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Positive Emotion Word Use and Longevity in Famous Deceased Psychologists

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Objective: This study examined whether specific types of positive and negative emotional words used in the autobiographies of well-known deceased psychologists were associated with longevity. ***Methods:*** For each of the 88 psychologists, the percent of emotional words used in writing was calculated and categorized by valence (positive or negative) and arousal (activated [e.g., lively, anxious] or not activated [e.g., calm, drowsy]) based on existing emotion scales and models of emotion categorization. ***Results:*** After controlling for sex, year of publication, health (based on disclosed illness in autobiography), native language, and year of birth, the use of more activated positive emotional words (e.g., lively, vigorous, attentive, humorous) was associated with increased longevity. Negative terms (e.g., angry, afraid, drowsy, sluggish) and unactivated positive terms (e.g., peaceful, calm) were not related to longevity. The association of activated positive emotions with longevity was also independent of words indicative of social integration, optimism, and the other affect/activation categories. ***Conclusions:*** Results indicate that in writing, not every type of emotion correlates with longevity and that there may be value to considering different categories beyond emotional valence in health relevant outcomes.

Keywords: emotions, longevity, arousal, text analysis, positive affect

Emotion has long been held to be an important determinant of health and disease (e.g., Hippocrates 466–375 B.C.), however, the focus has almost exclusively been on the role of negative feelings in detrimental health outcomes. Only recently has attention moved toward the influence of *positive* emotions on health and well-being (e.g., Chida & Steptoe, 2008; Fredrickson, 1998; Pressman & Cohen, 2005; Seligman & Csikszentmihalyi, 2000). To date, the strongest and most provocative evidence has been that connecting "trait" emotional styles (reflecting a person's typical emotional experience) to longevity with findings revealing benefits of 2 to 23 extra years of life in those individuals with higher levels of positive emotional style (PES) (e.g., Levy, Slade, Kunkel, & Kasl, 2002; Maier & Smith, 1999; Ostir, Markides, Black, & Goodwin, 2000; Parker, Thorslund, & Nordstrom, 1992). Although these associations typically withstood statistical controls for an array of potential confounds (e.g., baseline health, age, sex, race, socioeconomic status), this is still considered only a suggestive literature with many conceptual and methodological limitations (Cohen & Pressman, 2006; Pressman & Cohen, 2005).

One seriously neglected issue in the field has to do with the *types* of positive emotions that may influence health. Existing work merely differentiates between positive and negative emotions; however, there are many other characteristics to consider. One critical typology of affect for health researchers is that of arousal, which is thought to be a primary pathway linking emotional experiences to health (Cohen, Kessler, & Gordon, 1995; Krantz, Glass, Contrada, & Miller, 1981; Pressman & Cohen, 2005). Circumplex theories are one example of models of emotion that place importance on arousal by using two orthogonal dimensions, activation and valence, as the central components of affect (e.g., Russell, 1980). Affect adjectives can be categorized by where they fall on a two-dimensional plane resulting in four quadrants (high activated positive affect [e.g., excitement], unactivated positive affect [e.g., calm], high activated negative affect [e.g., anxiety], and unactivated negative affect [e.g., sadness]). Similarly, Thayer (1967, 1970) factor analyzed mood adjectives into an Activation-Deactivation check list with the goal of representing physiological arousal (e.g., skin conductance, heart rate) via self-report. Emotions were categorized as "General Activation" (e.g., full-of-pep, energetic), "High Activation" (e.g., fearful, jittery), "General Deactivation" (leisurely, calm), "Deactivation-Sleep" (e.g., drowsy, tired). While not specifically delineated by the author, these subscales map on to the circumplex dimensions. This issue remains relevant today given that the Positive Affect and Negative Affect Schedule (PANAS; Watson & Clark, 1988), one of the most commonly used emotions scales in the health psychology field, only assesses *activated* adjectives creating a concern if unactivated emotions are an important contributor to health.

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Another significant concern in the emotion-longevity literature arises from the (moderate) negative correlation generally found between positive and negative emotions. Because greater levels of negative emotional style (NES) have been frequently associated with poorer health outcomes (see reviews by Carney, Freedland, Miller, & Jaffe, 2002; Herbert & Cohen, 1993; Kiecolt-Glaser, McGuire, Robles, & Glaser, 2002; Krantz & McCeney, 2002), it is possible that the reported association of PES and increased longevity may merely be a product of persons with higher PES having lower NES. Existing studies of emotional styles and health generally include one or the other measure making it impossible to test whether associations with health are attributable to variations in NES, PES, or both.

