Use of Social Words in Autobiographies and Longevity

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Objective: To analyze the relationship between social word use in autobiographies and longevity. Although there is substantial evidence that our social relationships are associated with mortality, interpretation of this work is weakened by the limitations of assessing the social environment with structured questionnaires and interviews. By analyzing the word content of autobiographies, we could assess spontaneous indicators of important social relationships and relate them to longevity. This technique is less subject to social desirability reporting biases and more sensitive to aspects of the social environment that are central to how one experiences his or her social world. **Methods:** The autobiographies of 96 psychologists and 220 literary writers were digitized and scanned for social relationship word frequency via a computerized word counting program. Archival data were collected on birth and death dates, year of publication, place of birth, age when the autobiography was written, and sex. **Results:** After controlling for sex, year of birth, and age at the time of writing, we found that higher use of words indicating social roles/integration (e.g., father, sister, neighbor, co-worker) was associated with an increased lifespan in both samples. Specific social categories assessing the use of family role terms (e.g., aunt, family, brother) and references to other individuals (e.g., they, we, us, everyone) also predicted longer life, but only in the sample of psychologists. **Conclusions:** Assessing social word use in autobiographies provided an indirect measure of social relationships that predicted longevity. This technique of analyzing writing samples may be useful in future archival research as well as in studies where it is desirable to study social relationships in an indirect fashion. **Key words:** social integration, social network, mortality, writing, autobiography.

ST = social ties; **LIWC** = linguistic inquiry and word count.

INTRODUCTION

Constructs such as social support, social isolation, loneliness, and social integration have been frequently tied to psychological and physical well being. A lack of a diverse social network and stable, supportive relationships has been associated with increased mortality (1–3), morbidity (4,5), higher rates of suicide (6), poorer immune function (7,8), and poorer health status as demonstrated by an array of indicators (9–12).

Social relationships are measured generally by questionnaires or interviews that ask about the existence of specific types of social roles in which a person participates (e.g., marriage, friends, social group, and church memberships), perceptions of loneliness or support, or the size and qualities of one's social network. Although informative, these measures may be vulnerable to a social desirability bias where reporting larger and more diverse networks or more social support makes one seem more attractive, while reporting loneliness and isolation is adverse due to the associated stigma (13). These self-report measures are also often insensitive to the *importance* of social relationships to the respondent.

We report two studies of the association between social ties (ST) and longevity that use an alternative approach to assess social involvement. The measure is a count of the use of "social relationship words" in published autobiographies. The assumption underlying this technique is that the use of such words increases to the extent that social relationships are central to one's self concept and day-to-day existence. Although there is no published research on social word use as a predictor of health or longevity, studies of writing samples have examined first person pronoun usage (using "I" and "me" frequently) as a marker of perceived isolation and first person plural usage (we, us, our) as an indicator of a communal orientation. For example, Stirman and Pennebaker (14) found that the work of poets who had committed suicide contained more first person singular self-references and fewer numbers of first person plural words as compared with matched nonsuicidal poets. Similarly, a study of undergraduates found that, when asked to write about their feelings about attending college, depressed and formerly depressed students used first person singular words more often than students who had never been depressed (15).

Although any writing sample can be a useful indicator of social perceptions, autobiographies are a particularly valuable indicator of relationships given that life stories are intended to indicate important and meaningful aspects of one's life. If an individual devotes much of the autobiography to discussing social contacts, it may indicate not only the existence of these relationships but also that they are central to the person's self concept. One previous study examined the influence of autobiographical emotion word use on longevity (16); however, this is the first study to examine social word usage in autobiography and its association with life span.

The purpose of the studies presented here is to examine if the frequency of social word use in published autobiographies predicts longevity. To help establish the generality of this association, we used autobiographies written by two different groups: well-known psychologists and contemporary literary authors. By analyzing these published autobiographies, we hoped to limit social desirability effects because the authors were not aware that their writing would be evaluated on this basis and we wanted to assess the social network as spontaneously generated by the authors. We examined the use of references to the social roles viewed as central to social integration (17) as well as to specific social categories such as family, friends, and communication words relevant to other individuals used in a previously validated computerized word

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Received for publication June 9, 2006; revision received November 14, 2006.

