
servings
sex*
shirt*
shit*
shoe*
shoulder*
sick
sickday*
sicker
sickest
sickleave*
sickly
sickness*
sinus*
skelet*
skin
skin'*
skinni*
skinny*
skull
sleep*
slender*
slept
slut*
smok*
snack*
soda*
sore*
spat
spinal
spine
spit

spits
spitting
starve*
starving
std*
stiff*
stomach*
strept*
stroke*
stud
stuffed
sugar*
sunburn*
supper*
surgeon*
surger*
swallow*
sweat*
swelling
swollen
symptom*
syndrome*
syphili*
tast*
tea
teeth*
tender*
tendon
tendoni*
tendons
testosterone*
therap*
thermometer*
thigh*
thirst*
throat*
throb*
thyroid*
tingl*
tire*
tiring
tit
tits
titties
titty
toe

toenail*	vagina*	warts	whore*
toes	vd	wash	wine
tongue*	veget*	water	wines
tonsils	veggie*	weak*	withdrawal
tooth*	vein*	wear	womb*
tox*	vertigo	weary	wound*
tricep*	viagra	weigh	wrist*
tumo*	vicodin	weighed	xanax
twitch*	virgin*	weighing*	xray*
tylenol	vitamin*	weighs	yawn*
ulcer*	vomit*	weight	zit
unhealth*	waist*	wheez*	zits
urin*	wake	whiskey*	zoloft
uter*	wart	whisky*	

Body word sub-category

abdomen*	bony	face	horny
abs	boob*	faces	intestin*
anal	bowel*	facial*	itch*
ankle*	brain*	fat	jaw*
anus*	breast*	fatt*	joints
appendix	breath*	feet	kidney*
arch	butt	finger*	knee*
arm	butts	flesh*	knuckle*
armpit*	butt's	foot	leg
arms*	cheek*	forearm*	legs*
arous*	chest*	forehead*	lip
arse	clothes	genital*	lips*
arses	cock	goosebump*	liver*
arter*	cocks*	gums	lung*
asleep	colon	gut	mouth*
ass	colons	guts	mucous*
asses	cornea*	hair*	muscle*
bald	crap	hamstring*	muscular
bellies	crotch	hand	naked
belly	dick	hands	nasal
bicep*	dicks	head	neck
bladder*	drool*	heads	nerve*
blood	ear	heart	neural*
bloody	ears	hearts	neuron*
bodi*	elbow*	heel*	nipple*
body*	erectile	hip	nose*
bone	erection*	hips	nostril*
bones	eye*	hornie*	nude*

nudi*	rib	spat	toe
orgasm*	ribs	spinal	toenail*
ovar*	saliv*	spine	toes
palm	scalp	spit	tongue*
palms	sensation	spits	tonsils
pee	sensations	spitting	tooth*
pelvi*	shirt*	stomach*	tricep*
penis*	shit*	sweat*	urin*
perspir*	shoe*	teeth*	uter*
piss*	shoulder*	tendon	vagina*
poop*	skelet*	tendons	vein*
prick*	skin	thigh*	waist*
prostat*	skin'*	thirst*	wake
pulse	skinni*	throat*	wear
pussies	skull	tit	womb*
pussy*	sleep*	tits	wrist*
rash*	slender*	titties	
retina*	slept	titty	

Motion word dictionary

act	carried	departs	fly
action*	carrier*	departure*	flying
advanc*	carries	disappear*	follow
appear	carry	drift*	followed
appeared	carrying	drive	following
appearing	catch	driven	follows
appears	caught	drives	forward*
approach*	change	driving	front
arrival*	changed	drove	go
arrive	changes	enter	goes
arrived	changing	entered	going
arrives	climb*	entering	gone
arriving	closely	enters	grew
attend	closes	explor*	grow
attended	closing	fall	growing
attending	come	fallen	grown
attends	comes	falling	growth
behavio*	coming	falls	hang
brief*	cross*	fell	headed
bring	cruis*	fill*	heading
bringing	danc*	fled	hik*
brings	deliver*	flee*	increas*
brought	depart	flew	jog*
came	departed	flies	journey*
car	departing	flow*	jump*

lead*
leave
leaves
leaving
led
motion*
move
moved
movement*
mover*
moves
moving
pass
passed
passes
passing
pull*

push*
put
puts
putting
ran
receiv*
remov*
replace*
replacing
ridden
ride
rides
riding
rise*
rising
rode
run

runner*
running
runs
rush*
send*
sent
shake*
shook
slid
slide
slides
sliding
step
stepp*
steps
stopper*
swam

swim*
threw
throw*
took
transact*
transport*
travel*
trip
tripped
tripping
trips
visit*
walk
walked
walking
walks
went