There is also concern that measures of PES in this literature may be markers of social and/or positive cognitive dispositions such as sociability and optimism, which are also thought to be important predictors of health outcomes (Cohen, Alper, Doyle, Treanor, & Turner, 2006; Pressman & Cohen, 2005; Scheier, Carver & Bridges, 1994). In general, these factors have moderate associations with PES, but few existing studies control for the possibility that they and not PES are responsible for reported associations of PES and health.

Finally, most studies on the role of emotional styles in health base scores on self-reports of emotions. Because it is socially desirable to report more positive emotions (e.g., Diener & Suh, 1999) and self-reports of affect can be influenced by response styles (Lucas, Diener, & Larsen, 2003) it is advantageous to use other modes of affect measurement when possible (Diener, Suh, Lucas, & Smith, 1999). Assessing the components of writing has been proposed as an independent and meaningful way to study various trait differences (McAdams, 2001; Pennebaker & King, 1999), and when collected outside of a research context, may result in less self-presentation bias (Fazio & Olson, 2003). This procedure was used by Danner, Snowdon, and Friesen (2001) who hand coded short autobiographies written by a group of nuns when they were in their 20s. They found that more positive words in the writing samples were associated with lower mortality 65 years later but that negative words were not associated with longevity. Although extremely provocative, the generalizability of this study is uncertain given that the sample was made up of women belonging to a religious order and interpretation is complicated by the lack of health data at baseline. Moreover, their dictionaries distinguished word based on valence but not activation. More recent studies of emotion word usage in text have used the Linguistic Inquiry and Word Count program (LIWC; e.g., Pennebaker, Francis, & Booth, 2001) because of the program's ability to quickly and automatically calculate the different categories of words used in digitized texts although the standard emotions word lists utilized (i.e., dictionaries) do not differentiate words on activation level and include adjectives and behaviors in addition to emotions. This makes the existing LIWC emotion dictionaries unsuitable for the specific types of affect questions remaining in the PES-health literature.

The current study assesses emotional styles using scales drawn from established emotion measures that tap both the valence and activation dimensions of affect and automated word counting technology. The primary measure is consistent with a circumplex model of emotion and included words falling into quadrant combinations of positive/negative valence and activation/unactivation (Mackay, Cox, Burrows, & Lazzerini, 1978). For convergent validity and comparative purposes, the expanded version of the PANAS (Watson & Clark, 1994) was utilized to examine other variants of emotion not included in the Mackay scale and the LIWC was used to contrast general affect approaches from this study's more specific emotion technique. Finally, the LIWC affect subscales (sadness, anxiety, and anger) were included along with an author-created humor scale since this is a high activation emotion type that has been previously tied to health (e.g., Martin, 2001) but was untapped by other scales. This study tests the potential independent association of different types of emotion with longevity, and whether any found effects can be accounted for by demographics, native language, or emotion–related constructs. While objective health data at baseline was not available, health was controlled by examining the use of words describing self-ascribed illness.

Method

Participants

The sample included 88 influential researchers who each contributed an autobiographical piece to a seven volume series entitled "A History of Psychology in Autobiography" (e.g., Murchison, 1961). Individuals were chosen because of their great influence on different areas of contemporary psychology with some falling within the mainstream of the field and others picked from outside the field because they contributed to moving psychological research and theory in a new direction. The subjects' names are listed in the appendix. To obtain a sample of emotion words that broadly reflect life experience (and is not confounded with how many words an author used to discuss his or her work), analyses were restricted to the personal segments of the autobiographies. Out of 96 possible subjects, seven were excluded because they omitted personal information and focused solely on research. One additional subject was excluded for being alive at the time of analysis. In the final sample, individuals were born between 1843 and 1926, lived an average of 79 years, were 66.7 at the age of publication of their autobiographies, and lived on average 12.3 years postpublication. The final sample was primarily male (three females) and entirely White.

Biographic and Demographic Information

Biographic (birth date and death date) and demographic (sex, race) information was collected from the autobiographies themselves, online encyclopedias, obituaries, and psychology departments. Whenever possible, more than one source was used to provide this information. Year of publication of each volume was used to estimate age of the author when the autobiography was written. Longevity was defined as the number of days between the date of birth and date of death.

Word Counts

Several different word count measures were used. In all cases "word counts" represent the *number of times* words from a given subcategory (dictionary) were mentioned *divided by the total number of words* in the text resulting in a percentage score.

