Effects of Expressive Writing on Health and Psychology

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One of the basic assumptions of expressive writing research is that "the act of constructing stories is a natural human process that helps individuals to understand their experiences and themselves" (Pennebaker & Seagal, 1999, p. 1243). Learning the elements of storytelling is a critical developmental stage in early childhood and aids in forming a coherent emotional life (Pennebaker & Seagal, 1999). It can be very difficult to understand the causes and consequences of major life experiences, forcing continual thinking about the experience until it reaches some form of resolution in the mind. Major life events are often composed of many related events and experiences that complicate this search for resolution. For example, losing one's job will not only affect not only one's finances, but can also affect eating and sleeping habits, mood and attitudes, self-conceptions, and familial and social relationships. Such an event must be resolved so that effective coping can occur. Constructing stories is how individuals seek to understand their world and their experiences.

The process of storytelling allows individuals to organize events, giving them structure in the memory, and to integrate thoughts and feelings with the events, giving them meaning. This "packaging" of experience through storytelling into more concise narratives presumably makes the emotional impact of these events more easy controlled by the psyche. This technique for controlling the emotional impact of life events is particularly relevant when the events are disturbing for the individual and result in excessive and unhealthy ruminations. Narrative formation gives the events a sense of resolution, keeping unwanted, repetitive thoughts from persisting in conscious thought (Pennebaker & Seagal, 1999). If these negative ruminations or flashbacks of painful

events do continue over time, they can result in decreased psychological well-being and even depression (Koole, Smeets, van Knippenberg & Dijksterhuis, 1999).

Narrative formation is a fundamental part of any psychotherapy. People most often seek therapy when incessant negative ruminations about an event become too emotionally distressful (Pennebaker & Seagal, 1999). The objective of psychotherapy is to encourage the patient to disclose the negative experience to the therapist, thus facilitating the construction of a coherent narrative of the event. Although the methods of disclosure occur in a variety of different media depending on the therapy being used, the underlying principle that a narrative must be constructed remains the same. Traditional psychoanalysis uses speech to allow the client to tell his or her story. Poetry and writing therapies use writing a tool to disclose an event and shape it into a coherent narrative structure. Expressive arts therapies use different graphic arts to allow expression and find meaning in the client's life experiences through exploration of the unconscious. Music, dance, drama and play therapies all use different modes of expression. The common thread is that clients use a given medium or media to disclose the experiences that are troubling them. Of central importance is that the client must, together with the therapist, translate the emotional disclosure into language. This translation is part of the formation of a narrative that produces a simpler representation of the experience that is much easier for the mind to manage (Pennebaker & Seagal, 1999).

In this regard, expressive writing is more direct and less complicated than other forms of disclosure because the emotional and language components are inherent in performing the task. Recent experimental research has shown that using writing to express emotionally distressful events as coherent narratives can produce many beneficial

effects for both physical and mental health besides just effective coping. The research uses a model developed by Pennebaker (e.g. Pennebaker & Beall, 1986) to explore how emotional writing influences the human organism.

The Pennebaker Paradigm

Participants are told that they are required to write on an assigned writing topic for four consecutive days for 15 minutes each day. The only rule about the writing assignment was that the participants must write for the entire duration on each day continuously and without worrying about spelling, grammar, or sentence structure. Subjects were informed their writing would be confidential and anonymous. The participants were not informed of the true nature of the experiment, only that the experimenters were interested in learning more about writing. Subjects were then randomly assigned into either an experimental group or a control group.

"Those in the experimental group were asked to spend each session writing about one or more traumatic experiences in their lives. In the words of the experimenter:

> For the next four days, I would like for you to write about your very deepest thoughts and feelings about the most traumatic experience of your entire life. In your writing, I'd like you to really let go and explore your very deepest emotions and thoughts. You might tie your topic to your relationships with others, including parents, lovers, friends, or relatives, to your past, your present, or your future, or to who you have been, who you would like to be, or who you are now. You may write about the same general issues or experiences on all days of writing or on different traumas each day. All of your writing will be completely confidential." (Pennebaker & Seagal, 1999)

Those who were in the control group wrote essays about a trivial, nonemotional topic such as describing the room they were in for 15 minutes on each day of the study.

This expressive writing paradigm has given researchers a common methodological base from which to work. Other studies using this paradigm have varied

the number of sessions, the spacing between the sessions, and the duration of each session. Writing durations have ranged from 15 to 30 minutes. The spacing between sessions has ranged from writing on consecutive days to separating the writing sessions by one week. The number of sessions has varied from 1 to 5. Some evidence exists that longer the period over which the study elapses, the stronger the effects will be (Smyth, 1998), though experimental examination of this variable is needed. In a few experiments, talking has shown comparable effects to writing using this paradigm (see Pennebaker 1997; Pennebaker & Seagal, 1999). Even considering the variations of the writing paradigm, all have found significant mental and physical health benefits (e.g. Klein & Boals, 2001; Lepore, 1997; Richards, Beal, Seagal & Pennebaker, 2000).

