Measuring emotional expression with the Linguistic Inquiry and Word Count

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The Linguistic Inquiry and Word Count (LIWC) text analysis program often is used as a measure of emotion expression, yet the construct validity of its use for this purpose has not been examined. Three experimental studies assessed whether the LIWC counts of emotion processes words are sensitive to verbal expression of sadness and amusement. Experiment 1 determined that sad and amusing written autobiographical memories differed in LIWC emotion counts in expected ways. Experiment 2 revealed that reactions to emotionally provocative film clips designed to manipulate the momentary experience of sadness and amusement differed in LIWC counts. Experiment 3 replicated the findings of Experiment 2 and found generally weak relations between LIWC emotion counts and individual differences in emotional reactivity, dispositional expressivity, and personality. The LIWC therefore appears to be a valid method for measuring verbal expression of emotion.

Verbally expressing emotions yields several benefits. It is well documented that written expression of emotion is associated with positive physiological outcomes (Cameron & Nicholls, 1998; Esterling, L'Abate, Murray, & Pennebaker, 1999; Kelley, Lumley, & Leisen, 1997; Lepore & Smyth, 2002; Pennebaker, Colder, & Sharp, 1990; Sheese, Brown, & Graziano, 2004; Smyth, 1998). Talking to another person about upsetting emotions can also reduce the psychological distress associated with inhibiting expression and facilitate the development of insight (Kennedy-Moore & Watson, 2001).

One reason why disclosure is beneficial is that providing labels for emotional experience facilitates the integration and understanding of the emotions surrounding the event (Pennebaker & Francis, 1996; Pennebaker, Mayne, & Francis, 1997). Pennebaker and Francis randomly assigned college students to write about either their thoughts and feelings about coming to college or any object or event of their choosing. It was found that, among the students who wrote about their thoughts and feelings about coming to college, the use of more positive emotion words and words associated with the development of insight were associated

AMERICAN JOURNAL OF PSYCHOLOGY
Summer 2007, Vol. 120, No. 2, pp. 263–286

with an improvement in physical health. The role of emotional content of disclosures was further elucidated by Pennebaker et al. (1997), who analyzed written essays from multiple samples and found that the use of fewer negative emotion and more positive emotion words in the essays was associated with health benefits.

The scientific study of the emotional content of disclosures has benefited from an objective method of measuring words in language called the Linguistic Inquiry and Word Count (LIWC; Pennebaker, Francis, & Booth, 2001). The LIWC is a computerized text analysis program that categorizes and quantifies language use. The LIWC counts the frequency of words in a given category, including standard language categories (e.g., articles, prepositions), psychological processes (e.g., emotion, cognitive, sensory, social), words denoting relativity (e.g., time, space), and specific content areas such as school and work. Use of the LIWC to measure emotions has increased in the past few years (Alpers et al., 2005; Bohanek, Fivush, & Walker, 2005; Burke & Dollinger, 2005; Graves et al., 2005; Owen, Klapow, Roth, & Tucker, 2004; Pennebaker & Lay, 2002), and research with the LIWC has shown the value of measuring emotional disclosures in health and personality research.

But does the LIWC accurately measure emotional expression? Drawing conclusions from the existing literature about the utility of the LIWC as a measure of emotional expression is challenging because research has not been precise in its measurement of emotional experience. Manipulations typically have involved asking one group to write about their thoughts and feelings about an event and a control group to write about a nonemotional event (e.g., Pennebaker & Francis, 1996). Using this research paradigm, it is difficult to ascertain what one's emotional state is or should be. For example, when one is writing about one's "very deepest thoughts and feelings about coming to college" (Pennebaker & Francis, 1996, p. 607), one's emotional experiences could be positive, negative, or both. In essence, the construct validity of LIWC emotion counts is unclear.

Another approach to determining whether the LIWC is an accurate measure of one's emotional expression would be to manipulate emotional experience. If the LIWC is an accurate index of one's emotional experience, then, using the logic of construct validity, manipulations of emotional experience should also affect LIWC counts. To our knowledge a test of the validity of the LIWC using this experimental paradigm has not been done. This represents a troubling gap in the literature because the number of studies using the LIWC appears to be on the rise, and the LIWC's construct validity with respect to measuring specific emotions is unknown. Therefore, the purpose of our research was to determine

whether disclosures about specific, discrete emotions can be accurately measured by the LIWC. Based on previous research (Gross, John, & Richards, 2000), we chose amusement and sadness—prototypical pleasant and unpleasant emotions—as target emotions in our research.

In Experiment 1 we examined emotion words used in expressive writing. Specifically, we addressed whether writing about amusing, sad, and neutral autobiographical memories corresponds to the emotion counts measured by the LIWC. In Experiment 2 we used a well-established experimental paradigm (Gross et al., 2000) to manipulate the momentary experience of amusement and sadness, asked participants to talk about their momentary emotional experiences, and assessed whether the LIWC emotion word counts based on these oral reports corresponded to the manipulated emotions. In Experiment 3 we replicated the method and research questions in Experiment 2 and extended them to the investigation of individual differences in emotional expressivity, emotional reactivity, and personality. The investigation of individual differences allowed us to determine the extent to which LIWC scores result from aspects of the person as opposed to aspects of a specific emotional episode. Our general hypothesis guiding these studies was that the LIWC word counts would accurately distinguish between amusement, sadness, and nonemotional disclosures.

EXPERIMENT 1

In Experiment 1 we addressed whether the LIWC emotion counts are sensitive to differences in written essays about emotional autobiographical memories. To our knowledge, no study has compared written emotional autobiographical memories that differed in the target emotion on computer counts of emotion words. Therefore, there has been no clear test of the validity of the LIWC with respect to distinguishing between written essays that differ in their emotional content. Manipulating the target emotions for the essays was necessary to determine whether the emotion words people write, as measured by the LIWC, correspond to the discrete emotions described in the essay.