Research was funded by Grants HL65111 and HL65112 to the Pittsburgh National Institutes of Heath Mind-Body Center.

DOI: 10.1097/PSY.0b013e31803cb919

0033-3174/07/6903-0262

count (linguistic inquiry and word count, LIWC) program (18). By assessing the number of times other individuals are mentioned, we hope to tap how central ST were to the author's life.

STUDY 1: PSYCHOLOGISTS

METHODS

Subjects

The first sample included 96 psychologists who had contributed autobiographical pieces to an eight-volume series entitled "A History of Psychology in Autobiography" (beginning with volume 1 (19)). Precise birth and death date information was available for all but five authors. For two individuals, we were able to find the year of birth or death but not the precise date of one of the events. In these cases, we assumed they lived for the entire year (e.g., we used the "day" of their birth as the "day" of their death in the appropriate year). The psychologists were all white (100%) and predominantly male (96%); they were between the ages of 50 to 87 years when they wrote their life story (mean = 67.2; standard deviation (SD) = 7.1); and they lived on average 78.7 (SD = 8.8) years. Birth years ranged from 1843 to 1926.

Measures

Several word count measures were used to assess the frequency of social word usage. In all cases, "word counts" represent the number of times words from a given subcategory are mentioned, divided by the total number of words in the text resulting in a percentage score.

Social Ties Score

We created a ST dictionary based on the 11 types of social roles listed in the Social Network Index (17) (child, partner/spouse, parent, relative, close friend, student, neighbor, worker, volunteer, religious group member, social group member). The appendix lists the root words used in this dictionary. We calculated a cumulative ST score equal to the sum of all listed social roles (103 dictionary terms) mentioned, divided by the number of total words in the scanned text.

Linguistic Inquiry and Word Count

The LIWC default dictionaries (18) were designed for text analysis. We used the LIWC categories relevant to our question. The first is a broad social word category called Social Processes that includes words indicating other individuals or interactions with others (314 words: e.g., talk, us, friend[s], acquaintance[s], listen, group[s], meet). The remaining relevant categories are subsets of Social Processes and include Family (43 words: e.g., mom, brother[s], cousin[s], family, relatives); Friends (28 words: e.g., pal[s], buddy/buddies, co-worker[s], companion[s], roommate[s]); and Other References to people (54 words including 1st person plural words, as well as 2nd and 3rd person pronouns [e.g., y'all, we, they, her, everyone]). Seventy-three percent of the ST score words overlap with the Social Processes dictionary with differences emerging for words indicating social roles in clubs, work/school, religious organizations, and volunteering for the ST score. The Social Processes dictionary has approximately three times the words of the ST score and differs in its inclusion of communication words, both positive and negative (e.g., blame, argue, flatter, counsel), social behaviors (affair, celebrate, call), and general other person indicators such as pronouns and basic descriptors (e.g., she, his, adult).

Procedure and Apparatus

We scanned the first 10 pages of each autobiography in the seven volumes into an image file (PDF/TIF) using a Gestetner 7502 Xerox machine with 1200 × 1200 dots per inch resolution. Autobiographies (in PDF form) were then analyzed with ABBYY Sprint 5.0 object character recognition technology. Each autobiography was proofed for scan interpretation errors, spelling errors, and superfluous information that was not written by the author (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. "WordCount" counts the occurrences of words taken from specified lists (dictionaries). WordCount was written using standard GNU UNIX tools including "grep," "tr," and "wc." This program allowed us to determine the rate (frequency/# of total words) at which the author used social words by calculating the total of each of the categories based on a dictionary of words and word stems (to enable us to capture various forms of the word such as plural and singular tense).

Biographic (birth date and death date) and demographic information was collected from the autobiographies as well as from other sources such as on-line encyclopedias, obituaries, psychology department web sites, and in some cases, by contacting members of the department where the subject last worked. Whenever possible, more than one source was used to provide this information. We were able to determine sex and race from the autobiographies and the accompanying pictures. We also collected information on the year of publication of each volume to determine the author's approximate age at the time of writing the autobiographical piece (there was no information about how much in advance of publication the autobiographies were written).