Indeed, if nothing else, Pennebaker (1997) states that the writing paradigm demonstrates that individuals will readily disclose very personal experiences and feelings when given the opportunity. Although this disclosure can be quite painful for participants, the majority reported finding the experience extremely valuable and meaningful in their lives (Pennebaker, 1997; Pennebaker & Seagal, 1999). The paradigm is designed to allow individuals to disclose their deepest personal feelings about an event and shape that event through language into a coherent narrative. Unlike psychotherapy, however, the writing paradigm does not provide feedback to the participants; rather, they are on their own to explore their thoughts and emotions. Because expressive writing shows great potential as a disclosure therapy, experimental studies are needed to test the effects of expressive writing on a clinical group. If expressive writing proves to be effective in this case, writing may replace therapists or other medical interventions when an individual is suffering psychological distress.

The Effects of Expressive Writing

Since the 1980s, researchers have used the Pennebaker paradigm to explore the effects that expressive writing has on a variety of mental and physical health measures. These effects have been summarized is a variety of reviews (e.g. Pennebaker, 1997; Pennebaker & Seagal, 1999). One meta-analysis synthesizes data from many different writing experiments and finds significant effects in a variety of areas (Smyth, 1998). Significantly, Smyth (1998) found effects even after controlling for "experimenter effects" due to the heavy concentration of Pennebaker's work in this area.

Physical health measures have seen much experimental examination. Subjects' health has been shown to improve using expressive writing by measuring fewer reported health center visits, decreased self-reports of physical symptoms and improvements in upper respiratory illness (e.g. Pennebaker, Kiecolt-Glaser, & Glaser, 1988; Pennebaker & Beall, 1986; Greenberg, Wortman, & Stone, 1996). Physiological and immune functioning was shown to improve through increased functioning of T-helper lymphocytes (Petrie, Booth, & Pennebaker, 1998), improved antibody response to Epstein-Barr virus and to hepatitis B vaccinations (see Smyth, 1998). Expressive writing has also produced short-term effects on autonomic activity and muscular activity such as lowered heart rate. Health effects have demonstrated as much as one year after the writing manipulation (see Pennebaker, 1997).

Psychological health has also demonstrated improvements through expressive writing. Although Smyth (1998) has shown that distress increases in individuals while they are writing, this distress disappears over the long-term and actually significantly reduces below its pre-writing state. However, individuals in a highly distressed state, like

unemployed professionals, produced immediate improvements in mood by expressive writing (Spera, Buhrfeind & Pennebaker, 1994). Positive affect and happiness have increased through writing, while negative affect, sadness and anxiety have decreased (Greenberg, Wortman, & Stone, 1996; Paez, Velasco, & Gonzalez, 1999; Lepore, 1997; Pennebaker, Kiecolt-Glaser, & Glaser, 1988). People also exhibit better adaptive behaviours to new situations like coming to college (see Smyth, 1998).

Behavioural improvements have also been found. College students have demonstrated improvements in GPA (Klein & Boals, 2001), unemployed professionals have increased their chances of reemployment (Spera, Buhrfeind & Pennebaker, 1994), and university staff have lower rates of absenteeism after expressive writing (see Smyth, 1998). Interestingly, Smyth (1998) found that health-related behaviours, such as eating and sleeping habits, exercise and drug use did not have any significant change due to expressive writing.

Cognitive benefits of expressive writing are also beginning to be explored. Klein and Boals (2001) have demonstrated that expressive writing produces improvements in working memory. Thought generation and reaction time have shown improvements as well (see Smyth, 1998). The effects of expressive writing on cognition is minimal and this area requires further research.

The effects of expressive writing are multiple and diverse and the boundaries of these effects are often far-reaching. Expressive writing has been shown to benefit different populations like unemployed professionals (Spera, Buhrfeind & Pennebaker, 1994), maximum-security inmates (Richards et al., 2000), and college students (Klein & Boals, 2001). Similar effects have been found using different languages (e.g. Paez,

Velasco & Gonzalez, 1999). One study even shows that participants suffering from alexythimia (a dispositional deficit in self-disclosure) improved in mood after expressive writing, despite their natural difficulties in expressing their deepest thoughts and feelings (Paez et al., 1999). Pennebaker & Seagal (1999) claim that these effects have been found in all social classes and major racial/ethnic groups, citing examples in the US, Mexico, New Zealand, Belgium and the Netherlands. These examples hardly support this claim. These examples are all nations with strong Western cultural ties and the idea of social class is not clearly examined. Subjects in Asia and Africa are needed, especially considering the much larger percentage of population in these areas, though literacy may pose a problem in this. In general, more experimental exploration is needed to support this claim.