We asked college students to write three essays, one describing an amusing time in their lives, one describing a sad time in their lives, and one describing a typical day in their lives. We hypothesized that the LIWC categories reflecting negative emotions would be higher for writing about a sad event than either an amusing or a neutral event. LIWC categories reflecting positive emotions were expected to be higher in writing about an amusing event than either a sad or a neutral event.

METHOD

Participants and procedure

Seventy-nine undergraduate students (72 women, 7 men) attending a large Midwestern university participated in this research in exchange for extra course credit. Data were collected in groups of approximately 15 students. Participants were provided booklets that assessed demographic information on the front page. On subsequent pages participants were asked to write about three specific events. In the sad condition participants were instructed, "Write about a time in your life when you felt sad; you may write about any time in your life or any event, but it is important that you write about a time when you felt sad or unhappy." In the amused condition participants were instructed, "Write about a time in your life when you felt amused; you may write about any time in your life or any event, but it is important that you write about a time when you felt amused or entertained." Participants in the neutral condition were instructed, "Describe a typical weekday for you during the semester." The neutral condition was always presented second, but the sad and amused conditions were counterbalanced such that one was presented first and the other was presented third.

LIWC word counts

Before analysis we transcribed the handwritten essays into computer text files. These written expressions of emotion were then quantified via the eight emotion process categories of the LIWC (Pennebaker et al., 2001). The LIWC word counts for emotion processes were developed by judges grouping emotion words into positively and negatively toned categories. These categories are arranged hierarchically. At the highest level of the hierarchy is the total number of affect words. This *total affect* count is based on 615 words (e.g., *happy, ugly, bitter*) with both pleasant and unpleasant connotations. At the next level, the LIWC counts positively and negatively connoted words. The broad category of *positive emotion* comprises 261 words (e.g., *happy, pretty, good*) that reflect positive feelings and positively valenced words. The broad category for negatively valenced words is the *negative emotion* count, which comprises 345 words (e.g., *hate, worthless, enemy*) that reflect negative feelings and negatively valenced words. At the lowest level of the hierarchy are five specific categories. The *positive feelings* category is based on 43 words that reflect specific pleasant emotions one might experience (e.g., *happy, joy, love*), and it is a subset of the words in the positive emotion count. A second subset of the positive emotion count is the *optimism* category (69 words such as *certainty, pride,* and *win*). Three subsets of the negative emotion category are *anxiety/fear* (62 words such as *nervous, afraid,* and *tense*), *anger* (121 words such as *hate, kill,* and *pissed*), and *sadness/depression* (72 words such as *grief, cry,* and *sad*). Each count category comprises either whole words or word stems, and many words are counted in multiple categories. All word counts are expressed as a percentage of the total number of words, thus controlling for the length of the writing sample.

RESULTS

Themes emerged from participants' written autobiographical emotional memories. For the sad condition, responses almost exclusively concerned interpersonal stressors. For example, many participants wrote about the death of a loved one, the breakup of a close relationship, or separation from significant others. In contrast, memories in the amusement condition tended to focus on brief but entertaining events (e.g., college parties, concerts and stage productions, road trips). Qualitative analysis of these data therefore indicated that participants complied with instructions to write about sad and amusing memories, and these themes provide a context for subsequent quantitative analyses.

Before conducting the primary analyses, we tested whether mean word counts differed as a function of the order of condition (i.e., sad, neutral, and amused vs. amused, neutral, and sad). We conducted *t* tests on the eight LIWC emotion counts for each writing sample (i.e., sad, amusing, and neutral). This test of order effects revealed that participants who wrote about an amusing experience after writing about a sad experience had higher counts of total affect words and positive emotion words in the amusing condition than did participants who wrote about an amusing experience before a sad experience, $p < .01$. Because of this order effect, we accounted for order in the analyses by including it as an additional between-subjects factor.

To determine whether LIWC word counts differed as a function of the type of emotional memory the participants wrote about, we conducted a series of 3×2 (condition $\times$ order) mixed analyses of variance (ANOVAs). Significant main effects for condition were observed for all LIWC categories except for optimism (Table 1). We conducted pairwise comparisons across all conditions for the eight word counts using a conservative alpha level of .001 to guard against Type I error. These comparisons indicated that writing about an amusing event was associated with significantly more total affect, positive emotion, and positive feelings words than writing about either a sad or a neutral event. Writing about a sad event was associated with a significantly higher number of negative emotion and sadness/depression words than writing about an amusing or a neutral event. The anxiety/fear and anger word counts did not distinguish between writing about sad and amusing events.

We found an unexpected order effect such that the order of the writing instructions interacted with condition for total affect, $F(2, 76) = 6.13$, $p < .01$, $\eta^2 = .14$, and positive emotions, $F(2, 76) = 8.30$, $p < .01$, $\eta^2 = .18$. For total affect words, writing about an amusing event was associated with significantly more total affect words, $M = 8.51$, $SD = 4.00$, than writing

Table 1. Mean (*SD*) LIWC emotion word counts across different writing conditions, Experiment 1

	Writing condition				
LIWC category	Sad	Amusing	Neutral	$F(2, 76)$	η^2
Total affect	5.59[a] (2.45)	7.18[b] (3.62)	1.29[c] (1.27)	147.78***	.80
Positive emotion	1.44[a] (1.35)	6.24[b] (3.36)	1.01[a] (1.08)	94.69***	.71
Positive feelings	0.49[a] (0.82)	1.14[b] (1.50)	0.08[c] (0.28)	31.30***	.45
Optimism	0.39[a] (0.68)	0.49[a] (1.03)	0.41[a] (0.61)	0.25	.01
Negative emotion	4.11[a] (2.28)	0.92[b] (1.34)	0.27[c] (0.66)	105.75***	.74
Anxiety/fear	0.39[a] (0.72)	0.18[a] (0.48)	0.10[a] (0.49)	3.99*	.10
Anger	0.30[a] (0.59)	0.45[a] (0.95)	0.02[b] (0.15)	13.29***	.26
Sadness/depression	3.17[a] (2.11)	0.17[b] (0.54)	0.02[b] (0.10)	85.64***	.69