RESULTS

Descriptive Data, Preliminary Analyses, and Analytical Strategy

The purpose of the psychologists' autobiographies was primarily to document their research ideas, and as a result, their writing was highly focused on research and theory. Preliminary analyses demonstrated very low percentages of social words as compared with the "book" standards available from the LIWC manual (18). Because of this, we included only the text components (paragraphs or defined sections) containing discussion of personal topics (e.g., family, childhood, schooling) in the analyses. In most cases, subtitles delimited the personal subsections of the text, or the appropriate information appeared in the first few paragraphs or pages of the autobiography as an introduction. Selection of relevant paragraphs was made by a research assistant and verified by the senior author. Both individuals were blinded to longevity. Screening for personal content resulted in the exclusion of six authors who did not reveal anything personal in their writing. Although not statistically significant, the six excluded participants lived, on average, 2.8 fewer years than their counterparts who included some personal content in their autobiographies ($F = 0.578$, $p = .46$).

Number of Words

The amount of personal content in the autobiographies ranged widely from 280 to 9814 words (mean = 1862.6; SD = 1405.4 words). Total word number was not associated with longevity ($p = .97$). Reanalysis against LIWC standards for published books (18) showed that percentage values found within the edited writing samples had comparable values and did not differ significantly from the standard ($t(16) = -1.80$, $p = .09$).

Control Variables

We used three variables as control factors in all analyses: sex, year of birth, and age at the time of publication. Of the three factors, only age at the time of publication was itself significantly correlated with longevity ($r = 0.38$, $p < .01$).

TABLE 1. Association Between Linguistic Inquiry and Word Count (LIWC) Social Measures and Longevity (After Controlling for Sex, Year of Birth, and Age When Autobiography was Written) in the Psychologist Study Using Linear Regression Analyses (n = 85)

Dictionary	Sample Items	Percent of Text (mean ± SD)	Standardized β	p
Social Processes	Talk, us, celebrate	6.1 ± 1.9	0.22	<.04
Family	Mom, brother, cousin	1.2 ± 0.9	0.22	<.05
Friend	Pal, buddy, coworker	0.2 ± 0.1	0.11	<.3
Others	She, their, them	2.6 ± 1.1	0.24	<.02

Variables were entered in separate analyses. The percent of total text that each variable accounted for and the standard deviation (SD) (mean ± SD) are also included in the table.

Statistical Analysis

We used linear regression with total days alive as the dependent variable and reported standardized β. Controls were forced into the first step of the equation, and the second step included the word count predictor variable of interest (percent of total text words in that category).

Social Category Information

The mean number of Social Processes words mentioned in the autobiography was 117.7 words representing approximately 6.1% of the total text (Table 1 for all subcategory values). The ST score had a mean of 30.8 mentions representing approximately 1.6% of the total text. The ST score was correlated with the Social Processes and Family variables of the LIWC and marginally with the Friends and Other References categories (Table 2). LIWC categories tended to intercorrelate with the exception of the Friends category.

Social Words and Longevity

The overall ST score was associated with increased longevity ($\beta = 0.25$, $p < .05$); those who mentioned social roles most (highest tertile) lived >6 years longer than those with the lowest ST scores (lowest tertile) (Figure 1). Of the four social measures from LIWC, three were also associated with longevity as depicted in Table 1. Specifically, Social Processes, Family, and Other References categories were associated with a longer life (Figure 2). The Friends category was not associated with longevity.

TABLE 2. Bivariate Pearson's Correlations Between the Social Ties (ST) Score and All Linguistic Inquiry and Word Count (LIWC) Measures in the Psychologist Study (n = 85)

	Social Processes (LIWC)	Friend (LIWC)	Family (LIWC)	Other References (LIWC)
ST score	.50*	.18**	.79*	.20**
Social Processes (LIWC)	—	.128	.71*	.86*
Friend (LIWC)	—	—	−.088	.094
Family (LIWC)	—	—	—	.36*

* $p < .001$, ** $p < .10$.