Perceptual word dictionary

acid*
acrid*
aroma*
audibl*
audio*
beaut*
bitter*
black
blacke*
blackish*
blacks
blind*
blond*
blue*
boom*
bright*
brown*
brush*
butter*
candle*
caramel*
caress*
chocolate*
choir*
circle

citrus*
click*
cold*
cologne*
color*
colour*
column*
concert*
cool
cream
deaf*
delectabl*
delicious*
deoder*
drie*
drily
drool*
dry*
ear
ears
edge
edges
edging
experienc*
eye*

eying
feel
feeling*
feels
felt
fetid*
finger*
fire
fizz*
flavor*
flavour*
flexib*
fragil*
fragran*
freez*
froze*
fruit*
fuzz*
gaz*
glanc*
glow*
grab*
gray*
greas*
green*

grey*
grip
gripp*
grips
hair*
hand
handful*
hands
hard
harde*
harmon*
hear
heard
hearing
hears
heavie*
heavy*
honey
hot
hott*
hush*
image*
inaudibl*
inhal*
leather*

lick*	reddish*	shout*	sweets
light	redness	sight*	tang
limp*	reds	silen*	tangy
listen	reek*	silk*	tart
listened	ring	skin	tast*
listener*	ringing	skin'*	thick*
listening	rings	smell*	thin
listens	rotten	smooth*	thinn*
lit	rough*	sniff*	thunder*
look	round*	snort*	tight*
looked	rub	soft*	tongue*
looker*	rubbed	song*	touch*
looking	rubbing	sound*	triang*
looks	rubs	sour	unsavo*
loose*	saccharine	soure*	view
loud*	said	souri*	viewer*
mint*	saliv*	sours	viewing*
musi*	salt*	soury	views
nasal	sampl*	speak	vivid*
noise	sand	speaker*	voic*
noises	sands	speaking	waft*
noisy	sandy	speaks	warm*
nose*	sang	speech*	watch*
nostril*	savor*	spice	weight
odor*	savour*	spiced	weighted
odour*	saw	spices	weighting
oil*	say*	spicy	weightless*
orange*	scan	spoke*	weightlift*
palatabl*	scann*	squar*	weights
perfum*	scans	squeez*	wet
picture	scent*	stank	wetly
pink*	scratch*	stare*	whiff*
press	scream*	staring	whisper*
pressed	screen	stench*	white*
presser*	scrumptious*	stink*	whitish*
presses	see	stroke*	yell
pungen*	seeing	stroki*	yelled
purpl*	seen	stunk	yelling
quiet*	seer	sugar*	yellow*
rancid*	sees	sumptuous*	yells
rang	sharp*	sunli*	yum*
rectang*	shine	sunshin*	
red	shini*	sweet	
redde*	shiny	sweetness*	

Feeling word sub-category

brush*	froze*	press	soft*
caress*	fuzz*	pressed	squeez*
cold*	grab*	presser*	stroke*
cool	grip	presses	stroki*
drie*	gripp*	rough*	thick*
drily	grips	round*	thin
dry*	hair*	rub	thinn*
edge	hand	rubbed	tight*
edges	handful*	rubbing	touch*
edging	hands	rubs	warm*
feel	hard	sand	weight
feeling*	harde*	sands	weighted
feels	heavie*	sandy	weighting
felt	heavy*	scratch*	weightless*
finger*	hot	sharp*	weightlift*
fire	hott*	silk*	weights
flexib*	leather*	skin	wet
fragil*	limp*	skin'*	
freez*	loose*	smooth*	

Hearing word sub-category

audibl*	hears	quiet*	speak
audio*	hush*	rang	speaker*
boom*	inaudibl*	ring	speaking
choir*	listen	ringing	speaks
concert*	listened	rings	speech*
deaf*	listener*	said	spoke*
ear	listening	sang	thunder*
ears	listens	say*	voic*
fizz*	loud*	scream*	whisper*
harmon*	musi*	shout*	yell
hear	noise	silen*	yelled
heard	noises	song*	yelling
hearing	noisy	sound*	yells

Seeing word sub-category

beaut*	blacks	bright*	click*
black	blind*	brown*	color*
blacke*	blond*	candle*	colour*
blackish*	blue*	circle	column*

cream
eye*
eying
gaz*
glanc*
glow*
gray*
green*
grey*
image*
lit
look
looked
looker*

looking
looks
orange*
picture
pink*
purpl*
rectang*
red
redde*
reddish*
redness
reds
round*
saw

scan
scann*
scans
screen
see
seeing
seen
seer
sees
shine
shini*
shiny
sight*
squar*

stare*
staring
sunli*
sunshin*
triang*
view
viewer*
viewing*
views
vivid*
watch*
white*
whitish*
yellow*

Vita

Therese Verkerke Cash was born July 7, 1987, in New Haven, Connecticut, and is an American citizen. She graduated from Western Albemarle High School, Charlottesville, Virginia in 2005. She traveled and studied French in Grenoble, France and Dakar, Senegal for one year before going to college. She received her Bachelor of Arts in Psychology with Highest Distinction from the University of Virginia, Charlottesville, Virginia in 2010. As an undergraduate, she worked as a research assistant for Dr. Timothy Salthouse, Dr. David Grissmer, Dr. Timothy Wilson, and Dr. James Allen and served as a laboratory coordinator for Dr. Jonathan Haidt for two years. Her undergraduate thesis examining the effects of a mindfulness intervention on perspective-taking and relationship quality was awarded the John T. Harrison III Undergraduate Research Award. She entered the Clinical Psychology doctoral program at Virginia Commonwealth University in August 2011 and currently works as a graduate research assistant at the VCU Parkinson's and Movement Disorder Center. Mrs. Cash intends to pursue a career as a clinical research scientist engaged in the enhancement and investigation of emotion regulation, interpersonal functioning, and cognition in the context of mental and physical health.