Measures of activation and emotional style. Word count dictionaries were created using items directly from a model of affect designed to assess self-reported activation (Mackay, Cox, Burrows, & Lazzerini, 1978). This 34-item scale was based on factor analyses of previous scales designed to assess the arousal continuum within mood adjective checklists (Nowlis, 1965; Thayer, 1967). While the words were originally differentiated only on the arousal continuum, for the purpose of this paper, words were assigned into categories based on positive or negative valence and low or high activation. Activated and unactivated positive words were each assessed with eight items (active, energetic, vigorous, alert, lively, activated, stimulated, and aroused for activated PES; peaceful, relaxed, cheerful, contented, pleasant, comfortable, calm, and restful for unactivated PES). Activated negative words were measured via 11 items (tense, worried, apprehensive, bothered, uneasy, dejected, uptight, jittery, nervous, distressed, fearful) while unactivated negative words were based on seven items (drowsy, tired, idle, sluggish, sleepy, somnolent, passive). In all dictionaries, when the emotion adjectives had more than one tense of use, word stems were used to account for all versions of the adjective (e.g., "relax" stem would include relax, relaxed, relaxation etc.).

Coding dictionaries were also created by using the exact items from the PANAS-X (Watson & Clark, 1994). Items in the PANAS are generally considered to represent "activated" emotions and are assessed with 10 items each (negative affect [NA]: e.g., afraid, guilty, upset; positive affect [PA]: e.g., active, enthusiastic, inspired). Also included were the seven basic emotions subscales from the PANAS-X including self-assurance (6 items; e.g., proud, confident), attentiveness (4 items; e.g., alert, determined), joviality (8 items; e.g., cheerful, happy) for the positive subscales, and fear (6 items; e.g., afraid, nervous), hostility (6 items; e.g., angry, irritable), guilt (6 items; e.g., guilty, ashamed), and sadness (6 items; e.g., lonely, downhearted) for the negative subscales. Subscales have minimal item overlap with the general scales. As is evident from the words used, the specific positive subscales are *all activated*. The negative subscales are a mix of activated (fear, hostility, guilt) and unactivated (sadness) items.

It was important to use a measure that has previously been used in linguistic analysis and one that contained a larger number of words, therefore the LIWC 2001 measures of emotion were also included (Pennebaker et al., 2001). Positive (261 words) and negative (435 words) emotion scores are not differentiated on activation and include some nonemotion words (e.g., adjectives, behaviors). Importantly, the majority of the words from the shorter affect scales described above were included within these broader LIWC scales. The LIWC negative emotion subscales were also included that are: anxiety (62 words; e.g., afraid, sickened, vulnerable), anger (121 words; e.g., wicked, temper, ugly, fight, hate), and sadness (72 words; e.g., low, useless, weep, lonely). There are no LIWC positive emotion subscales, however, a humor/laughter dictionary was created by the researchers based on 10 terms drawn from the LIWC positive emotions (chuckle, laugh, funny, humor, giggle, hilarious, fun, hilarity, jolly, silly). Please refer to Figure 1 for a list of all emotions measures and their theorized activation levels.

Cognitive and social measures. Two other concepts that are often closely associated with positive emotions were assessed: optimism and social integration. Optimism was measured using the optimism dictionary from the LIWC which includes a number of cognitive, emotional, and descriptive adjectives (69 items: e.g., bold, certainty, hope, optimism, pride, superior, win). Social integration/sociability was measured with a social role index (103 terms) which included words such as husband, wife, family, friend,

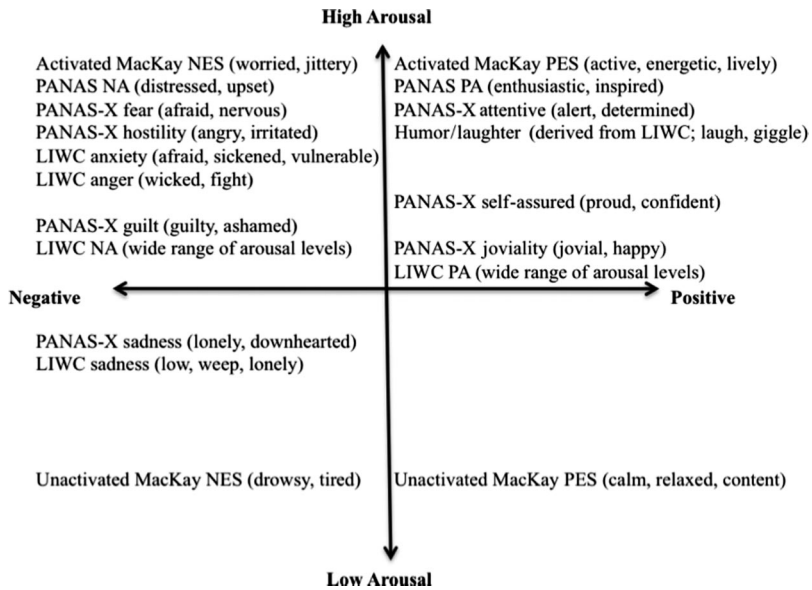

Figure 1. The theorized arousal levels of the different emotions scales utilized in this study. Word lists (directly derived from existing affect measures) are placed on a scale of high to low arousal and positive to negative valence. This model parallels existing circumplex models of affect (e.g., Russell, 1980) although the location of the specific affect measures is not based on data from these exact scales. Locations of affect types *within* the clusters are not meant to be informative but only the general location within each quadrant (high, middle, low).

partner, grandparent derived from an existing writing measure of social networks (Pressman & Cohen, 2007).