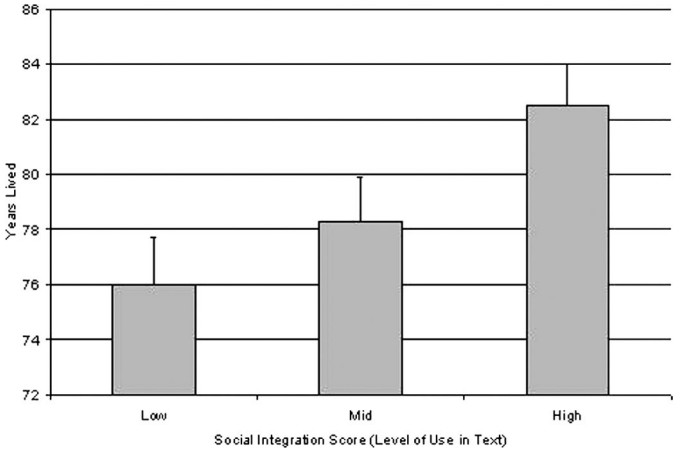

Figure 1. Association between the use of social roles in text (social ties score) and longevity (depicted in tertiles for visual purposes only) in Study 1 (psychologists).

STUDY 2: CONTEMPORARY LITERARY AUTHORS

METHODS

Subjects

Participants comprised 220 writers who contributed autobiographies in the first 11 volumes of a 30-volume series on literary authors (20). These authors were established writers from a variety of fields (poetry, science fiction, mystery, children's literature, nonfiction, and translation) who submitted approximately 10,000 word life stories. Nine authors were excluded for the following reasons: their autobiographies were written in a language other than English; they committed suicide; their birth/death information was not available; or in one case, the life story was published in handwritten form. The remaining 211 authors were born between 1911 and 1947; they were predominantly male (81.5%) and white (94.3%), with 2.8% black, 1.9% Asian, and 0.9% Latino. Most authors were born in the United States (64.9%) or the United Kingdom (21.8%).

Year of birth data were available for all 211 authors, but the precise month and day were not available for two participants. For these cases, because the participants were still living, we could not set their birth dates (month and day) as the same date as that of their death (as in the case for the psychologists). We therefore used a default date of January 1st as their birthday to ensure that their true birth date was encompassed. Given the recentness of these autobiographies, 64% of our participants (n = 135) were still living; 36% (n = 76) had died at the time of analysis. The average age at the time of death was 78.7 (SD = 9.6) years. The average age when the autobiography was written ranged from 41 to 88 years (mean age = 61.1 (SD = 10.9) years.

Measures

We used the same measurements described in Study 1.

Procedure and Apparatus

We used the same scanning tools and software described in Study 1 to analyze the first 10 pages of each of the 211 autobiographies. Biographic (birth date and death date) and demographic information was collected from the autobiographies themselves as well as from other sources such as on-line encyclopedias and obituaries. The publisher of the contemporary author series also maintains a web site with biographical information on all of its authors (available at www.galenet.galegroup.com). This site was very helpful in determining the birth dates for the majority of the authors; however, given that the site is not updated frequently, information on the recent deaths of some authors was not provided. For this reason, all authors with no death date listed

