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Identifying linguistic differences between empty-nest and non-empty-nest youth on Weibo

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Abstract

Recently, empty-nest (EN) youth has aroused extensive concern of the Chinese public. This phenomenon is closely related with the social system, reflecting the current social changes in China. While advancing the urbanization, the EN youth has suffered from the homesickness and pressures from work, communication and housing. Therefore, the mental state and emotional expression of this group should be given enough attention. However, most of the current research is based on questionnaires or interviews, which are unable to provide direct and reliable evidence of emotional expression differences between EN and non-empty-nest (NEN) youth. By analyzing the microblog posts on Weibo, this paper aims to investigate the linguistic differences in emotional expression between EN and NEN youth. This study selected 5,040 EN and 8,000 NEN youths from 1 million active Weibo users. We conducted emotional analysis on original posts based on affective lexicon constructed by Dalian University of Technology, and compared the differences in emotional expression by independent sample t test. The results indicate that there are no practical significant differences between EN and NEN youth in their Weibo expressions; the results of two-way ANOVA indicate that there are significant differences in both gender and region (Qinling-Huaihe as the geographical boundary). This paper found that the EN state may not lead youth to have practical significant differences in emotional expression; EN status has different effects on youth of different genders and regions; Male EN and northern EN youths are more inclined to express inner emotions in online social networks than other youth.

KEYWORDS
emotional expression, empty-nest youth, linguistic differences

1 | INTRODUCTION

With the development of urbanization, more and more young people become empty-nest (EN). EN youth refers to the young people who live away from families and live alone in big cities. They are usually between 20 and 35 years old, with high level of education and decent jobs (Anlong, 2017; Wei & Xiaotian, 2017; Xiaohong, 2018). In 2016, a

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survey conducted by the China Youth Daily Social Survey Center reported that 64.3% of the respondents had numerous EN youths around them. "Lack of emotional support" (57.9%) and "poor dwelling conditions" (57.8%) are considered to be the two major difficulties faced by EN youths. More than half (55.1%) of respondents believe that being EN is both a living state and a state of mind (CYD, 2016). The phenomenon of EN youth has attracted researchers in different fields.

By surveying, researchers had contradictory findings about EN youths. Some researchers found that the most EN youths were

well-educated and had a strong sense of self-esteem and self-confidence (Shaohui, 2017). The other researchers believe that EN youths were lonely with poor life and simple social connection (Anlong, 2017). According to a population survey (Hu, 2017), EN youths generally had high living pressure, low sense of security, and strong loneliness. However, JinFeng (2017) found that although EN youths were not satisfied with life, they still could control their lives and had no significant mental problems. Rong (2019) showed that EN youths were highly self-closure and rarely communicate with others. Contrarily, ShuQie (2017) reported that EN youths still kept close contact with their family. Living alone even deepened the emotional bond between the EN youths and their parents instead of reducing it. Moreover, EN youths constantly built and maintained their social network with friends or colleagues through online and offline activities, though it requires more efforts.

The size of the EN youth population is very large in China (Alibaba, 2017). Most of EN youths are experiencing the dual test of family and career, often feeling difficult for the status quo and confused about the future (Yingying, 2016). Some works have been carried out to study the differences in mental status between EN youth and non-empty-nest (NEN) youth. Xiaohong (2018) reported that EN youth had a higher degree of depression, lower happiness and lower life satisfaction than NEN youth. Yun (2018) found that loneliness of EN youth was significantly higher than NEN youth, and social support and psychological capital were significantly lower than NEN youth. However, Wei and Xiaotian (2017) found that EN youths showed high sense of urban belonging, high sense of life control, and nearly the same degree of negative emotion, including anxiety, tension, and depression comparing to other youth.

Although EN youth attracts much attention, few in-depth interpretations and analyses has been conducted. Previous studies have three-obvious limitations. First, the results were based on small sample data so they were unstable. Second, some studies collect data by self-report which may introduce bias because of social desirability. Third, few works has psychologically studied not only the differences between EN youth and NEN youth, but also the intra-group differences in EN youth (demographic information as control variables). Consequently, these studies are difficult to fully reflect the true state of EN youth and have different results due to the influence of the sample. Further studies are required to understand the emotional expression and mental state of EN youth from different perspectives.