Smyth's (1998) meta-analysis produces some evidence that men may benefit more from expressive writing than women. He suggests that men may have lower prewriting levels of emotional expression than women and that their different coping mechanisms predispose them to benefit more than women from expressive writing (Smyth, 1998). Indeed, groups writing on undisclosed traumatic events have shown greater improvements over those that had previously disclosed the experience (Paez et al., 1999). The possibility of gender differences, however, needs further experimental inquiry (Pennebaker & Seagal, 1999). Some studies show that individuals that exhibit disordered cognitive processing (like posttraumatic stress disorder) or severe depression fail to show effects with expressive writing alone (Pennebaker & Seagal, 1999). Evidence seems to indicate that these individuals' thought processes are so disrupted that

they cannot form a coherent narrative of their trauma experiences without special training (Pennebaker & Seagal, 1999).

While effects have been found using a variety of different writing topics like coming to college (e.g. Klein & Boals, 2001) or getting laid off (Spera et al., 1994), there do seem to be some topic restrictions. In many cases, writing about a traumatic experience or at least a negative one produces greater effects (e.g. Klein & Boals, 2001) or is essential for the effect to occur (see Pennebaker, 1997). The topic of choice may also influence the outcome of the study. Writing topics must be directed towards the dependent measure or results can be misleading (see Pennebaker, 1997). Pennebaker and Seagal (1999) indicate one study where students demonstrated health benefits even when writing about an imaginary trauma rather than something they had experienced directly. This result puts an interesting spin on the ideas of narrative formation as a process for individuals to understand themselves and their environment.

How Does Expressive Writing Work?

Although there is no unifying theory that explains the underlying mechanisms that produce these effects, there are two general approaches that can do provide some indications as to how expressive writing actually works within the human organism.

Catharsis Theory

Researchers in expressive writing originally applied an approach that disclosure of emotional experiences was a kind of catharsis that released the individual from inhibitions. According to this theory, active inhibition involved in suppressing emotional thoughts is a form of physiological work, exhibiting itself in autonomic and central nervous system activity (Pennebaker, 1997). This inhibitory work is considered a long-

term low-level stressor. In turn, this continuing stress strains psychosomatic processes, increasing both mental and physical health problems related to stress (Pennebaker, 1997). Expressive writing, then, is a cathartic agent that relieves inhibitory stress through emotional disclosure. As Pennebaker (1997) points out, there has been no experimental evidence to illuminate the precise role inhibition plays in expressive writing. Smyth (1998) argues that while emotional expression is necessary to produce effects, it is not sufficient. Pennebaker and Seagal (1999) echo this point, stating that health gains require a translation of emotional experiences into language. This is consistent with what is understood about constructing narratives.

Cognitive Changes Theory

This theory proposes that "the act of converting emotions and images into words changes the way the person organizes and thinks about the trauma" (Pennebaker & Seagal, 1999). The distress caused by an experience is not just a result of the event itself, but also in all of the complexities that arise from the event. The act of writing serves to integrate thoughts and feelings with the event into a coherent narrative more easily. The story format simplifies complex experiences and the more it is told, it becomes more so. As the story shortens and simplifies the structure and meaning becomes more apparent, even as details are lost. Once this compact, coherent narrative has been created, it can be removed from conscious thought much more easily (Pennebaker & Seagal, 1999).

In order to test this theory, subjects' writing samples were examined to discover who benefited the most from expressive writing. Independent judges found that those who showed the best improvements were more "self-reflective, emotionally open, and thoughtful" (Pennebaker & Seagal, 1999). As Pennebaker (2002) points out, examining

words to understand individuals' mental and physical states dates back to Freud. However, due to poor interreliability among judges, a computer text analysis application was created called the Linguistic Inquiry and Word Count (LIWC) (Pennebaker, Francis & Booth, 2001). Revising and updating this programme, Pennebaker, Francis and Booth (2001) designed the LIWC2001. The programme works by finding the percentage of words in a text that fall into the 82 different judge-defined language categories (Pennebaker, Francis & Booth, 2001). Despite the large number of categories, only four were particularly relevant to this theory. Two categories were emotional, referring to the percentage of positive-emotion words (e.g. happy, laugh) and negative-emotion words (e.g. sad, angry). The other two categories were cognitive, referring to causal words (e.g. because, reason) and insight words (e.g. understand, realize). The cognitive word categories were chosen to examine how participants were thinking in their writing (Pennebaker & Seagal, 1999).

In examining writing samples from previous studies, two major findings were discovered (Pennebaker, Mayne & Francis, 1997). This analysis showed that writers who benefited most from expressive writing used many positive-emotion words, a moderate number of negative-emotion words and an increase in the use of both causal and insight words. Other studies have used the LIWC analysis and found the same results (e.g. Klein & Boals, 2001; Lepore, 1997). This offers promising evidence that narrative formation is key to achieving benefits from writing.