Participant Characteristics

Illness. Each autobiography was manually read and tabulated for mentions of illnesses that were suffered by the author (e.g., sick, cancer, hypertension, ill, emphysema, disease, diabetes, heart attack, angina, stroke, ulcer, epilepsy). The assumption was that individuals who had suffered from a serious disease would write about it. Manual counting was used on only this occasion because computerized counting would capture the illness occurrences of others.

Language. It is feasible that the native language of the author could influence emotional expression in writing. A variable that indicated whether the life story was translated was created ($N = 20$ translated).

Procedure and Apparatus

Since the current questions focused on emotional word use, text analyses were done on personal segments of the autobiographies. Specifically, the sections devoted to childhood, education, family, culture, and growing up as opposed to sections focused on later research. This was necessary because several subjects study emotions (confounding the predictor variables of interest) and also because research was discussed in a less emotional fashion.

Research assistants identified these personal sections from each autobiography then scanned them into an image file (PDF/TIF) using a Gestetner 7502 Xerox machine with 1,200 × 1,200 dots per inch (dpi) resolution. Autobiographies were then analyzed with ABBYY Sprint 5.0 object character recognition technology. Each autobiography was proofread for scan errors and to remove superfluous information (e.g., page numbers, captions, footnotes, headers). A word count software program was developed to calculate the extent to which different categories of words were used. The "Word Count" program counts the total number of words as well as the frequency of words and words stems in a specified dictionary.

Autobiography personal content ranged widely from 280 words to 9,814 words ($M = 1{,}862.6$; $SD = 1{,}405.4$ words), however, total words were not associated with longevity ($p = .97$). Although not statistically significant, the seven excluded participants without personal content in their writing samples (discussed earlier) lived on average, 2.8 fewer years than their personal-content included counterparts ($F = .578$, $p = .46$).

Primary Statistical Approach

The primary analytical technique for this study was to examine whether different types of emotion categories (Independent Variables [IVs]) were associated with longevity after controlling for the appropriate covariates in Hierarchical Multiple Regression models. This approach tested three types of affect variables as the IVs: (1) The MacKay scale with separate testing of the four valence and activation quadrants; (2) PANAS measures, and (3) LIWC emotion scales as the IVs. The goal of these analyses was to determine which *types* of emotion were tied to longevity. A secondary analytical question was whether the negative and positive valence measures had similar explanatory power and whether they were independent of one another. This was tested by including positive and negative variables in the same regression and examining the decrease in explained power of the initial IVs. Next those variables that were shown to be significant were forced into a regression model with variables thought to be closely related to PES. Covariates for assessment of longevity including sex, year of birth, health (illness words), language, and age at time of publication were included in ALL regression models irrespective of associations with the IVs or longevity.

Results

Based on Pearson's correlations, age at publication was the only control variable correlated with longevity ($r = .40$, $p < .01$), however, the use of more self-ascribed illness words was marginally associated with a shorter life span ($r = -.16$, $p = .1$). Control variables were generally not correlated with the four main affect word count variables, with the exception of associations between age at publication and unactivated PES ($r = -.22$, $p < .05$) and activated NES ($r = -.25$, $p < .05$).

Word usage in the Mackay emotion scales was skewed for three out of the four scales with skewness values of 2.4 (unactivated PES), 3.1 (unactivated NES), and 3.8 (for activated NES). This was because of greater than 58% of individuals not using these word types in their autobiographies, or specifically 76 and 72 nonusers for unactivated and activated NES respectively (range of 0–5 and 0–2 uses in text), and 58 nonusers for unactivated PES (0–3 uses in text). Because of this irregular distribution in word use, data could not be normalized and therefore variables were dichotomized into those who did and did not use the words. Activated PES had a skewness statistic of .60 allowing the data to be analyzed as a continuous variable (range of 0–9 uses in text). However, to enable comparisons to the other dichotomous word categories it was also dichotomized into words used or not used ($N = 23$ not used). Phi coefficients were examined to determine the association between the dichotomized emotion categories revealing a correlation between unactivated NES and unactivated PES ($\varphi = .32$, $p < .01$) and a weak association between activated NES and unactivated NES ($\varphi = .19$, $p = .07$).