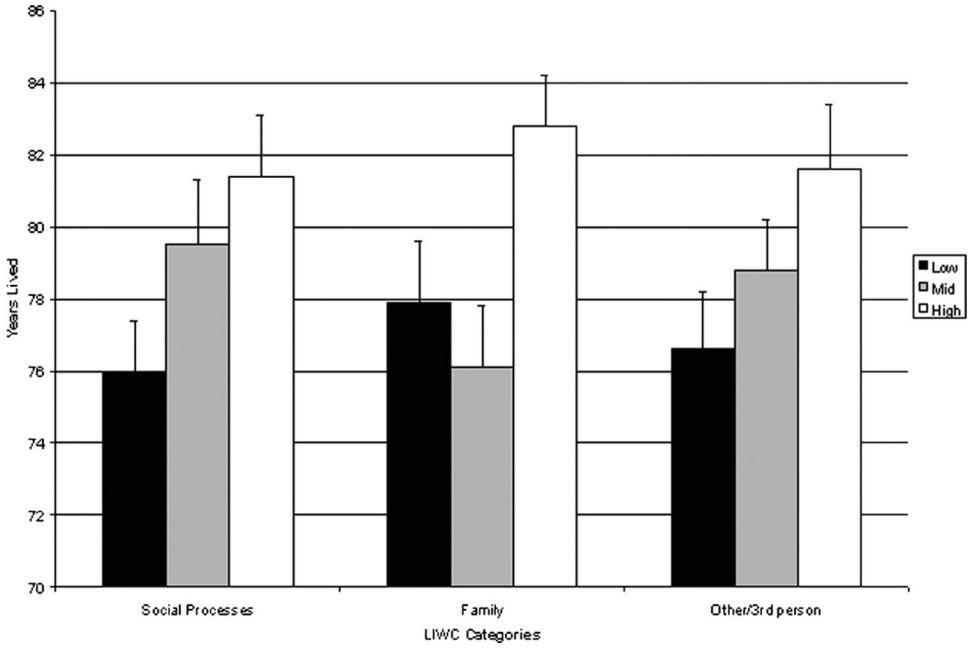

Figure 2. Association between the use of linguistic inquiry and word count (LIWC) social factors in text and longevity (depicted in tertiles for visual purposes only) in Study 1 (psychologists).

on the web site were also checked in other sources (similar to Study 1) to verify that they were still living. We could determine sex and race from the autobiographies and the accompanying pictures. We also collected information on the year of publication of each volume to determine the approximate age of the author at the time of writing the autobiographical piece.

RESULTS

Descriptive Data

To verify that we had a sufficient amount of social word use in our sample, we examined the associations between the LIWC standard published book percentages and our sample (18). There was no difference between the authors and the subsample of text from books ($t(16) = -1.60$, $p = .13$). Descriptive data are shown in Table 3.

TABLE 3. Association Between Linguistic Inquiry and Word Count (LIWC) Social Measures and Longevity (After Controlling for Sex, Year of Birth, and Age When Autobiography was Written) in the Literary Author Study Using Cox Regression Survival Analyses ($n = 189$)

Dictionary	Sample Items	Percent of Text (mean ± SD)	Standardized β	p
Social Processes	Talk, us, celebrate	7.6 ± 1.8	0.026	.7
Family	Mom, brother, cousin	1.1 ± 0.6	−0.19	.36
Friend	Pal, buddy, coworker	0.2 ± 0.1	0.52	.28
Others	She, their, them	2.8 ± 1.3	0.046	.21
ST Score	Brother, student, club	2.0 ± 0.8	0.47	.07

Variables were entered in separate analyses. The percent of total text that each variable accounted for and the SD (mean ± SD) are also included in the table.

Number of Words

The ten pages of scanned text from each author resulted in an average autobiography length of 6338.6 (SD = 1550.9) words. The variability in text length in these first ten pages was due to differences in the number and the size of photographs included by the authors. All autobiographies contained a large amount of personal content so there was no need to selectively edit.

Control Variables

We used the same three controls as in Study 1: sex, year of birth, and age at the time of publication. We analyzed these factors via logistic regression predicting the alive/dead outcome. Age at the time of publication was associated significantly with survival with younger people more likely to still be living ($\beta = 0.13$, $p < .001$), as was year of birth ($\beta = -0.15$, $p < .001$). Sex was not associated with survival ($\beta = 0.29$, $p = .45$), likely due to the small number of women in the study. Despite this, we included it as a covariate in the study due to its consistent association with longevity in most research. Race (analyzed categorically as white versus all other races) and country of origin (categorical) were also considered as potential covariates. Neither was associated with survival and they were not included.

Statistical Analysis

To analyze the effect of percent word use on survival, we utilized Cox regression survival analyses. This allowed us to model the time to death in our sample and account for censored data points (alive participants). It also allowed the use of multiple covariates (both continuous and categorical). Our first step in the model was entering the control covariates (sex,

TABLE 4. Bivariate Pearson's Correlations Between the Social Ties (ST) Score and All Linguistic Inquiry and Word Count (LIWC) Measures in the Literary Authors Study (n = 189)

	Social Processes (LIWC)	Friend (LIWC)	Family (LIWC)	Other References (LIWC)
ST score	.19*	.70*	.84*	.79*
Social Processes (LIWC)	—	.038	.34*	.20*
Friend (LIWC)	—	—	.41*	.73*
Family (LIWC)	—	—	—	.61*

* $p < .001$.

age at the time of writing, birth year). Our dependent variable was dead/alive, and our time variable was the amount of time each subject was in the "study." In the case of those who died, "study" time was their life duration. For those who did not die, "study" time was the amount of time that had passed between their birth and the date of data analysis.