Conclusion

Expressive writing taps into the fundamental human process of storytelling to understand the world. There are several important elements in this narrative formation as

it applies to emotionally complex events in an individual's life. One is that uninhibited emotional expression is required. Second, a coherent narrative that organizes thoughts and feelings on an experience and gives it a concise meaning is required. A person must fully understand the causes and consequences of an event in addition to his or her emotional reactions to this in order to gain a sense of closure and move past the experience. Once this is done, a variety of effects are documented that can benefit the human organism mentally, physically and behaviourally. Although there is clearly something at work here, the exact mechanisms remain somewhat uncertain. It is possible that other cognitive changes are at work besides those that are examined by the LIWC that have not yet been discovered. More knowledge about the nature of inhibition in expressive writing would also be helpful in finding a more unified theory.

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Emotional Expression and Working Memory: Can Expressive Writing About An Imaginary Trauma Produce Working Memory Gains?

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The effect of emotional disclosure through expressive writing about real traumatic events on available working memory capacity has already been established. This study examined whether disclosing emotions generated by writing about a novel imaginative traumatic event would produce similar gains in working memory. Sixty-two first-year university students were randomly assigned to write about a real trauma, an imaginary trauma, or a trivial topic (time management). One and one half weeks following the writing condition, no significant effects were found. However, the imaginary trauma and real trauma writing groups did show more similarities with each other than with the control group. The results are discussed in terms of the previous findings of expressive writing on working memory.

Expressive writing such as diaries, personal letters and autobiographies that occur outside of the laboratory are one mechanism for the disclosure of deep personal feelings and emotions about stressful events. This distinction is key in a laboratory setting: writing must be about stressful events or traumas, not the mundanities of everyday living. However, writing is only one method that can be used to disclose one's feelings and emotions. Writing, as well as other mechanisms of disclosure are rooted in Freud's psychoanalytic theory.

Freud's psychoanalytic theory is based on the disclosure of an individual's deepest thoughts and feelings to gain insight into that individual's unconscious. Traditional psychoanalysis focuses on the verbal disclosure of a subject's feelings and emotions to a therapist, so language remains the main vehicle of emotional expression even though the mode of expression is different. Many other types of therapies have derived from Freud and C. G. Jung's psychoanalytic theory. Poetry therapies and expressive arts therapies use writing or graphic arts as a creative tool to express hidden

feelings and emotions in the unconscious. Other therapies use different media like music, drama and play to explore the unconscious and offer psychological benefits to the individual. What these therapies all have in common that patients are required to express their deepest thoughts and emotions, regardless of the medium of disclosure.

Pennebaker's extensive research in the area of written expression as a mode of disclosure has established him as an authority this field and provided a framework for further research in the area. Pennebaker devised an expressive writing paradigm (Smyth, 1998) to give researchers a common methodological base from which to scientifically test various beneficial effects of written disclosure on the human organism and examine the theoretical underpinnings that make it work. Pennebaker's expressive writing paradigm asks participants to write brief essays about traumatic life experiences while control participants write about trivial topics without any emotional valence. This model differs from traditional psychotherapies because it does not provide feedback to participants, instead requiring that they explore their thoughts and feelings independently. Despite slight variations in Pennebaker's model between studies, Smyth's (1998) research synthesis shows that the effects are consistent. This paradigm has given research in this field more empirical validity than it had previously by providing researchers with a consistent writing structure to measure the effects of written disclosure and allowing the synthesis of similar studies (e.g. Smyth, 1998).

The beneficial effects of expressive writing have been well established in many controlled studies. Using studies that follow Pennebaker's model, Smyth (1998) found several factors that might benefit from expressive writing. Expressive writing has been shown to produce better physical health, better physiological functioning, greater

psychological well-being, improvements in general functioning and improvements in cognitive functioning (Smyth, 1998). The effects on cognitive functioning are of particular interest to this study (e.g. Klein & Boals, 2001). Taken in conjunction with other studies in the field, Smyth's (1998) research synthesis provides substantive evidence that expressive writing produces a variety of beneficial effects in humans across various studies.

The majority of research in expressive writing has explored whether it produces any health benefits, likely because the first writing study involved this effect (Pennebaker & Beall, 1986). Reported health of subjects, measured by fewer health center visits, decreased self-reports of physical symptoms and improvements in upper respiratory illness, was found to improve through expressive writing (e.g. Pennebaker, Kiecolt-Glaser, & Glaser, 1988; Pennebaker & Beall, 1986; Greenberg, Wortman, & Stone, 1996). Subjects' physiological functioning also improved, increasing the functioning of T-helper lymphocytes (Petrie, Booth, & Pennebaker, 1998) and improving the body's immunological response to Epstein-Barr virus and hepatitis B vaccinations, among other health benefits as a result of expressive writing (see Smyth, 1998).