Results of individual linear regression analyses of each of the four scales appear in Table 1. As apparent from the table, only activated PES was significantly associated with *increased* longevity ($p > .2$ for other three scales) accounting for approximately 6% of the variance in longevity. The same result was found whether examining activated PES as a continuous or dichotomous variable. There was a 5-year advantage for those who used activated positive words versus those that did not (see Figure 2). To determine whether the association of activated PES and longevity was independent of the other scales, a single regression equation was utilized including all four Mackay emotion measures. Activated PES remained significantly associated with longevity when assessed continuously ($\beta = .22$, $p < .05$) or when assessed as a used or not used variable ($\beta = .20$, $p < .05$).

Next the PANAS dictionaries were tested. General PA from the PANAS (i.e., the standard 10 item scale) was normally distributed (skewness rating of .84, 8% nonusage, range of 0–43 uses) but NA had 62% nonusage (skewness rating of 4.37, range of 0–6 uses). The PANAS-X subscales were not normally distributed with a

Table 1
Independent Hierarchical Multiple Regression Analyses Predicting Longevity From Different Emotion Types and Dictionaries (Adjusted for Covariates)

Predictor	β
Block 1 (covariates entered together)	
Date of birth[1]	0.16
Age at publication[1]	.40**
Sex[2] (1 = male, 2 = female)	−0.01
Health[1]	−0.07
Translated[2] (1 = yes, 0 = no)	−0.17
Block 2 (each entered in separate equation)	
Positive emotional style	
(High arousal)	
Activated PES[2] (MacKay)	.22*
Humor/laughter[2] (created from LIWC)	.36**
PANAS PA[1]	0.02
PANAS-X attentiveness[3]	0.20†
PANAS-X self-assured[2]	0.24*
PANAS-X joviality[3]	−0.05
(Neutral/mixed)	
LIWC positive emotion[1]	0.12
(Low arousal)	
Unactivated PES[2] (MacKay)	0.10
Negative emotional style	
(High arousal)	
Activated NES[2] (MacKay)	−0.11
PANAS NA[2]	0.05
PANAS-X hostility[2]	0.05
PANAS-X fear[2]	0.10
LIWC anger[1]	0.01
LIWC anxiety[2]	0.07
(Neutral/mixed)	
PANAS-X guilt[2]	0.07
LIWC negative emotion[1]	0.06
(Low arousal)	
LIWC sadness[2]	0.03
PANAS-X sadness[2]	0.17
Unactivated NES[2] (MacKay)	−0.08

Note. Results are sorted based on valence and arousal level. All emotional style types were entered independently in separate equations after covariates. $N = 88$; PES = positive emotional style; NES = negative emotional style; PANAS = Positive and Negative Affect Schedule; NA = negative affect; PA = positive affect; LIWC = Linguistic Inquiry and Word Count.
[1] Entered as a continuous variable. [2] entered as a dichotomous variable. [3] entered as dummy variables in tertiles (reported as high group versus else).
† $p < .10$. * $p < .05$. ** $p < .01$.

range 30–65% nonusage. To assess the association of these scales with longevity, continuous measures were utilized when appropriate (normally distributed data with skewness ratings <1.5), the data were dichotomized for those variables with greater than 50% nonuse, and tertiles were used for those variables in the middle (i.e., with approximately one-third nonusage). Variables that were tertiled were dummy coded for analysis. As is apparent from Table 1, neither the PANAS PA nor NA scale was associated with longevity. However, two of the PANAS-X positive subscales were associated with increased longevity (one marginal) accounting for approximately 4% of the variance in life span each. This represented a 3-year advantage for those who used attentive words and a 2.7-year advantage for those who used self-assurance words (vs. nonusers). Joviality was not associated with longevity nor were the NA subscales.

Finally, when examining LIWC affect measures, both positive and negative scales were normally distributed (skewness under 1.5; 2–161 and 0–92 uses, respectively) but neither was associated with longevity, nor were the LIWC negative subscales (all ps $> .2$). The humor/laughter words subscale usage was skewed with 72% of the population not using them (0–3 uses) and was therefore analyzed as a used/not used category. As is apparent from Table 1, use of these words was associated with increased longevity, accounted for 8% of its variance, and amounted to a 6-year advantage for humor word users.

Other Plausible Explanatory Factors

Optimism was not associated with longevity ($p > .2$) and including it as a covariate did not alter any of the associations between significant positive measures and longevity (all betas remained the same and with $p < .1$). As noted in the methods, the optimism dictionary included some PES/PA words. When these were excluded from the word list (5 overlapping constructs), it remained uncorrelated with longevity ($p > .5$). Using more social words was associated with greater longevity ($\beta = .24$, $p < .05$) per previous findings (Pressman & Cohen, 2007); however, inclusion of this factor in the separate regressions had little to no effect on the association between any of our activated positive variables (Activated PES, humor/laughter, and PANAS-X attentiveness and self-assuredness) with all betas and significance levels remaining approximately the same.