The large-scale of the EN youth group in China is caused by frequent social mobility, revolutionary concept of marriage, non-traditional lifestyle, and the one-child policy (Shaohui, 2017). Talhelm et al. (2014) found that people in different regions of China have differences in emotional and mental status. According to gender-specific patterns, males and females differ in experiencing powerful emotions (e.g., anger) and powerless emotions (e.g., sadness, fear) (Fischer, Rodriguez Mosquera, Van Vianen, & Manstead, 2004). Some research (Deng-Feng & Zhang-Ming, 2017; McRae, Ochsner, Mauss, JJD, & Gross, 2008; Xie, Lu, & Xie, 2015) found that males are more likely to express anxiety, depression, and loneliness than females. In addition, Eid and Diener (2009) found that norms for emotions were related to

emotional experiences. Therefore, there may be differences in emotional expression between EN youth and NEN youth in different regions and genders.

In recent years, Online Social Networks (OSNs) have been growing at an alarming rate, motivating users to share their interests and activities and build new or close social relationships. Sina Weibo (hereafter Weibo) is one of the most popular social networks in China. It is considered to be the Chinese version of Twitter, which is used by 42.3% of Chinese online users (CNNIC, 2019). As of September 2017, Weibo had a total of 376 million active users per month, and the number of daily active users reached 165 million (Center, 2017). Over 100 million microblog posts are published every day. Weibo is a platform for information sharing, dissemination and acquisition based on user interaction. Users provide detailed information (e.g., geographic location, gender) in their profiles, follow others, repost, and broadcast their own posts to their followers. In addition, they can use the format "@username" to remind someone to read this message (Chiu, Ip, & Silverman, 2012).

Because all online information of users is public, Weibo provides us with an unprecedented opportunity to conduct research on human behavior. Previous studies have shown that computer-mediated communication and face-to-face communication are similar in emotional exchanges, which means that offline communication is nearly the same with online communication in emotional expression and personal involvement (Derks, Fischer, & Bos, 2008). Therefore, we can perform sentiment analysis and emotion recognition (Bollen, Pepe, & Mao, 2012; Liu, 2012; Xue, Chen, & Zhan, 2014) on posts. Taboada, Brooke, Tofiloski, Voll, and Stede (2011) constructed an emotional dictionary based on emoji and theme tags containing emotions, then combined the relevant features of the dictionary, as well as some other features to train the emotional classification system, and finally achieved the first place in the SenEval-2013 evaluation task. Zhitao, Zhiwen, and Bin (2015) constructed an emotional word dictionary from 400,000 Weibo data, and proposed a microblog posts emotional analysis method based on dictionary and rule set. The effectiveness of the method is verified by experiments on the collected original posts. Jing, Bo, Linlin, Min, and Yonglin (2014) used the common emotional and emotional phrases in the emotional factor, combined with the functions of punctuation and emoji in emotional analysis, to establish emotional dictionaries and emotional rules. By using the emotional rules, the recognition and classification of microblog post emotions were realized. These studies show that the results of social media data research are reliable.

In the present study, we aim to investigate the linguistic differences on the emotional expression between EN and NEN youth by analyzing their original posts on Weibo. In this paper, we focus on three questions: (a) whether EN and NEN youths have linguistic differences in emotional expression; (b) whether EN and NEN youths of different genders have linguistic differences in emotional expression; (c) whether EN and NEN youths in different regions have linguistic differences in emotional expression. We hypothesis that there is no significant linguistic difference in emotional expression between EN

and NEN youths. EN and NEN youths may have linguistic differences in gender and region.

2 | METHODS

In the study, a three-step procedure was conducted: (a) data collection, (b) data processing, and (c) data analysis. Methods and procedures applied have been approved by the Review Board of Institute of Psychology, Chinese Academy of Sciences. The data is publicly available. When people register a Weibo account, they are informed that their posts would be available for viewing and downloading publicly. Moreover, in order to protect the privacy of users, personal information was excluded.

2.1 | Data collection

First of all, a Weibo User Pool (WUP) was established, and 1.16 million active users which were determined based on the total number of posts and the average number of posts per day were included in the WUP. This study focused on active users as they can provide enough data (i.e., original posts) for further analysis. Then, their posts were downloaded using the Application Programming Interface.