Psychological well-being and adjustment has also improved through expressive writing. Psychological well-being, often measured by increased positive affect and happiness while producing decreased negative affect and sadness (Greenberg, Wortman, & Stone, 1996; Paez, Velasco, & Gonzalez, 1999; Lepore, 1997; Pennebaker, Kiecolt-Glaser, & Glaser, 1988). Expressive writing generally produces better-adjusted people (e.g. Lepore, 1997). Smyth (1998) also showed that a person's general functioning, defined as reemployment (e.g. Spera, Buhrfeind, & Pennebaker, 1994), GPA (e.g. Klein

& Boals, 2001), absenteeism and school behaviour also improved through the use of expressive writing. However, Smyth (1998) found that health behaviours such as alcohol use, drug use (including cigarettes and caffeine), exercise, sleeping habits and eating habits were not significantly altered by expressive writing.

Previous research has placed less emphasis on any cognitive effects of expressive writing, yet some benefits have been discovered. Smyth's (1998) synthesis found an improvement in cognitive functioning, defined as increased thought generation and reaction time. However, Smyth (1998) included this study in his analysis of general functioning, indicating the lack of data of the effects on cognitive functioning. In conjunction with Klein & Boals' (2001) study in which expressive writing increased working memory capacity, some evidence does exist for positive effects of expressive writing on cognition. The purpose of this current study is to expand the research in this area.

Like other disclosure/confrontation therapies, expressive writing causes subjects to confront the stressful events that are present in their psyche, though theories as to what happens to produce the sought after beneficial effects have differed. Originally, expressive writing was viewed as a cathartic agent, reducing inhibitions due to not expressing the event (e.g. Pennebaker, Kiecolt-Glaser, & Glaser, 1988; also see Smyth, 1998). Active inhibition of feelings about a traumatic event produces stress over time and this stress causes negative effects (Pennebaker, 1997). This negative stress is released when patients release their inhibitions through disclosure, thus producing improvements. Smyth (1998) argues that while emotional disclosure is necessary, it is not sufficient. Current theories argue that if the confrontation (i.e. writing) is of a

sufficiently long duration, cognitive processing of the stressful event occurs (see Smyth, 1998). Cognitive processing presumably integrates the complex thoughts and feelings produced by a traumatic experience into a simplified and coherent narrative (Pennebaker & Seagal, 1999). Cognitive processing does not eliminate the event from memory, but does seem to put a more positive valence on it (e.g. Paez, Velasco & Gonzalez, 1999; Lepore, 1997). The "packaged" experience produced by reworking the memory in the mind to create a less stressful, more coherent narrative is easier to inhibit, thus producing less stress over time (Pennebaker & Seagal, 1999). These two theories together embody the psychological mechanisms that underlie the benefits of expressive writing mentioned above.

Klein and Boals (2001) have illuminated how expressive writing works even further by demonstrating that expressive writing actually reduced intrusive and avoidant thinking about the stressful event in subjects. They theorized that gains in working memory arose because expressive writing reduced intrusive and avoidant thinking about stressful events and, therefore, attentional resources that would ordinarily be wasted in this type of unfocussed thinking could be devoted to working memory. Klein and Boals (2001) found that subjects writing about negative emotional events did experience greater reduced intrusive and avoidant thinking than those who wrote about positive events or a trivial topic. These findings contradict an earlier study in which expressive writing did not affect the frequency of intrusive thoughts, but rather influenced the impact of these thoughts on depressive symptoms that indicate mood (Lepore, 1997). It is possible that reduced intrusive and avoidant thinking may be linked only to cognitive benefits.

The results of Klein and Boals' (2001) study are central to the current study. In this experiment, subjects that wrote about the stressful experience of coming to college as first-year students experienced gains in working memory, i.e. participants showed improved cognitive functioning while performing a mental task, while those who wrote about innocuous topics did not. At its simplest, the working memory system is comprised of two components working together. The short-term memory storage component consists of a limited number of items from long-term memory that are kept in a relatively high state of activation for the purpose of performing some mental task (Engle, Tuholski, Laughlin, & Conway, 1999). The central executive component consists of controlled, limited-capacity attention processes that maintain the hyperactivated state of those items in short-term memory as the focus of attention for completing the task at hand (Engle, Tuholski, Laughlin, & Conway, 1999). However, the working memory system is not an isolated one and many task-irrelevant distractors compete for attentional resources, reducing working memory capacity. As mentioned above, Klein and Boals (2001) argue that the working memory gains produced by expressive writing resulted from the reduced frequency of task-irrelevant distractors that compete for attentional resources. Presumably, writing about a traumatic experience (i.e. a potential distractor) "packages" the experience into a concise narrative that becomes easier to inhibit from drawing on attentional resources that are necessary for optimal functioning of the working memory system.