Given the small number of females ($N = 3$), the primary PES findings were reanalyzed without them in the sample. No major changes occurred with their removal with the largest change being a standardized beta weight change from .22 (self-assured) to .20 (new $p < .1$) and vice versa for attentiveness (change from .20 to .22, new $p < .05$).

Finally, there may be some question as to whether there is a significant effect in years lived *after* writing the autobiography (or whether findings are an artifact of living a longer life and therefore being able to contribute a life story). Because analyses control for date of birth, *as well as* age at publication, this had been statistically controlled to some extent, however, to be conservative results were additionally tested with the outcome years lived *postpublication* (controlling for standard covariates). Analyses revealed no major differences in any emotion associations. For example, the activated PES finding revealed a significant association with longevity ($\beta = .23$, $p < .05$) nearly identical to the past association ($\beta = .22$, $p < .05$) and humor showed no substantial change (βs were .31 with new assessment vs. .36 for old, both ps $< .01$).

Discussion

This study found that including different types of activated positive emotion words in one's autobiography was associated with approximately three to six additional years of life for those who included at least one of these word types. These associations withstood accounting for covariates such as date of birth, sex, age at publication of autobiography, health, NES, and language. To help the reader understand what it looks like to be high in written activated PES, two examples from the text are included: (1) "*By*

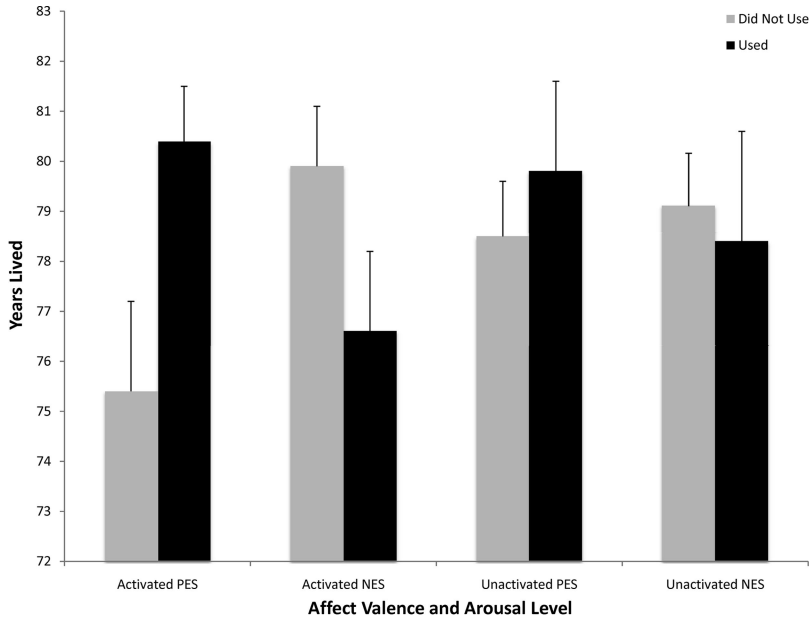

Figure 2. The unadjusted associations between activated and unactivated measures of emotion (PES and NES) with longevity. For the figure, emotion categories are dichotomized into those who did and did not use the words in each category. Error bars represent standard errors.

the spring, after lying awake all night in the excitement of genuine vocational choice . . . I decided to take an MA in psychology." and (2) "*I entered with zest all those extracurricular activities which make up college life in a small town. Life was vital and enjoyable.*"

Because previous studies of affective styles and longevity have not classified affective styles based on activation, there are no comparable data. However, it is possible that previously published associations between PES and longevity were driven by the activated components of the scales. This is especially likely given that many health studies rely on scales heavily weighted with aroused adjectives such as the PANAS (Watson & Clark, 1988) and the Profile of Mood States (McNair, Lorr & Droppleman, 1971). These data are however consistent with those from a prospective viral-challenge study on the role of emotional styles in susceptibility to the common cold. There, among the four quadrants of emotion, activated positive emotions were the primary predictors of resistance to illness among healthy people exposed to a cold virus (Cohen et al., 2006). Together with the evidence from the cold study, these data suggest that the valence/activation distinction may play an important role in understanding the association between affect and health.