Social Categories and Survival

Correlations between the ST score and LIWC social variables are shown in Table 4. Because the ST variable was not normally distributed, it was analyzed in tertiles for the survival analysis. Mentioning social network roles more frequently was marginally associated with an increased likelihood of survival ($\chi^2 = 3.22$, $p = .07$). This effect seemed to be driven by the difference between those at the top and bottom of social word usage; therefore, we compared the top and bottom tertiles that resulted in a significant positive association between network roles and survival ($\beta = 0.67$, $p < .05$) (Figure 3).

LIWC categories represented between 0.2% (SD = 0.2) and 7.2% (SD = 1.8) (for the Friends and Social Processes categories, respectively) of the total text; however, none of the LIWC social measures was associated with survival (all p values $>.15$) (Table 3).

Comparing Study 1 and Study 2

Because of the noncomparability of the β from Study 1 to Study 2 (linear regression versus Cox regression), we conducted the same Cox survival analysis on the sample of psychologists and examined the top and bottom tertiles of social word use, as we did for the sample of authors. We again found that those individuals using social words the most frequently, as assessed by the ST score and the LIWC Social Processes score, had increased longevity ($\beta = 0.86$, $p < .05$ and $\beta = 0.72$, $p < .05$, respectively). For comparative purposes, we show the ST finding in Figure 4.

DISCUSSION

In both the psychologist and literary writer samples, we found that the greater use of words that were markers of ST were associated with living longer. These analyses all controlled for sex, birth date and age at the time the autobiography was written. These results are consistent with those findings from prospective community studies in which more traditional questionnaire/interview measures have been used. By analyzing published autobiographies, we limited social desirability effects because the authors were not aware that their writing would be evaluated on this basis and we assessed the social network as spontaneously generated by the authors rather than cuing them as to what they should include.

Of the categories analyzed, the cumulative ST score, based on writing about the relationships and social roles typically listed in a standard social integration questionnaire, was the only one that predicted life duration in both studies. Frequent

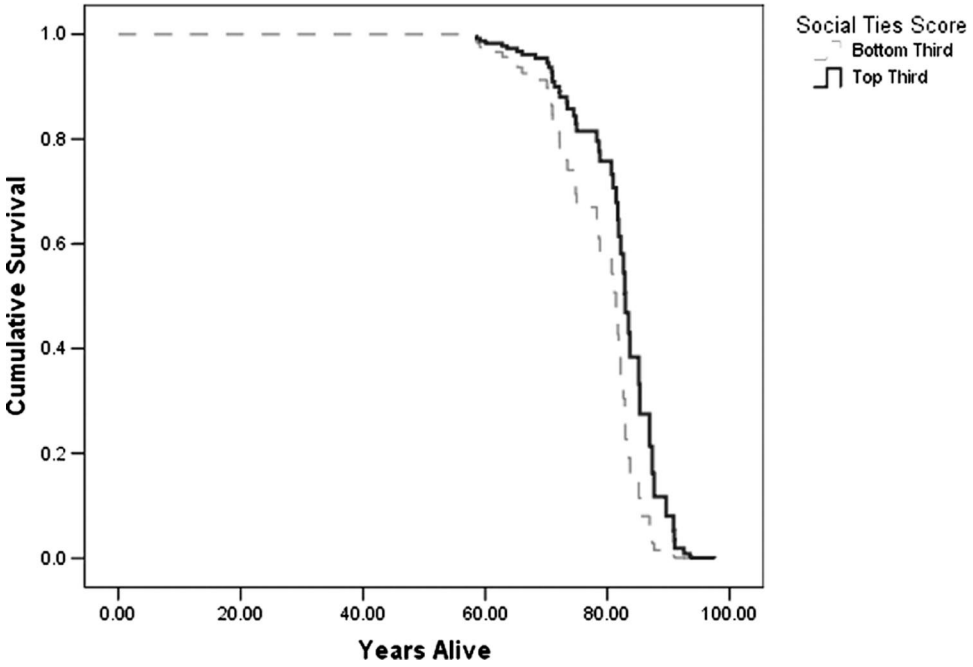

Figure 3. Association between the number of social roles mentioned (top and bottom tertiles of social ties score) and survival in Study 2 (literary authors).