Note. $N = 79$; means with the same superscript letter are not significantly different from each other, $p < .001$. LIWC = Linguistic Inquiry and Word Count.
*$p < .05$. ***$p < .001$.

about a sad event, $M = 5.57$, $SD = 2.58$, only if writing about the sad event preceded writing about the amusing event; participants who wrote about a sad event after writing about an amusing event did not show a difference between total affect words in the amusing, $M = 5.82$, $SD = 2.58$, and sad, $M = 5.61$, $SD = 2.35$, conditions. For positive emotion words, participants who wrote about the amusing event after the sad event used significantly more positive emotion words, $M = 7.52$, $SD = 3.59$, than those who wrote about the amusing event first, $M = 4.92$, $SD = 2.54$. However, regardless of the order of administration, participants used more positive emotion words when writing about an amusing event than either a sad or a neutral event, so this interaction did not affect the conclusions regarding LIWC validity.

DISCUSSION

The results of Experiment 1 are consistent with the idea that writing about emotional events brings about differences in the number of emotion words used to describe them. Labeling an emotion is part of the process of arriving at an understanding of an emotional event (Pennebaker et al., 1997), and Experiment 1 suggests that these emotional memories were labeled in a way that the LIWC counts could detect. This provides experimental support for the validity of the LIWC with respect to measuring written emotional disclosures about two discrete emotional experiences. Specifically, more positive emotion and positive feelings words were used to describe an amusing event than either a sad or neutral event, and more

negative emotion and sadness/depression words were used to describe a sad event than either an amusing or neutral event. There was also an effect for total affect words, but the nature of the interaction indicated that this effect was not reliable across order of writing tasks.

These findings can be interpreted in two ways. First, it appears that participants wrote about the experiences in the way in which they were instructed. From this point of view the results of Experiment 1 constitute a manipulation check. However, from a second perspective, it was no guarantee that the LIWC would be sensitive to these different types of autobiographical memories because not all participants might have used emotion words to label their experience. For example, one can describe a sad event using only the facts surrounding the event. The effectiveness of the LIWC depends on the individual using specific emotion words to describe the memory. Experiment 1 supports the efficacy of the LIWC in this regard and therefore provides important new validity information.

It was also of interest that the broad categories of positive emotion and negative emotion counts distinguished between conditions even though we manipulated two discrete emotions. These broad categories comprise hundreds of words, and most of them are not specific to amusement or sadness. We suspect that these broad LIWC counts differed across conditions because there are enough words associated with sadness and amusement in these word counts to elevate the scores. It is also possible that the written descriptions of sad and amusing autobiographical memories contained words related to other emotions that may have been measured by the positive emotion and negative emotion counts, although the lack of findings with respect to optimism, anxiety/fear, and anger does not support this conclusion.

Despite these promising results, there were some questions Experiment 1 did not answer. First, Experiment 1 concerned an autobiographical memory of an emotional experience that may have occurred long ago. Emotional memories are different from the momentary experience of emotion because participants may have had many opportunities to examine the event, provide emotional labels to their experiences, and subsequently experience the emotional aspect of the event in a different way. To extend the scope of our test of the LIWC's validity it was important to determine whether the LIWC has validity regarding the disclosure of one's current emotional experience. Second, written emotional expression probably is different from oral emotional expression because the slower writing (compared with speaking) process provides more time for response modulation processes to activate. Experiment 2 therefore was designed to extend the findings from Experiment 1 by addressing these issues.

EXPERIMENT 2

The goal of Experiment 2 was to assess the validity of the LIWC with respect to measuring the oral disclosure of one's momentary experience of a pleasant (amusement) and unpleasant (sadness) emotion. Because we needed to elicit emotion in a controlled setting, we used film clips in the laboratory to induce momentary amusement and sadness. Film clips are a common and effective way to manipulate emotional experience (Gross et al., 2000), and prior research has validated specific film clips for the purposes of inducing sadness and amusement (Gross & Levenson, 1995). On the basis of Gross and Levenson's data, we selected a comedy routine by Robin Williams as the film clip designed to elicit amusement. The film designed to elicit sadness shows a funeral scene from the movie *Steel Magnolias*. These films, and the general method described here, have been used successfully in research examining emotional experience and expression (e.g., Gross et al., 2000, Study 2).

On the basis of Experiment 1's results, we hypothesized that the use of LIWC categories reflecting positive emotion and positive feelings words would be higher for verbalizations after the comedy film than the funeral film. The use of LIWC categories for negative emotion and sadness/depression was expected to be higher for verbalizations after the funeral film than the amusement film. Consistent with the findings from Experiment 1, we did not expect differences for total affect, optimism, anxiety/fear, or anger words.

METHOD

Participants and procedure

Sixty-one college students (49 women, 12 men) came to the laboratory individually, where they were greeted by an experimenter who obtained informed consent. The participant then sat in front of a 35-cm TV and VCR unit and a microphone leading to an audiotape recorder. Instructions to the participant were provided on a videotape that played on the TV and VCR while the experimenter waited outside the room. The first film the participant viewed was a 1.5-min emotionally neutral film that showed flowers in a park; this silent film clip was designed to familiarize the participant with the procedure.

After this baseline film, the participant completed 22 items to measure the subjective intensity of his or her momentary emotional experience. The first 20 items were emotions from the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). There are 10 items measuring positive affect (PA) and 10 items measuring negative affect (NA) on the PANAS (e.g., *interested* and *excited* for PA, *distressed* and *upset* for NA). Participants were instructed to indicate the extent to which they currently felt each emotion on 5-point Likert-type scales ranging from 1 (*very slightly or not at all*) to 5 (*extremely*).Total scores therefore ranged

from 10 to 50 for both PA and NA, with higher scores reflecting more intense experiences of PA and NA. The 21st and 22nd items were *sad* and *amused,* and they were rated on a similar 5-point scale. The PANAS and the amusement and sadness items were used as manipulation checks.