What is missing from Klein and Boals' study is any evidence that the stressful topic must be real. It is possible that subjects predicted the experimenters' expectations, writing about stressful experiences that did not happen to them containing strong fictional

emotional content. Writing emotionally, yet fictionally, might produce the same effects as writing about real stressful experiences following Pennebaker's model. One study by Greenberg, Wortman, and Stone (1996) has shown that expressive writing about a novel imaginary traumatic experience produces improvements in physical health and psychological well-being. The same effects might easily transfer to improvements in cognitive functioning using a similar procedure. In summary, expressive writing about real-life traumatic events does influence cognitive functioning, particularly improvements in working memory capacity; yet, the same gains may be produced by expressive writing about an imaginary traumatic experiences. The ultimate question this study seeks to answer is can expressive writing about an imaginary trauma produce the same benefits in working memory as writing about a real trauma? It is the experimenter's hypothesis that writing about a novel imaginary trauma following Pennebaker's model will produce similar benefits in working memory as writing about a true life trauma.

Method

Participants. Nineteen male and 33 female first-year students from the Psychology programme at Algoma University College aged 17 – 60 years completed the study for partial course credit (N = 52). Participants were randomly assigned to one of three groups. One group wrote expressively about a real negative traumatic experience (n = 21), another group wrote expressively about a novel imaginary trauma (i.e. one that subjects had not actually experienced) from a first-person narrative perspective (n = 20) and a control group wrote about the nonstressful topic of time management (n = 20).

In an effort to prevent subject attrition, participants were told that all who completed the entire experiment (i.e. all six sessions) would have their name entered in a

raffle for gift certificate for a free dinner, to be collected when they wanted after completion.

Materials. A computerized version—developed with Adriel Boals and Jack Dunning—of the arithmetic operation-word memory span task (OSPAN) was used to measure participants' working memory as was used in the original Klein and Boals (2001) study. The OSPAN is a well-established measure of working memory capacity (see Engle, Tuholski, Laughlin, & Conway, 1999). The OSPAN has a high internal consistency (0.75), reliability (0.88) and is stable across time (Klein & Boals, 2001). Participants read a simple arithmetic equation (e.g. (9 X 1) – 9 = 1) on a computer followed by a one-syllable word (e.g. coin). Participants pressed a key indicating whether the problem presented was true or false and read the word. The subject then advanced the computer programme to the next operation. After sets of three to seven problems, participants were required to write down as many words as possible from the previous set. Each set size was used once in three different sequences, totaling 75 operations in all. The equations acted as distractors for the controlled attention required to recall the words, which were activated in short-term memory. All one-syllable words used were matched for frequency. Different equations and words were used in each sequence and each time the test was administered. Working memory scores were obtained from the total number of words recalled that were associated with correctly solved equations. All versions of the OSPAN were completed in small groups in the Algoma University computer labs.

Subjects wrote their essays using a pen and paper. A questionnaire designed by the experimenter was used to assess the participants' perceptions of their writing.

Procedure. Six experimental sessions were scheduled for subjects during the Winter/Spring 2003 semester during the month of March. During the first session, participants were required to give informed consent. The form explained the measures to protect the anonymity of each subject during the writing sessions and explained that essays would not be examined until the study was completed to ensure that they conformed to the assigned manipulation, but essay content would remain confidential and the subjects would only be known by their IDs. Participants were also informed that counseling was available to those who might want to discuss any personal issues or emotional difficulties after each session because expressive writing about personal traumas can sometimes be psychologically stressful for subjects. Subjects were allowed to leave if they did not wish to participate. No subjects that attended the first session declined to participate. After giving informed consent, participants were then tested on the cognitive task (OSPAN) for working memory.

Sessions 2-4 were writing sessions lasting 20 min each. There was a 2-4 day separation between writing sessions to encourage participants to stay in the writing "mind set". Participants wrote in small groups varying in size from 1 to 10 while sitting at a table by themselves. One male experimenter supervised each writing session by indicating when the writing session began and when it finished and also informed participants when the next session would be. At the beginning of the each writing session, participants received a printed copy of standard writing instructions in a manilla envelope. This larger envelope also contained 3 smaller envelopes for the subjects to place their completed essays in. In the expressive writing condition instructions asked that participants write about "the most traumatic, upsetting experience in your entire life"

that has had a negative impact in their lives. The instructions for this group emphasized that participants should delve into their deepest thoughts and emotions about the experience and try to integrate as many aspects of the experience as possible. In the imaginary writing group, instructions asked subjects to write a first-person narrative about "an imaginary experience that would be extremely traumatic and upsetting in your life", but were explicitly told not to write about a topic that had actually occurred in their lives or the life of someone close to them. Participants of this group were encouraged to be as creative as possible in formulating their narrative, but to emphasize the emotional content. If a subject was absent from a session, an attempt was made to contact him or her to reschedule within a couple of days. If rescheduling was not possible, that subject was omitted from the study. Participants were required to write for a full 15 min. at each session. After each writing session, participants placed their essays into one of the smaller envelopes provided, sealed it and wrote the session number on the seal. These envelopes were placed into the larger envelope at kept there until the writing sessions were completed so that subjects could see that their essays had not been tampered with and their privacy was being respected.