Secondly, as purpose of this study is to explore the linguistic differences in emotional expression between EN group and NEN group. We selected the two target groups as subjects from all active users, and then collected their Weibo posts for text analysis. Specifically, this process includes two stages:

3 | SCREENING

The recruitment for both EN and NEN youth must meet the following criteria: (a) Users should be between 20 and 35 years old, that is, the

TABLE 1 Keywords for selecting the "target post"

The Empty-Nest youth group	The Non-Empty-Nest youth group
"空巢青年" ("empty-nest youth")	"住一块"/"住一起" + "父母" ("living together" and "parents")
"独居青年" ("young people living alone")	"住一块"/"住一起" + "男朋友" ("living together" and "boyfriend")
"空巢" + "我" ("empty-nest" and "I")	"住一块"/"住一起" + "男朋友" ("living together" and "girlfriend")
"独居" + "我" ("living alone' and "I")	"室友" ("roommate")

range of user's birthdate in Weibo is set from January 1, 1983 to January 1, 1998; (b) Users have posted "target posts" containing keywords in Table 1 on Weibo before March 2018. The reason we chose March 2018 as the time node is that in September 2018, when we crawled the microblog posts, users could provide more than 6 months of data after the "target post" was posted. By web crawler, this study acquired these users' basic registration information, including gender, age, location, certification, number of followers, graduate school, etc.

In this stage, we identified 5,040 EN and 8,000 NEN youths in the WUP, and then grouped the 13,040 Weibo users by region and gender, as shown in Table 2. In both groups, the number of female Weibo users is more than twice that of males, and the number of Weibo users in Southern China is higher than that of Weibo users in Northern China. These users are all used for subsequent analysis.

4 | GETTING THE MICROBLOG POSTS

After screening, the posts of these users within 6 months before and after posting the "target post" were obtained separately. All posts of each user in 1 year are acquired for text analysis.

4.1 | Data processing

Data preprocessing operations, such as data de-duplication, were completed in the data preparation stage. Since the content of reposted posts is not the users' self-expression, we filtered out the reposted posts, and only included the original part of the reposted posts and the original posts.

In data processing, Term Frequency–Inverse Document Frequency, a numerical statistic that weighs how important a word is to a document in the corpus (Rajaraman & Ullman, 2011), was used to segment all posts of both groups, and then preliminary statistical analysis of word frequency was conducted. We use Affective Lexicon constructed by Dalian University of Technology (Linhong, Hongfei, & Yu, 2008) to classify and analyze the posts. This affective lexicon is one of the most widely used lexicons in the field of Chinese emotional recognition, which contains seven categories and 20 sub-categories of emotions, as shown in Table 3.

With the help of this affective lexicon, the classification statistics of emotional vocabulary ware carried out on the posts after word segmentation. The results of word frequency statistics of all kinds of emotional categories were used as the characteristics of users' emotional expression to conduct the following comparative analysis.

TABLE 2 The demographic information of target Weibo users

	Gender		Region		
	Female	Male	Southern China	Northern China	Other
Non-Empty-Nest group	3,494	1,546	2,443	1,627	970
Empty-Nest group	5,827	2,173	4,060	2,272	1,688

Note: Table entries are the number of Weibo users.

TABLE 3 The affective lexicon ontology

	Category	Sub-category	Example
1	Happiness	Happy	喜悦、欢喜、笑眯眯、欢天喜地
2		Disburden	踏实、宽心、定心丸、问心无愧
3	Goodness	Respect	恭敬、敬爱、毕恭毕敬、肃然起敬
4		Praise	英俊、优秀、通情达理、实事求是
5		Believe	信任、信赖、可靠、毋庸置疑
6		Love	倾慕、宝贝、一见钟情、爱不释手
7	Anger	Angry	气愤、恼火、大发雷霆、七窍生烟
8	Sadness	Grief	忧伤、悲苦、心如刀割、悲痛欲绝
9		Disappointment	憾事、绝望、灰心丧气、心灰意冷
10		Guilt	内疚、忏悔、过意不去、问心有愧
11		Miss	相思、思念、牵肠挂肚、朝思暮想
12	Fear	Panic	慌张、心慌、不知所措、手忙脚乱
13		Scare	胆怯、害怕、担惊受怕、胆战心惊
14		Shy	害羞、害臊、面红耳赤、无地自容
15	Disgust	Boredom	憋闷、烦躁、心烦意乱、自寻烦恼
16		Abhor	反感、可耻、恨之入骨、深恶痛绝
17		Derogate	呆板、虚荣、杂乱无章、心狠手辣
18		Envy	眼红、吃醋、醋坛子、嫉贤妒能
19		Doubt	多心、生疑、将信将疑、疑神疑鬼
20	Surprise	Surprise	奇怪、奇迹、大吃一惊、瞠目结舌