After completing the emotion rating scale, the participant was instructed, "Reflect on what you are feeling right now, at this moment." After a brief pause the participant was further instructed, "Talk about what you are feeling by speaking into the microphone." No other instructions, such as what specific emotions to express, were given. The microphone led to an audiotape recorder. The participant was given 2 min to speak; a 2-min countdown on the screen indicated how much time the participant had left to speak. We chose a 2-min verbalization period because the verbal expression of an intense emotion tends to decline after the second minute (Luminet, Bouts, Delie, Manstead, & Rimé, 2000, Experiment 2).

After this 2-min verbalization, there was a 1-min cooldown period during which the participant was asked to wait quietly. Then either the comedy film or the funeral film was shown. (The film order was counterbalanced such that participants saw either the comedy film before the funeral film or the funeral film before the comedy film.) After the comedy or funeral film, the participant completed the intensity measures and again verbalized his or her reactions to the film for 2 min. After another 1-min cooldown, the participant viewed a 3.5-min neutral film (a computer screen saver) to "wash out" the previous emotional experience, completed the intensity measures, and verbalized her or his reactions. The fourth film, either the comedy or funeral film (whichever one the participant did not view previously) was then shown. Once more, participants were instructed to complete the intensity measures and verbalize their reactions to the film before they were debriefed and excused.

LIWC word counts

Participants' verbal expressions of emotions were transcribed to text files. These files were then quantified via the eight emotion word count categories of the LIWC described in Experiment 1.

RESULTS

We conducted preliminary analyses on film order. A series of independent sample t tests revealed that none of the word counts for any of the four films were related to film order. Moreover, film order did not interact with the film clips on any of the LIWC counts. We therefore did not consider film order in subsequent analyses.

Manipulation checks

Two one-way repeated-measures ANOVAs assessed the efficacy of the film manipulations with respect to affecting one's positive and negative affect and the intensity of one's subjective experiences of amusement and sadness, as measured by the self-report items. The films resulted in

expected differences in positive affect, $F(3, 58) = 52.21$, $p < .001$, $\eta^2 = .73$, and negative affect, $F(3, 58) = 18.98$, $p < .001$, $\eta^2 = .50$. Also, in the analysis of amusement, there was a significant effect for film, $F(3, 58) = 65.27$, $p < .001$, $\eta^2 = .77$. A priori contrasts at an alpha level of .01 revealed that the comedy film generated significantly higher ratings of amusement experience, $M = 3.92$, $SD = 1.32$, than either the funeral film, $M = 1.57$, $SD = 0.92$, the baseline film, $M = 1.74$, $SD = 0.98$, or the washout film, $M = 1.33$, $SD = 0.85$. The ANOVA for the intensity of sadness experience also showed the expected main effect for film, $F(3, 58) = 97.66$, $p < .001$, $\eta^2 = .84$. Contrasts revealed that the funeral film generated significantly higher ratings of sadness, $M = 3.62$, $SD = 1.19$, than either the comedy film, $M = 1.05$, $SD = 0.28$, the baseline film, $M = 1.25$, $SD = 0.79$, or the washout film, $M = 1.10$, $SD = 0.44$. Accordingly, the film clips evoked the expected affect and the targeted emotions of amusement and sadness, thus supporting the construct validity of the manipulations.

LIWC word counts as a function of film clips

We hypothesized that the funeral film would elicit a greater use of words in the negative emotions and sadness/depression LIWC categories than the other films, and we also hypothesized that the comedy film would elicit greater use of positive feelings and positive emotion words than the other three films. We did not expect differences for total affect words, optimism, anxiety/fear, or anger. We conducted a series of eight one-way repeated-measures ANOVAs to test these hypotheses. Results are presented in Table 2.

Our hypotheses for positive emotion and positive feelings categories were supported with significant main effects for both of these word counts.

Table 2. Mean (*SD*) LIWC emotion word counts in verbalizations following film clips, Experiment 2

	Film					
LIWC category	Baseline	Washout	Funeral	Comedy	$F(3, 58)$	η^2
Total affect	7.83^{a} (5.35)	5.91^{b} (3.07)	7.65^{a} (3.10)	9.18^{a} (3.69)	17.66***	.48
Positive emotion	4.57^{a} (2.92)	2.69^{b} (2.00)	2.50^{b} (1.87)	7.31^{c} (3.38)	32.98***	.63
Positive feelings	0.51^{a} (0.90)	0.30^{a} (0.87)	0.42^{a} (0.59)	1.52^{b} (1.45)	10.98***	.36
Optimism	0.38^{a} (0.62)	0.30^{a} (0.60)	0.50^{a} (0.79)	0.53^{a} (0.81)	1.20	.06
Negative emotion	3.20^{ab}(4.56)	3.22^{a} (2.41)	5.10^{b} (3.27)	1.67^{c} (2.16)	27.75***	.59
Anxiety/fear	1.16^{a} (1.55)	0.78^{a} (0.96)	1.36^{a} (1.41)	0.74^{a} (1.15)	2.98*	.13
Anger	0.41^{a} (0.89)	0.55^{a} (0.96)	0.38^{a} (0.87)	0.40^{a} (0.66)	0.50	.03
Sadness/depression	0.41^{a} (0.86)	0.16^{a} (0.36)	2.41^{b} (1.74)	0.10^{a} (0.25)	37.08***	.66

Note. $N = 61$; means with the same superscript letter are not significantly different from each other, $p < .001$. LIWC = Linguistic Inquiry and Word Count.
*$p < .05$. ***$p < .001$.

To interpret these main effects we conducted pairwise comparisons at an alpha level reduced to .001 because of the large number of tests. Significantly more positive emotion and positive feelings words were verbalized after exposure to the comedy film than after exposure to any of the other three films. In other words, the momentary experience of amusement corresponded to a relative increase in the use of words related to positive emotion and positive feelings. Our hypothesis for the sadness/depression count was also supported, whereby verbalizations following viewing of the funeral film resulted in a significantly greater use of sadness/depression words than verbalizations following any of the other three films. The significant main effect for negative emotion words also supported LIWC validity, such that the funeral film resulted in significantly more negative emotion words than exposure to either the washout or the comedy film (but, interestingly, not the baseline film).