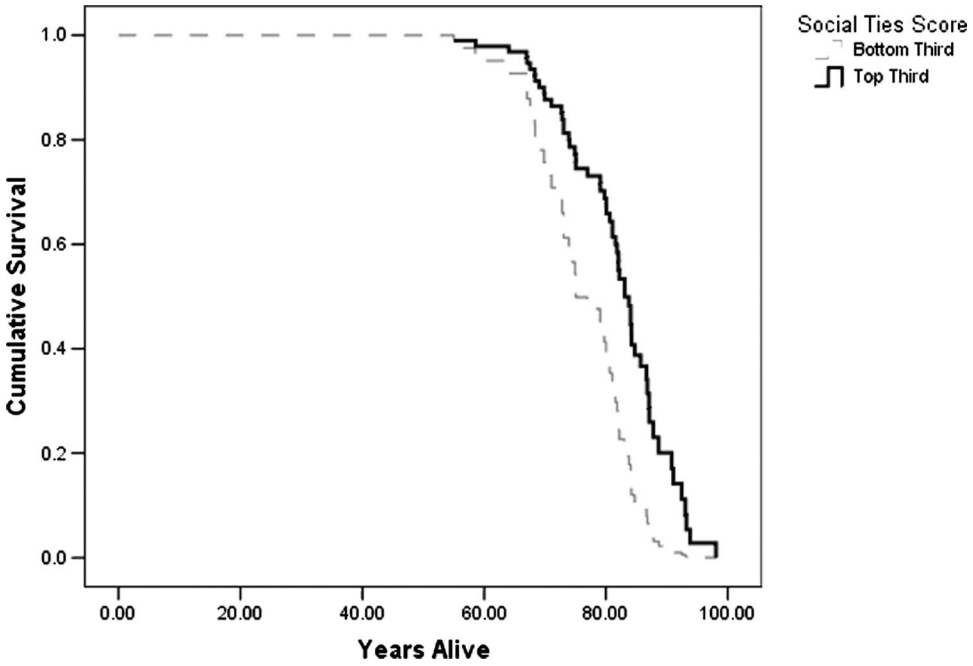

Figure 4. Association between the number of social roles mentioned (top and bottom tertiles of social ties score) and survival in Study 1 (psychologists).

reference to one's social roles and relationships in a life story seems to be a protective factor for longevity perhaps because individuals who allocate a relatively high percentage of their text to discussing them place a greater value on their social lives and have higher levels of integration or more social relationships. They may also spend more of their time participating in social activities and experience less loneliness and social isolation. Future studies should investigate the correlation between questionnaire/interview-based social measures and the use of social words to describe one's life.

A number of other social categories predicted longevity in the sample of psychologists but not in the sample of literary authors. Specifically, the family category from the LIWC (e.g., husband, sibling, mother) was found to predict a longer life. It is well established that married individuals have lower levels of morbidity and mortality and that this is especially true for men (21,22) who made up the vast majority of the sample of psychologists. Previous research had also found similar results in regard to the importance of close familial relationships in predicting well-being (23) and longevity (24). Making "other references to people" (using terms other than social roles) was also associated with improved longevity in the sample of psychologists. Those individuals who frequently used terms referring to other people (e.g., she, we, them, their, everyone) lived approximately 4.5 years longer than those who did so infrequently (top versus bottom thirds of usage). Perhaps those mentioning others infrequently were isolated throughout their lives, or at the least they described their life stories from a more solitary standpoint. Finally, the "social processes" category from LIWC was also associated with a longer life in the sample of psychologists.

The "Friends" category was not related to life duration in either sample nor was it correlated with the other social variables in the same fashion that the other social categories related to longevity in the sample of psychologists. This finding is likely due to the low usage of these words in autobiography (approximately 0.2% of total text in each sample). Although friends are an important component of one's social network, the autobiography may not be the appropriate venue to tap their importance and/or presence in the life of the author because life stories tend to be focused on immediate family, and in the case of our two populations, on work-life. Research focused on the importance of friendship would be better suited to tap a nonautobiographical text, or the autobiographies of younger student samples who do not yet have spouses and children to discuss in their life story.