Two to four days after the final writing session participants were tested for working memory again, using a different version of the OSPAN. One and one half to two weeks after the last writing session subjects were tested with a third version of the working memory task and took a questionnaire asking participants about their essays and their reactions to the experiment. All participants were debriefed on the study at Algoma University College's annual thesis conference.

Results

Of a total of 77 subjects that signed up for the study, 62 attended the first session. None declined to participate after being informed of the study. Ten subjects did not attend one of the six experimental sessions and their data was not analyzed. Fifty-two (84%) subjects completed all six experimental sessions. The final sample sizes for the experimental groups is as follows: the real trauma group contained 21 subjects (13 female and 8 male, the imaginary trauma group contained 16 (11 female and 5 male) and the control group contained 15 subjects (9 female and 6 male).

Effects of expressive writing on working memory. Means of the raw working memory scores are presented in Table 1. Two subjects in the control group scored extremely low in all three tests. These floor values were included in the analysis and brought the means in this group down and increased the standard deviations. There were no differences in prewriting mean working memory scores (Test 1) as a function of writing topic or gender.

Table 1

Mean Unadjusted Working Memory Scores for Each OSPAN Test

Writing Group	Test 1	Test 2	Test 3
Control	42.8 (23.3)	43.5 (18.1)	47.5 (18.0)
Real Trauma	49.9 (10.1)	44.8 (10.3)	46.1 (14.2)
Imaginary Trauma	51.2 (10.1)	45.3 (12.6)	47.6 (14.8)

Note: Standard deviations are in parentheses. Maximum possible scores are 75.

This was determined using a 3 (writing condition) X 2 (gender) factorial analysis of variance. There were also no differences among the means of the two postwriting working memory scores (Test 2 and Test 3) using the same analysis. It is important that

there were no differences among prewriting means because these scores become a baseline in the following analysis.

Keeping with the analysis used by Klein and Boals to make the data between experiments comparable, prewriting working memory means (Test 1) were used as predictors to calculate residual working memory for the postwriting working memory means collected 2 – 4 days (Test 2) and 1.5 – 2 weeks (Test 3) after writing. If the prewriting means perfectly predict the postwriting means, then the mean residual scores will be zero. Any postwriting residuals that are higher than zero indicate better performance than would have been predicted from the prewriting score, while residuals less than zero indicate poorer performance than would have been predicted. Raw mean residual scores are presented in Table 2 and the mean residual working memory scores are displayed graphically in Figure 1. Two to days after writing (PostTest 1), the expressive writers who wrote about real trauma and those writing about an imaginary trauma both had lower working memory scores than would have been predicted based on their initial working memory scores. The control group's scores were higher than would be predicted based on the prewriting scores. These results are consistent with those obtained by Klein and Boals (2001), but, as reported above, the difference between the control group and the experimental groups was not significant. One and one half to

Table 2

Mean Residual Working Memory Scores for Each PostWriting OSPAN Test

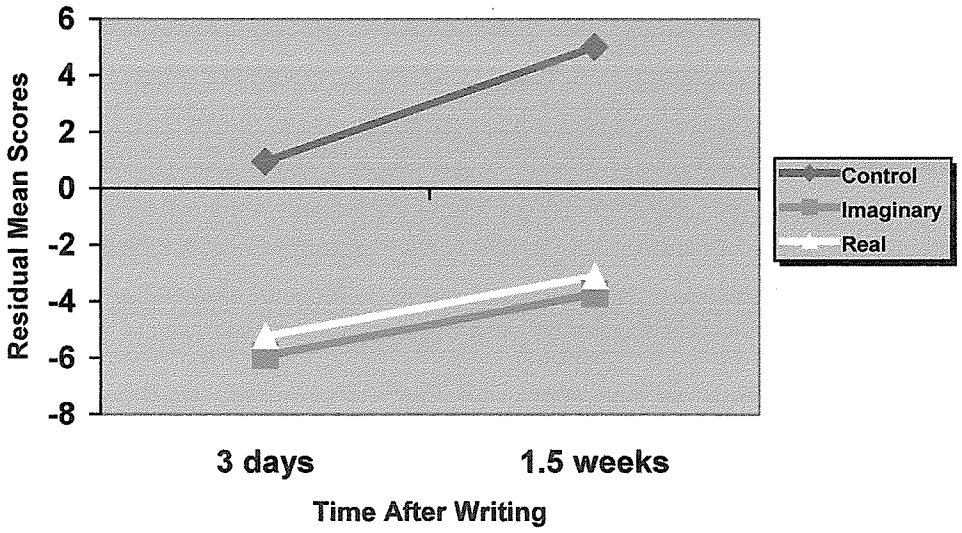
Writing Group	**PostTest 1**	**PostTest 2**
Control	0.972	5.027
Real Trauma	-5.221	-3.101
Imaginary Trauma	-5.909	-3.727

two weeks after writing (PostTest 2), the residual working memory scores for both expressive writing groups increased, but still remained below what would have been predicted by the prewriting working memory scores. The control group's residual scores also increased, becoming higher than would have been predicted by the initial working memory scores, but again the difference between groups was not significant. As Figure 1 demonstrates, the expressive writing groups did show more similarities with each other than with the control group.