As expected, the use of optimism words, anxiety/fear words, and anger words did not vary as a function of film. Although we did not expect differences for total affect words, there was a significant main effect for the total number of affect words, whereby significantly fewer affect words were verbalized after the washout film than the other three films.

DISCUSSION

Experiment 2 offers data to support the hypothesis that one's momentary experiences of sadness and amusement are related to the oral expression of these emotions as measured by the LIWC. In particular, the positive emotion, positive feelings, negative emotion, and sadness/depression counts significantly distinguished between momentary experiences of sadness and amusement. Moreover, three of these counts (positive emotion, positive feelings, and sadness/depression) also distinguished between one's momentary experience of an emotion and their baseline expression after a neutral emotional stimulus.

Optimism, anxiety/fear, and anger word counts did not differ across categories. Given that we did not experimentally manipulate these emotions, it was not surprising that these word counts did not distinguish between the conditions in Experiment 2. Instead, the films eliciting two target emotions in Experiment 2—sadness and amusement—affected the word counts to which they are more closely related, namely the positive feelings and sadness/depression counts. This pattern of convergent and discriminant validity provides compelling evidence for the use of the LIWC counts to measure sadness and amusement.

One potential criticism of the method of Experiment 2 is that demand characteristics may have influenced our results. Specifically, asking participants to "talk about what you are feeling" may have heightened the mean

levels of emotional expression across all four films. Likewise, completing the self-report measure of intensity of the emotional experience may have primed participants to use more feeling words than they otherwise would have used. If the goal of Experiment 2 was to determine whether the films caused participants to express more emotion, then this would be a valid criticism. However, the goal of Experiment 2 was to determine whether the LIWC measures the expression of the *targeted* emotion; thus, the relative differences across film condition were of interest, not the absolute levels of emotion expression. Participants were not told what emotions to express; they were merely asked to express whatever emotions they were experiencing. Thus, Experiment 2 allowed us to determine whether the content of the emotional expressions, as measured by the LIWC, differed as a function of the film content.

Taken together, Experiments 1 and 2 demonstrated that the LIWC is sensitive to verbally expressed emotions, in terms of both writing about emotional autobiographical memories and talking about one's momentary emotional experience. An important extension of these tests of LIWC validity is to the realm of individual differences. In particular, it is important to ascertain whether individual differences in emotional reactivity or expressivity predict LIWC word counts after exposure to emotional stimuli. For example, it is possible that the use of emotion words when one is experiencing an emotion depends partly on how strongly one experiences an emotion, how one typically expresses emotions, or some other aspect of personality. On the other hand, the verbal expression of emotion may result almost exclusively from situational factors. Experiment 3 was designed to replicate the results of Experiment 2 using the same method and extend these findings by examining the role of individual differences in the oral expression of sadness and amusement.

EXPERIMENT 3

Research has documented that individuals differ in their dispositions to express emotions to others (Gross & John, 1995, 1997; King & Emmons, 1991; Kring, Smith, & Neale, 1994). These individual differences may be construed as a trait, such that some people typically are highly expressive (e.g., they laugh out loud when happy), whereas others are not expressive (e.g., they hide anger when they feel angry). Much evidence supports the existence of positive and negative components of dispositional expressivity (Gross & John, 1995, 1997; King & Emmons, 1990). Thus, we would expect people high in dispositional negative expressivity to express sadness more strongly than people low in negative expressivity, and we would expect people high in dispositional positive expressivity to express amusement

more strongly than people low in positive expressivity. This pattern has been found with studies of nonverbal emotional expression (Gross et al., 2000), but to our knowledge dispositional expressivity has not been examined with respect to the verbal expression of emotion. One purpose of Experiment 3 was to determine whether dispositional emotional expressivity relates to verbal expression of emotion as measured by the LIWC.

A second purpose of Experiment 3 was to test whether the intensity of an experienced emotion predicts LIWC scores based on verbalizations made while an emotion is experienced. Individual differences in emotional reactivity have been well documented (e.g., Larsen & Diener, 1985), and people who experience an emotion more strongly ought to express that emotion more strongly (Stiles, 1987). We therefore examined whether individual differences in the intensity of one's typical emotions and the intensity of the emotions experienced after exposure to an emotional cue predicted LIWC scores.

Third, we examined whether global factors of personality as conceptualized by the Big Five (i.e., neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness) were associated with LIWC scores. Extraversion may be associated with emotional expression because of the experience in interpersonal communication an extraverted person would have had. Likewise, neuroticism may be associated with emotional expression because of the high level of negative affect experienced by people high in neuroticism. Confirming these relations would lend additional support to the validity of the LIWC emotion categories. There is already some reason to question these relationships, however. On the basis of college students' essays about coming to college, Pennebaker and King (1999) found that neither the positive emotion nor negative emotion counts were correlated stronger than .16 with measures of the Big Five, although they were in theoretically expected directions: Positive emotion word usage was positively related to extraversion, and negative emotion word usage was positively related to neuroticism. However, these relationships have not been examined with respect to the disclosure of an actively experienced discrete emotion.

We hypothesized that dispositional emotional expressivity and emotional reactivity would be positively associated with LIWC counts. More specifically, we expected positive expressivity, emotional reactivity, and the intensity of one's amusement and positive affect after the comedy film to correlate positively with positive emotion and positive feelings counts. We also expected negative expressivity, emotional reactivity, and the intensity of one's sadness and negative affect after the funeral film to correlate positively with negative emotion and sadness/depression counts. Consistent with Pennebaker and King's (1999) findings, we expected only modest correlations between LIWC counts and personality. Finally, we

hypothesized that results from Experiment 2 regarding the differences in LIWC counts across films would be replicated.