There is a difference between the South and the North in Chinese culture, so we regard "region" as a variable. For "region" variable, we divided China into northern and southern regions according to the geographical boundary of Qinling-Huaihe. Each user was marked according to the "location" in his registration information. The specific corresponding relationship is shown in Table 4.

4.2 | Data analysis

In this paper, we conducted data analysis step by step. Firstly, the study using independent sample t test on different emotional word

TABLE 4 List of provinces in the North/South China

Region	Province
Southern China	Yunnan, Guizhou, Hunan, Jiangxi, Guangxi, Guangdong, Fujian, Zhejiang, Shanghai, Hainan, (Hong Kong, Macao and Taiwan)
Northern China	Shandong, Henan, Shanxi, Shanxi, Gansu, Qinghai, Xinjiang, Hebei, Tianjin, Beijing, Inner Mongolia, Liaoning, Jilin, Heilongjiang and Ningxia

frequency of the two groups to show emotional expression differences between groups. Then, we further divided the two groups according to region and gender to further explore the differences in emotional expression. This process was realized through two-way ANOVA and simple effect analysis.

5 | RESULTS

5.1 | Linguistic difference in the seven categories of vocabulary

Results showed that "goodness," "happiness," and "disgust" were more frequently used compared to "surprise," "fear," "sadness," and "anger" in both groups (Table 5). To identify expression differences between the EN group and NEN group on the seven emotional categories, independent sample t test indicated that EN group statistically significantly express more words concerned of "goodness," "surprise," "disgust," "fear," and "sadness" ($t(7,829.6) = -7.98$, $p < .001$; $t(9,380.8) = -2.59$, $p = .010$; $t(9,788.5) = -3.54$, $p < .001$; $t(7,897.3) = -6.52$, $p < .001$; $t(7,077.2) = -2.23$, $p = .020$; Figure 1) than NEN group. However, Cohen's D indicated that there is no practical significant difference between EN group and NEN group in "goodness," "surprise," "disgust," "fear," and "sadness" ($d = .15$, $d = .05$, $d = .12$, $d = .06$, $d = 0.04$)categories. Other than that, there was no more significant difference between the two groups ($t(10154) = -0.60$, $p = .560$; $t(10303) = -1.94$, $p = .052$;).

5.2 | Linguistic differences in the seven categories of vocabulary from different regions

We conducted two-way ANOVA, with word frequency(word-freq) as dependent variable and region (the North/the South) and living conditions (EN/NEN) as the independent variable, and the result revealed a main effect of living condition ($F[1,10,397] = 61.22$, $p < .001$) in "goodness" (as shown in Tables 6 and 7). "Goodness" word-freq was significantly higher in EN group. The main effect of region was significant ($F[1,10,397] = 8.93$, $p = .003$). People from northern China used "goodness" more frequently than people from the South. Whereas, the interaction effect of region and living condition was not significant ($F[1,10,397] = 2.20$, $p = .138$).

As for "happiness" word-freq, the main effect of living condition, the main effect of region and the interaction effect of region and living condition were all not significant ($F[1,10,397] = 0.23$, $p = .630$; $F[1,10,397] = 0.50$, $p = .480$; $F[1,10,397] = 2.20$, $p = .230$).

Category	Non-Empty-Nest group M ± (SD)	Empty-Nest group M ± (SD)	t	Cohen's d
Goodness	64.92 ± 160.19	95.65 ± 241.98	−7.98***	0.15
Happiness	46.60 ± 109.88	47.84 ± 117.81	−0.60***	0.01
Surprise	03.21 ± 007.13	03.58 ± 008.46	−2.59***	0.05
Disgust	27.70 ± 065.44	38.86 ± 097.62	−3.45***	0.12
Fear	04.43 ± 010.15	05.13 ± 011.40	−6.52***	0.06
Sadness	09.53 ± 022.43	10.94 ± 039.81	−2.23***	0.04
Anger	00.94 ± 002.82	00.74 ± 002.97	−1.94***	0.07