Self-reports of writing and reactions to the experiment. Responses to a questionnaire designed to determine how subjects perceived their writing and their reactions to the experiment were analyzed. Comparisons between the means of each writing group were made using a Student-Newman-Keuls post-hoc test (0.05 alpha level). The means for this questionnaire and the analysis results are presented in Table 3.

Figure 1

Residual Mean Working Memory Scores as a Function of Writing Group and Time



Subjects within both expressive writing groups differed from the control group, reporting higher disclosure of emotions in their essays. The control group and the real trauma group reported having talked more about their topic before the study than the imaginary trauma group. Participants in both expressive writing groups felt less comfortable writing about their topics than participants assigned to write about time management. The writing groups did not differ in terms of how much subjects believed their writing impacted they way they thought about their topic or on how organized they felt their writing was.

Correlations between self-reports and working memory scores were also conducted. The only significant correlation was among the imaginary trauma expressive writing group. Working memory scores measured 1.5 – 2 weeks after writing were correlated with how much participants in this group felt their writing impacted the way they think about their topic, $r = -0.531, p < 0.05$.

Table 3

Mean Ratings of Essay Characteristics

	Control	**Real**	**Imaginary**
Revealing emotions	2.13	4.00 *	3.69 *
How often disclosed before study	2.67 *	3.33 *	1.63
How comfortable writing	4.73	3.48 *	3.88 *
Impact of writing on thoughts about topic	2.07	2.76	2.07
How well organized	3.00	3.38	2.81

Note: means with an asterisk differ significantly, $p < 0.05$. Response scales ranged from 1 (lowest) to 5 (highest)

Discussion

The results did not support the hypothesis. Two to four days after writing, there was no significant difference in working memory scores between subjects in either

expressive writing group and the control group. One and one half weeks to two weeks after writing, there was still no difference among the groups. These findings are not consistent with those of Klein and Boals (2001), indicating that there should have at least been a difference between participants assigned to write about their deepest personal thoughts and feelings about a stressful event and those assigned to write about time management.

Analysis of participants' self-reports on their essay content reveals that the intended manipulations were strong. The expressive writers revealed more emotions in their writing than the control group, as was desired. Those subjects required to write about a novel imaginary traumatic experience reported talking much less about their topic before this study than the real trauma writing group or the control group as expected. The expressive writers also felt less comfortable writing about their very personal, emotionally-charged topics than did the control group. Consistent with Klein and Boals' (2001) results, there was no difference between writing conditions as to how well organized subjects thought their essays were. The variation in results between the current study and that of Klein and Boals' (2001) is not explained by differences in manipulations.

There are several possible reasons for the divergence of results between this study and that conducted by Klein and Boals (2001). The current study had very small sample sizes and this affected working memory scores because of some extreme scores within the groups. A study using larger sample sizes would control for this and allow a more sound statistical analysis. Due to restrictions of available time and space in which to conduct the experiment, some control was inevitably lost. This is another possible reason

for the differing results found in this experiment when compared with those found in Klein and Boals' (2001). The most important factor of control that was lost was during the administration of the working memory tests. These tests were given in a computer lab in small groups, which at times created a busier and noisier environment than would have been ideal. Working memory involves limited-capacity controlled attention processes that must focus on the task at hand and interruptions, high noise levels and any other environmental distractors will compete for the attentional resources that the working memory scores needed. This is particularly relevant to the last postwriting working memory test conducted because many subjects had rescheduled to times were noise and other distractions would have made focussing attention very difficult.

The most illuminating reason for the discrepancies between the two studies is the difference in timing. In Klein and Boals' (2001) experiment, working memory was measured 1 week after the last writing session and again 7 weeks after writing. It was not until working memory was measured at the 7 week postwriting mark that any gains in working memory were found. The current study measured working memory 2 – 4 days after writing and again 1.5 – 2 weeks after writing. This period of time falls roughly into the timeframe of the initial postwriting test in the original Klein and Boals (2001) study. The data were consistent with Klein and Boals' during this timeframe, showing the interesting finding that expressive writers actually perform worse than would be predicted by their initial working memory scores and that those assigned to the control group actually perform better, but these differences were not significant between the writing groups. Further, as seen in Figure 1, the trend of the expressive writing groups indicates some improvement in working memory capacity was occurring. It is possible

that with more time for the final postwriting working memory test to be conducted that an effect may be found. There is evidence that the longer this duration of time is, the more likely there will be an effect (Klein & Boals, 2001; see also Smyth, 1998). Whether or not working memory gains can be established through expressive writing about a novel imaginary trauma given more time and tighter control over the dependent variable requires further research.

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