It was surprising that negative emotions were not associated with longevity in this study given the vast literature showing that higher scores on negative traits such as depression, anxiety and hostility are associated with poorer health (e.g., see reviews by Carney et al., 2002; Hemingway & Marmot, 1999; Kiecolt-Glaser et al., 2002). As is apparent from Figure 2, there is a trend whereby those who use more activated NES words have shorter lives. That this association does not approach significance is likely because of the rarity of negative emotion usage in these samples. Given that these are published autobiographies, it may be that some individuals curbed negative emotion expression for self-presentation purposes. This may have also been the case for the nuns in the Danner and colleagues study (2001) given that there were comparatively low levels of NES expression (in comparison to PES) and also no found association of NES with longevity. However, it also may have to do with the increasing evidence indicating a positivity bias in the memories of older adults similar to our sample (e.g., Mather & Carstensen, 2005).

Activated but not unactivated PES was tied to longevity. Consistent with this finding, emotions researchers have purported that low arousal emotions are actually the absence of emotion (e.g., Watson & Clark, 1988) lending credibility to the current finding that activated PES is the critical ingredient to better health outcomes. That being said, the multitude of studies on relaxation interventions and the like would argue that feeling calm is also critical to health and well-being (e.g., Gruzelier, 2002), however, given that these studies frequently start with stressed individuals, the benefits of calm in healthy unstressed populations remain unclear. While it is tempting to assume that low usage of words is responsible for the lack of unactivated PES findings in this study, some high activation scales had *greater* nonusage (e.g., humor) but were still tied to longevity.

Why are activated positive words associated with increased longevity? One possibility is that there are physiological changes that occur in conjunction with arousing positive emotional experiences (e.g., improved vagal tone, increased endogenous opioids) that contribute to better health (Pressman & Cohen, 2005; Ryff & Singer, 2000). These changes may improve health through their influences on immune and cardiovascular function and may also aid in buffering physiological stress responses. It is also possible that activated PES terms may be tapping the author's perception of their health status (e.g., vigorous, active, energetic; Pressman & Cohen, 2005). If this is the case, the association of activated PES

and longevity may merely represent perceived health predicting longevity. This possibility was controlled for, albeit imperfectly, by adding a covariate for the percent of words referring to the author's own illnesses. Activated PES might also reflect physical fitness, however, a post hoc analysis of usage of 30 exercise words (not shown) did not reveal associations with longevity. Along the same lines, it is possible that those who aged *well* felt more positive. However, because neither objective age (date of birth, age of publication), nor perceived health, nor fitness could explain the association, this seems unlikely. While it is possible that subtle affective markers pick something up about the authors' health not represented by these terms, there is existing evidence from both mortality (Parker, Thorslund, & Nordstrom, 1992) and morbidity (Cohen et al., 2006) studies that PES-health associations are not explicable in terms of traditional perceived health measures. Finally, given the strong ties between social relationships, health, and positive emotions (Lyubomirsky, King, & Diener, 2005; Holt-Lundstad, Smith, & Layton, 2010) it was also possible that social relationships were responsible for the found emotion effects. The PES-longevity associations however, were independent from the influence of social integration (as measured in writing) raising the possibility of distinct pathways connecting emotion versus social relationships to better health. While there are hypotheses about separate mediators connecting these variables to health outcomes (e.g., oxytocin for social measures), to our knowledge no work has tested in a single study whether there are unique paths.

There was an interestingly strong association between age at time of publication and longevity, where those who wrote their autobiography later in life (e.g., in their 80s) lived longer. Part of this is likely because of the artifact of these individuals already outliving their life expectancy (and therefore living longer than the average for the sample), however, it is also interesting to consider that these individuals who are older may be different in some way. Analyses revealed them to have lower levels of activated NES indicating that they are less distressed which may produce some overall well-being benefit. There was however no association with *any* of the activated positive variables tested (all $ps > .4$) indicating that it was not simply living longer that was responsible for the found PES-longevity associations. This issue was further addressed by examining years lived postpublication as a dependent variable (as opposed to overall longevity) and all of existing activated PES findings persisted despite this new modeling technique. While there was no PES association with age at publication, because some of these subjects were still productive and working late in their lives, it is possible that this life purpose is also extending their longevity (e.g., Boyle, Barnes, Buchman, & Bennett, 2009). While "life purpose" is not easily testable in writing, previous work has shown that finding meaning in the context of an expressive writing paradigm (tested by insight words and causal language) is tied to better health (e.g., Pennebaker, Mayne, & Francis, 1997). When these variables were tested in the current data (analyses not shown) they were not tied to increased life span ($ps < .3$).