METHOD

Participants and procedure

A total of 66 college students (52 women, 14 men) participated in Experiment 3. Participants were pretested on the Berkeley Expressivity Questionnaire (BEQ) and Big Five Inventory in a large mass-testing session. Two to 10 weeks later, they came to the laboratory for an individual session to watch film clips. At that point all procedures were identical to those used in Experiment 2.

LIWC word counts

Participants' verbal expressions of emotions were measured with the LIWC, as in Experiments 1 and 2. However, in Experiment 3 we analyzed scores only for positive emotions, positive feelings, negative emotions, and sadness/depression. We did not analyze the total affect, optimism, anxiety/fear, or anger word counts because Experiments 1 and 2 did not show them to be related to the experience of amusement or sadness.

Individual difference measures

Berkeley Expressivity Questionnaire. The BEQ (Gross & John, 1995) comprises 16 items that measure individual differences in dispositional emotional expressivity and reactivity. Gross and John conceptualized emotional expressivity as a trait that describes the strength of individuals' emotion response tendencies and the extent to which these tendencies are typically expressed as overt behavior. The BEQ has three subscales: impulse strength (six items; $\alpha = .87$; e.g., "I experience my emotions very strongly"), negative expressivity (six items; $\alpha = .73$; e.g., "No matter how nervous or upset I am, I tend to keep a calm exterior" [reverse scored]), and positive expressivity (four items; $\alpha = .71$; e.g., "When I'm happy, my feelings show"). Respondents rate their agreement with each item on a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*); thus, higher scores indicate greater reactivity or expressivity. Gross and John reported that test–retest reliability (2- to 3-month interval) of the subscales ranges from .71 (positive expressivity) to .82 (impulse strength).

Intensity of momentary emotional experience. As in Experiment 2, we measured the intensity of the emotion experienced in the laboratory with the 22 affect items: the 20-item PANAS and the additional *sad* and *amused* items. The individual differences of interest were the intensity of sadness and negative affect immediately after exposure to the funeral film and the intensity of amusement and positive affect immediately after exposure to the comedy film. Internal consistency reliability estimates for momentary experiences of PA and NA have been reported to be .89 and .85 (Watson et al., 1988). Alpha coefficients in this study were .88 and .82 for PA and NA, respectively.

Big Five Inventory. The BFI (John & Srivastava, 1999) comprises 44 items that measure individual differences in the Big Five factors of personality. The BFI has

five subscales: extraversion (eight items; $\alpha = .89$; e.g., "Is talkative"), agreeableness (nine items; $\alpha = .77$; e.g., "Likes to cooperate with others"), neuroticism (eight items; $\alpha = .82$; e.g., "Gets nervous easily"), conscientiousness (nine items; $\alpha = .77$; e.g., "Perseveres until the task is finished"), and openness to experience (10 items; $\alpha = .78$; e.g., "Is sophisticated in art, music, or literature"). Respondents rate their agreement with each item on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Test–retest reliability of the scales (3-month interval) ranges from .80 to .90 (Benet-Martínez & John, 1998).

RESULTS

Preliminary analyses on film order revealed that the order of viewing the comedy and funeral films was not related to the four LIWC counts analyzed in Experiment 3. Also, as in Experiment 2, there was no interaction between film order and film clips on the LIWC counts. Therefore, we did not consider film order in subsequent analyses.

Manipulation checks

As in Experiment 2, we conducted one-way repeated-measures ANOVAs to confirm that the film clips evoked the intended affective experiences as measured by the PANAS and the self-reported intensity of amusement and sadness. Emotions elicited by the four film clips differed in expected ways on the measures of positive affect, $F(3, 63) = 53.21$, $p < .001$, $\eta^2 = .72$, and negative affect, $F(3, 63) = 27.97$, $p < .001$, $\eta^2 = .57$. There was a significant effect for film on amusement, $F(3, 63) = 145.38$, $p < .001$, $\eta^2 = .87$. Pairwise comparisons at the .01 alpha level revealed that, as expected, the comedy film generated significantly higher reports of amusement, $M = 3.97$, $SD = 1.04$, than either the funeral film, $M = 1.77$, $SD = 1.13$, the baseline film, $M = 1.74$, $SD = 1.04$, or the washout film, $M = 1.39$, $SD = 0.70$. A similar effect was found for the intensity of sadness experienced, $F(3, 63) = 90.95$, $p < .001$, $\eta^2 = .81$. Self-reports of sadness were significantly higher after the funeral film, $M = 3.33$, $SD = 1.11$, than either the comedy film, $M = 1.14$, $SD = 0.49$, the baseline film, $M = 1.09$, $SD = 0.29$, or the washout film, $M = 1.14$, $SD = 0.43$.

LIWC word counts as a function of film clips

To replicate the findings of Experiment 2, we conducted four one-way repeated-measures ANOVAs comparing the LIWC word counts across the four films (Table 3). Hypotheses for the four LIWC counts were supported, with all main effects being significant, $p < .001$. Pairwise comparisons at the .001 alpha level revealed that the positive emotion and positive feelings word counts were significantly higher in the verbalizations made after the comedy film than in the verbalizations made after each of the other three films. The negative emotion word count was significantly higher

Table 3. Mean (*SD*) LIWC emotion word counts in verbalizations following film clips, Experiment 3

	Film					
LIWC category	Baseline	Washout	Funeral	Comedy	$F(3, 63)$	η^2
Positive emotion	4.89^a (3.35)	2.71^b(2.55)	2.27^b (1.82)	7.29^c (3.18)	51.93***	.71
Positive feelings	0.59^a (1.09)	0.18^a (0.42)	0.53^a (0.75)	1.83^b (1.49)	26.14***	.55
Negative emotion	1.73^a (1.77)	3.04^b (2.11)	3.73^b (1.92)	1.53^a (1.55)	20.17***	.49
Sadness/depression	0.13^a (0.34)	0.14^a (0.42)	1.90^b (1.37)	0.14^a (0.42)	35.01***	.63

Note. $N = 66$; means with the same superscript letter are not significantly different from each other, $p < .001$. LIWC = Linguistic Inquiry and Word Count.
***$p < .001$.

in the verbalizations after the funeral film than the verbalizations after the baseline and comedy films (but not the washout film). Finally, the sadness/depression word count was significantly higher after the funeral film than after each of the other three films.