Although the ST score predicted across both samples, the LIWC social scales were only relevant to the life span of the psychologists. Whereas our samples had comparable percentage values for social word usage, the participants diverged in numerous ways. There was a difference in the mean year of publication (40 years; 1883 for psychologists and 1926 for authors) as well as in the average age at the time of writing (67 years old for psychologists and 61 years old for authors). Also, the majority of the sample of authors was still alive at the time of the analysis. Then, it is possible that, with more statistical power (when the entire author sample has died), the LIWC social variables will similarly predict longevity as they did in the sample of psychologists. Finally, it may be that the ST score measures a component of social relationships that is important to longevity that the Social Processes measure lacks. For example, the inclusion of a broader range of social role words assessing worker and volunteer roles as well as religious social group participation may have increased the power of this assessment given that these factors have specifically been tied to better health outcomes (25–27). Alterna-

tively, the LIWC Social Processes measure's association with survival might have been weakened by the inclusion of words not specific to social relationships and roles like "celebrate," "admit," "ask," "express," and negative social words like "fight" and "blame."

There are several limitations in interpreting this work. Foremost is the lack of information on the health status of the authors at the time they wrote their autobiographies. It is possible that poor health over the authors' life span (or during the writing of the autobiography) altered the nature and range of their social interactions and/or the extent to which they thought about them. In turn, this could decrease the frequency of their use of social words. Also, the positive correlation between age at the time of publication and longevity suggests a (unavoidable) sampling bias where those who die when they are young (before the age when they were likely to be asked to write an autobiography) are excluded. Consequently, this should be thought of as a study of social relationships and longevity in older adults (>60 years old). Because we wanted to focus on deaths from natural causes, we did not include two suicides in our analyses. Although it is plausible that few social words in text would predict suicide due to its indication of social isolation, we did not wish to confound our measure of longevity. However, including those two individuals makes no difference to the results. Finally, these stories were written for public consumption and a desire to create a certain image may have altered their choice of subject topic. Perhaps if these life stories were private, more individuals would have admitted to social isolation and rejection. Future research will need to elucidate if truly isolated, less integrated, and/or lonely individuals use fewer social words in their life stories or if word use represents only a difference in cognitive representation of the social network.

We thank Brian Potetz for his work on the WordCount program and Michal Kollnesher for her assistance in digitizing the autobiographies. Finally, we express our appreciation to Peggy Clark, Vicki Helgeson, Anna Marsland, and Joel Greenhouse for their comments and assistance on the dissertation work that was the basis for this paper, and to Ellen Conser for her comments on a preliminary draft of this article.

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APPENDIX. Words and Word Roots for the Social Ties Score Dictionary

aunt.*	daughter.*	grandson.*	Mum's	son	wive.*
boss	employee.*	great-.*	neighbor.*	sons	worker
boyfriend.*	employer	husband.*	neighbour.*	Son's	worship.*
brother.*	exgirl.*	kin	nephew.*	spouse.*	
bud	faction	league	niece.*	step-.*	
buddies	father.*	lover.*	organization	stepfat.*	
buddy	fellow.*	manager	pal	stepmot.*	
buds	fiance.*	mate	pals	student	
child	folks	mates	parent.*	supervisor	
children	fraternit.*	meeting	parish	sweetheart.*	
church	friend	mom	parishioner.*	synagogue	
churchgoer.*	friends.*	momma.*	parishner	teach.*	
club.*	gang	mommy.*	partner.*	teacher.*	
colleague.*	girlfriend.*	moms	relatives	temple	
companion	grandchil.*	Mom's	roomate.*	uncle	
comrade	granddad.*	mosque	roomie.*	uncles	
congregation	granddau.*	mother.*	roommate.*	Uncle's	
cousin.*	grandf.*	mum	shul	union	
crew	grandm.*	mummy.*	sister.*	volunteer.*	
dad.*	grandpa.*	mums	society	wife.*	

* Indicates a root word where all forms of the root (eg., plural) are counted.