Note: SD represents the standard deviation.
M represents the mean value.
t represents the t-statistic.
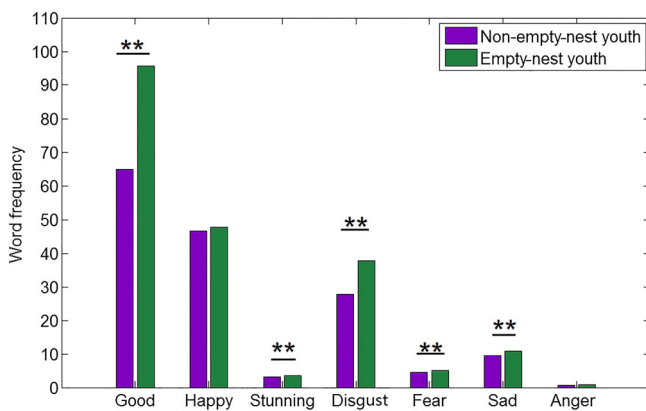*p < .05; **p < .01; ***p < .001.

FIGURE 1 Linguistic difference between Non-Empty-Nest and Empty-Nest youth in the seven categories of vocabulary

For "surprise" word-freq, the main effect of living condition was significant ($F[1,10,397] = 10.40$, $p = .001$). "Surprise" was significantly higher in EN group. The main effect of region was not significant ($F[1,10,397] = 3.07$, $p = .079$). And the interaction effect of region and living condition was significant ($F[1,10,397] = 5.36$, $p = .020$). Simple effect analyses showed that "surprise" word-freq of ENs from the North was significantly higher than that of EN youths from the South ($p = .019$). However, in NEN group, no significant regional difference existed ($p = .995$).

According to "disgust," the main effect of living condition was significant ($F[1,10,397] = 37.57$, $p < .001$). Word-freq of "disgust" was significantly higher in EN group. The main effect of region was significant ($F[1,10,397] = 8.99$, $p = .003$). People from the North used more frequently of "disgust" than people from the South do. And the interaction of region and living condition was significant ($F[1,10,397] = 4.14$, $p = .041$). Simple effect analyses showed that "disgust" word-freq of ENs from the North was significantly higher than that of ENs from the South ($p = .003$). However, in NEN group, no significant regional difference existed ($p = .731$).

In terms of "fear," the main effect of living condition was significant ($F[1,10,397] = 10.46$, $p = .001$). ENs used "fear" more frequently than NEN youths do. But the main effect of region and the interaction effect were not significant ($F[1,10,397] = 0.29$, $p = .587$; $F(1,10,397) = 0.25$, $p = .249$).

In "sadness" category, the main effect of living condition was significant ($F(1,10,397) = 4.64$, $p = .031$). "Sadness" word-freq was significantly higher in EN group. The main effect of region was significant ($F(1,10,397) = 4.81$, $p = .028$). People from the North used more frequently of "sadness" than people from the South do. And the interaction effect of region and living condition was significant

Category	Non-Empty-Nest group		Empty-Nest group	
	The South M ± (SD)	The North M ± (SD)	The South M ± (SD)	The North M ± (SD)
Goodness	63.78 ± 150.10	71.07 ± 167.11	90.40 ± 164.76	110.15 ± 346.84
Happiness	45.13 ± 115.53	44.51 ± 089.93	44.02 ± 102.40	048.95 ± 141.07
Surprise	03.11 ± 006.86	03.08 ± 006.93	03.31 ± 006.11	004.03 ± 011.96
Disgust	26.52 ± 066.77	28.73 ± 063.16	33.75 ± 006.11	042.84 ± 130.39
Fear	04.39 ± 010.85	04.31 ± 008.92	04.90 ± 009.43	005.33 ± 014.75
Sadness	09.15 ± 023.05	09.28 ± 020.41	09.24 ± 023.74	012.56 ± 060.56
Anger	0.70 ± 002.82	00.76 ± 002.12	00.94 ± 002.89	000.94 ± 003.55

Note: SD represents the standard deviation.
M represents the mean value.