LIWC counts and individual differences

We computed correlation coefficients between LIWC categories and measures of dispositional expressivity, emotional reactivity, and the Big Five to examine whether LIWC scores were associated with these individual differences. We limited our analyses to the positive emotion and positive feelings counts during the verbalization after the comedy film and to negative emotion and sadness/depression counts during the verbalization after the funeral film. As displayed in Table 4, dispositional positive expressivity was positively correlated with the positive emotion word count, $p < .05$, but uncorrelated with the positive feelings count. Dispositional negative expressivity was unrelated to either the negative emotion or the sadness/depression word counts. Thus, there was limited evidence to support the idea that individual differences in expressivity were associated with LIWC scores.

There was mixed support for the idea that emotional reactivity was associated with verbal expression of emotions as measured by the LIWC. Scores on the impulse strength subscale of the BEQ were positively correlated with the positive feelings category of the LIWC, suggesting that people who typically experience emotions intensely uttered more positive feelings words when experiencing amusement. The intensity of the momentary experience of amusement after the comedy film was also positively correlated with both positive feelings and positive emotion word usage following the comedy film, and the experience of more positive affect was associated with the use of more positive feelings words. In contrast, the intensity of one's experience of sadness and negative affect did not relate to either negative emotion or sadness/depression

Table 4. Correlation coefficients between LIWC word counts and measures of individual differences in dispositional expressivity, emotional reactivity, and personality, Experiment 3

	LIWC category			
Individual difference	Positive emotion[a]	Positive feelings[a]	Negative emotion[b]	Sadness/ depression[b]
BEQ positive expressivity	.25*	.21	.10	.19
BEQ negative expressivity	.20	.22	−.08	.10
BEQ impulse strength	.17	.26*	.05	.20
Amusement experience[a]	.31*	.38**	—	—
Positive affect experience[a]	.09	.33**	—	—
Sadness experience[b]	—	—	.18	.13
Negative affect experience[b]	—	—	.21	−.02
BFI extraversion	−.23	.11	.15	.17
BFI agreeableness	.05	.11	.02	.12
BFI conscientiousness	−.16	−.04	−.02	−.01
BFI neuroticism	.03	−.05	−.13	−.12
BFI openness to experience	−.03	−.07	.14	.19

Note. $N = 66$. Dashes indicate that the correlation was not theoretically meaningful and therefore not reported. LIWC = Linguistic Inquiry and Word Count. BEQ = Berkeley Expressivity Questionnaire. BFI = Big Five Inventory.
[a]Assessed after comedy film.
[b]Assessed after funeral film.
*$p < .05$. **$p < .01$.

word usage after the funeral film. Thus, the intensity of one's emotional experiences is generally predictive of the expression of positive but not negative emotions.

Finally, we assessed whether LIWC scores were associated with personality. None of the 20 correlations between LIWC scores and the Big Five was statistically significant. Thus, there was no evidence that broad dimensions of personality are associated with the verbal expression of emotion while one is experiencing either sadness or amusement.

DISCUSSION

Experiment 3 replicated the results of Experiment 2 and examined the role of individual differences on LIWC scores. As in Experiment 2, an amusement-inducing film was associated with the use of more words related to positive emotions and positive feelings than other films, and the sadness-inducing film was associated with the use of more words related to negative emotions and sadness/depression. More intense experiences of amusement and positive affect after the comedy film correlated with more positive feelings words. It was also the case that one's typical

impulse strength predicted expressions of positive feelings. However, impulse strength and the intensity of one's emotional experience of sadness and negative affect after the funeral film were not related to emotional expression of negative emotion or sadness/depression. Perhaps this difference between amusement and sadness results from display rules in Western cultures that dictate greater expression of pleasant emotion than of unpleasant emotion (Gross et al., 2000).

There was little relation between dispositional expressivity and LIWC counts. Perhaps dispositional expressivity, as measured by the BEQ, is insensitive to the verbal expression of emotions. An examination of BEQ items supports this, as the items tap behavioral expressions such as crying, laughing, and facial expressions. One therefore cannot assume that dispositional expressivity (as measured by the BEQ) necessarily has implications for verbal expression.

The difficulty in predicting LIWC scores from individual differences was even more clear when we examined the Big Five and LIWC counts. Our findings that the Big Five were not correlated with LIWC counts replicates Pennebaker and King's (1999) findings and are consistent with Pennebaker, Mehl, and Niederhoffer's (2003) conclusion that self-reports of personality have only small correlations with word use. Granted, it is difficult to predict specific behaviors from personality measures (Mischel, 1968), but dispositional expressivity has been linked to nonverbal emotion expressive behavior in response to films in the past (Gross et al., 2000). It therefore seems that the use of emotion words in speech is not strongly related to dispositional expressivity or personality in a broad sense. Although there is some reason to believe that empirically derived factors of the LIWC (some of which include emotion word counts) have promise as indicators of individual differences (Pennebaker & King, 1999), our research suggests that the four LIWC emotion word counts we examined do not.

GENERAL DISCUSSION

From this investigation we can conclude that the LIWC is a useful means of measuring one's verbal expression of amusement and sadness. We are able to draw this conclusion because in these three experiments we manipulated the discrete emotional experience, and these emotional experiences mapped onto expression in predictable ways. In Experiment 1 we manipulated the target emotion of written autobiographical memories, and in Experiments 2 and 3 we manipulated momentary experience of emotions. Four LIWC categories—positive emotion, positive feelings, negative emotion, and sadness/depression—were consistently associated

with expressions of sadness and amusement in hypothesized ways. That these results were obtained across both written (Experiment 1) and oral (Experiments 2 and 3) expressions of emotion attests to the usefulness of the LIWC as a measure of different modalities of expression. Word use therefore appears to be a meaningful indicator of emotion that may be used as an alternative or complement to self-reports of emotion.