This study has several strengths such as its indirect assessment of emotional style, assessment of different emotion *types*, and its controls for multiple alternative explanations including year of publication, year of birth, language, baseline health (via disclosed illness in writing), negative emotional style, optimism, and social integration. There is still the possibility that other variables such as unreported illness in writing, openness to experience, other personality characteristics, or other psychological and biological variables not assessed could account for both greater PES and longevity. This study is also limited by the lack of objective health data at the time of writing (e.g., those individuals who aged "well" may have been more positive) and the use of a self-reported health assessment in a published writing sample. This limits this study's ability to say anything about the causality or directionality of the findings. Additionally, while no psychologist in this study was listed as committing suicide in obituaries or other encyclopedia entries, it is impossible to say with 100% certainty that all causes of death were natural. The generalizability of these findings may also be limited given that famous psychologists differ from the general population. Nevertheless, it remains impressive that this sample of highly educated, and primarily male psychologists showed similar associations with writing PES and longevity as did the entirely female Danner et al. (2001) nun sample.

It may be that specific types of emotion are relevant to health in different scenarios, and that by diluting these constructs with other emotions (e.g., by looking at overall PES instead of subscales), researchers are missing out on potentially interesting findings. This study raises the possibility that it is not only important to distinguish between the effects of positive and negative emotions, but also the specific *types* of emotions within these domains.

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Appendix

The subjects included in this study are listed below in rank order based on age at death, with the longest life span being 98.07 years (Viteles) and the shortest being 55.04 years (Klemm)

M. Viteles (98.1)	G. Murphy (84.0)	J. Angell (80.0)	R. Dodge (71.0)
E. Hilgard (97.3)	M. Bentley (83.8)	H. Carr (80.0)	G. Allport (70.0)
H. Murray (93.8)	K. Groos (83.1)	R. Yerkes (79.7)	J. Konorski (69.8)
W. Miles (93.2)	B. Bourdon (83.0)	H. Helson (79.0)	D. Katz (69.0)
O. Klineberg (93.1)	C. Seashore (83.0)	L. Terman (79.0)	L. Thurstone (68.4)
R. Woodworth (93.1)	H. Pieron (83.0)	J. Drever (77.0)	M. Washburn[1] (68.3)
R. Cattell (92.9)	A. Michotte (82.5)	M. Mead[1] (77.0)	D. Krech (68.0)
A. Anastasi[1] (92.4)	R. Elliott (82.4)	F. Beach (76.1)	C. Hull (68.0)
S. Pressey (91.1)	K. Marbe (82.2)	W. Wirth (76.0)	E. Claparede (67.6)
J. Guilford (90.8)	E. Boring (82.1)	A. Luria (75.0)	D. Broadbent (67.0)
C. Stumpf (88.7)	C. Spearman (82.0)	C. Osgood (75.0)	S. Stevens (67.0)
C. Burt (88.7)	F. Bartlett (81.8)	J. Gibson (75.0)	H. Warren (67.0)
P. Janet (87.8)	F. Kiesow (81.6)	O. Mowrer (75.0)	Q. McDougall (67.0)
H. Hoffding (87.1)	H. Eysenck (81.6)	L. Carmichael (74.9)	W. Stern (66.9)
J. Dashiell (87.1)	T. Newcomb (81.1)	G. Thomson (74.0)	M. Calkins[1] (66.9)
T. Ziehen (86.8)	F. Allport (81.0)	E. Thorndike (73.9)	W. Hunter (65.4)
W. Pillsbury (86.7)	D. Hebb (81.0)	C. Judd (73.4)	C. Graham (65.0)
B. Skinner (86.5)	R. Sears (81.0)	C. Myers (73.0)	G. Ferrari (64.3)
Q. McNemar (86.1)	A. Gesell (81.0)	E. Tolman (73.0)	S. Franz (58.6)
K. Goldstein (85.7)	J. Jastrow (81.0)	S. De Sanctis (73.0)	O. Klemm (55.0)
C. Rogers (85.1)	J. Watson (80.8)	J. Baldwin (72.8)	
H. Simon (84.7)	J. Frobes (80.6)	K. Dunlap (72.7)	
K. Dallenbach (84.2)	F. Geldard (80.6)	H. Zwaardemaker (72.4)	
J. Piaget (84.2)	A. Gemelli (80.4)	W. Bingham (72.0)	
C. Morgan (84.0)	E. Scripture (80.1)	G. Heymans (71.8)	

[1] Female.

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Correction to Pressman and Cohen (2011)

In the article "Positive emotion word use and longevity in famous deceased psychologists," by Sarah D. Pressman and Sheldon Cohen (*Health Psychology,* Advance online publication. September 19, 2011. doi: 10.1037/a0025339), the bars in Figure 2 were mislabeled. The black bars should have been labeled the "Used" words category and the grey bars should have been labeled as the "Did Not Use" category. All versions of this article have been corrected.

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