We chose to manipulate two emotions—amusement and sadness—that are prototypical markers of pleasant and unpleasant emotions (Gross et al., 2000). These studies indicated that the LIWC is sensitive to both differences along a broad continuum ranging from pleasant to unpleasant emotions and to differences between two discrete emotions. The most general emotion categories on the LIWC—positive emotions and negative emotions—differed as a function of whether amusement or sadness was expressed. At the more specific level, amusement was associated with greater expressions of positive feelings but not optimism, and sadness was associated with greater expressions on sadness/depression but not anger or anxiety/fear. It therefore appears that the profile of counts on the five specific LIWC emotion categories (positive feelings, optimism, sadness/depression, anger, and anxiety/fear) might reflect unique emotional fingerprints for different emotions. It is important for future research to investigate this possibility with emotions in addition to sadness and amusement.

These three studies also help to reduce concerns about the ability of linguistic text analysis programs to handle the context of emotional expressions. Pennebaker et al. (2003) noted that programs such as the LIWC may incorrectly classify words because of the program's inability to consider irony, sarcasm, and unusual sentence structure. For example, the sentence "I was not at all happy" would add to the positive feelings count because the word *happy* is included in the disclosure. This concern is partly alleviated by high correlations between LIWC emotion counts and judges' ratings of emotions expressed (Pennebaker & Francis, 1996; Pennebaker et al., 1997). We believe that the evidence of LIWC validity in our studies adds support to the conclusion that any problems with ignoring context are not sufficient to preclude the use of the LIWC as a measure of emotional expression.

It is of theoretical interest to note that Experiments 2 and 3 supported the idea that emotional experience corresponds with verbal emotional expression. There has been mixed evidence for congruence between one's emotional experience and one's nonverbal emotional expression (Fernández-Dols, Sánchez, Carrera, & Ruiz-Belda, 1997; Gross et al., 2000; Rosenberg & Ekman, 1994); far fewer studies have addressed the correspondence between emotional experience and verbal expression (cf. Lee & Wagner, 2002). In Experiments 2 and 3 we manipulated the experience of emo-

tion and found that expression, as measured by the LIWC, was consistent with those manipulated emotional experiences. It will be important for future research to establish this experience–expression link empirically so the degree to which the LIWC reflects one's emotional experience can be determined. A multimethod approach to this problem might manipulate emotion experience and measure the correspondence between psychophysiological responses, self-report measures, behavioral responses such as facial expression, and verbal reports as measured by the LIWC.

It is important to note that the process of writing an essay or speaking into a microphone for 2 min may be dissimilar to how emotional expression occurs outside the laboratory. Emotional expression does not occur in a social vacuum, and the quality and quantity of verbal expression are highly dependent on whether an audience is present (Pennebaker, Hughes, & O'Heeron, 1987). Despite this concern, research has shown that disclosing into a tape recorder may bring about psychological and psychophysiological changes that have relevance for long-term health (Murray & Segal, 1994; Pennebaker et al., 1987). Moreover, our study supported the idea of social sharing (Rimé, 1995) and other theories of disclosure (e.g., Stiles, 1987) that suggest that when people experience emotions they are motivated to verbalize their feelings. This occurred despite the lack of a confidant, suggesting that the need to share emotions occurs even in the absence of an audience. Using the method of Experiments 2 and 3, it would be important to test how our results would differ if one were disclosing to an audience rather than a tape recorder.

It may also be useful for future research to examine other aspects of word usage in response to the experience of emotions. An analysis of press conferences by Mayor Rudolph Giuliani (Pennebaker & Lay, 2002) revealed that during times of personal and professional stress, he used words indicative of more cognitive complexity, and he used more first-person singular pronouns than before the stressful periods. It may therefore be the case that when people are experiencing unpleasant emotions, they use more words that reflect cognitive processing and more first-person singular pronouns. Investigating nonemotion words that people use while experiencing intense emotions may add to our understanding of the underlying mechanisms of emotion processing. Although this was beyond the scope of our studies, future research aimed at these hypotheses may help elucidate the connection between word usage and well-being.

Another future direction for this line of research may be a more refined focus on gender and cultural differences in the LIWC's ability to measure the expression of emotions. In the current research, we focused on samples made up primarily of Caucasian American women. A focus on women is common in this research tradition (Gross et al., 2000, Study 2; Lee & Wagner, 2002); accordingly, our findings are readily integrated into this

literature. However, gender and cultural differences exist in the expression of emotion (Brody & Hall, 2000; Kring & Gordon, 1998; Wellenkamp, 1995), and future work may benefit from multiple group comparisons.

It is also important to extend this research to the expression of other discrete emotions. We expect that these findings with sadness and amusement would generalize to other discrete emotions, but the LIWC is limited in its emotion categories. The LIWC assesses a broader range of discrete negative emotions (i.e., sadness, anger, and anxiety) than positive emotions (i.e., optimism); however, even the negative emotion categories are not comprehensive. For example, it is unclear whether emotions such as shame, guilt, and embarrassment would be uniquely identified by the LIWC categories because these discrete emotions are not counted separately. The categories for positive emotions (i.e., positive feelings and optimism) are even less comprehensive than the categories for negative emotions (although the positive feelings category may serve as a catchall category for positively valenced emotions, including amusement). The value of disclosing positive emotions has been demonstrated empirically (Pennebaker & Francis, 1996; Pennebaker et al., 1997); therefore, the study of positive emotion expression is warranted. Future research efforts might focus on the creation and validation of new emotion categories for the LIWC that are sensitive to a wider array of discrete emotions than sadness and amusement. Even in its present form, however, it appears that the LIWC has promise as a tool for measuring emotional expression.

Notes

This research was supported by a University Research Grant provided by Illinois State University. We thank William Graziano, Margaret Nauta, and W. Joel Schneider for their comments on an earlier draft of this manuscript. We also thank Bethany Munge, Lane Fraley, and Kelly Taylor for their assistance with data collection and Brooke Tetzlaff for her assistance with data analyses.

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