TABLE 7 Vocabulary frequency influenced by living condition and region

Category	F Living condition	Region	Interaction
Goodness	61.22***	8.93***	2.20***
Happiness	0.23***	0.50***	2.20***
Surprise	10.40***	3.07***	5.36***
Disgust	37.57***	8.99***	4.14***
Fear	10.46***	0.29***	0.25***
Sadness	4.64***	4.81***	5.90***
Anger	3.53***	3.95***	0.98***

Note: Table entries are *F*-tests (*F*).
*$p < .05$; **$p < .01$; ***$p < .001$.

$(F(1,10,397) = 5.90, p = .015)$. Simple effect analyses showed that "sadness" word-freq of EN youths from the North was significantly higher than that of EN youths from the South $(p = .006)$. However, in NEN group, no significant region difference existed $(p = .998)$.

Under "anger" category, the main effect of region was significant $(F(1,10,397) = 3.95, p = .047)$. People from the North used more "anger" than people from the South do. But the main effect of living condition and the interaction effect of region and living condition were not significant $(F(1,10,397) = 3.53, p = .060, F(1,10,397) = 0.98, p = .323)$.

5.3 | Linguistic differences in the seven categories of vocabulary of different genders

We conducted two-way ANOVA, with word-freq as dependent variable and gender (male/female) and living conditions (EN/NEN) as the independent variable, and the result indicated that for words from "goodness," "surprise," "disgust," "fear," and "sadness" categories, the main effect of living condition was significant $(F[1,13,036] = 76.59, p < .001; F[1,13,036] = 7.26, p = .007; F[1,13,036] = 50.80, p < .001; F[1,13,036] = 13.26, p < .001; F(1,13,036) = 6.64, p = .009)$ (as shown in Tables 8 and 9).

We found that the word-freq of "goodness," "surprise," "disgust," "fear," and "sadness" was significantly higher in EN group. The main

effect of gender was significant $(F(1,13,036) = 83.903, p < .001; F(1,13,036) = 56.24, p < .001; F(1,13,036) = 54.53, p < .001; F(1,13,036) = 23.66, p < .001; F(1,13,036) = 54.53, p < .001)$. Male used more "goodness," "surprise," "disgust," "fear," and "sadness" than female do. And the interaction effect of gender and living condition was significant $(F(1,13,036) = 9.78, p = .002; F(1,13,036) = 13.24, p < .001; F(1,13,036) = 5.56, p = .018; F(1,13,036) = 5.07, p = .024; F(1,13,036) = 6.09, p = .0135)$. Gender difference in EN group was significantly larger than that in NEN group.

In the use of the words from "happiness," the main effect of living condition and the interaction effect of gender and living condition were both not significant $(F(1,13,036) = 0.37, p = .544; F(1,13,036) = 0.80, p = .371)$. But the main effect of gender was significant $(F(1,13,036) = 8.23, p = .004)$. Male used more "happiness" than female do.

In the use of words from "anger," the main effect of living condition was significant $(F(1,13,036) = 3.85, p = .050)$. "Anger" word-freq was significantly higher in EN group. The main effect of gender was significant $(F(1,13,036) = 37.94, p < .001)$. Male used more "anger" than female do. But the interaction effect of gender and living condition was not significant $(F(1,13,036) = 0.11, p = .739)$.

6 | DISCUSSION

The result indicates that the emotional expression differences between ENs and NENs do not have practical significance on Weibo, although they are statistically significant in various dimensions, either positive or negative. In addition, while NENs show no significant difference in region and gender, male ENs and northern ENs do have a more emotional expression.

6.1 | Emotional expression differences in various dimensions of emotions

The results show that although ENs express more "goodness," "disgust," "sadness," "fear," and "surprise" than NENs, the difference between the two groups is not large. On one hand, the results are consistent with "Uses-Gratifications" theory. When people lack enough or high-quality relationship with others in daily life, they might be inclined to build relationships in OSNs. Thus, they turn to

TABLE 8 Linguistic differences in the seven categories of vocabulary from different genders

Category	Non-Empty-Nest group Female M ± (SD)	Male M ± (SD)	Empty-Nest group Female M ± (SD)	Male M ± (SD)
Goodness	58.14 ± 143.46	83.10 ± 197.23	58.14 ± 216.57	129.69 ± 288.45
Happiness	45.33 ± 099.19	50.01 ± 134.39	45.33 ± 111.67	053.85 ± 130.41
Surprise	03.02 ± 006.66	3.69 ± 008.26	3.02 ± 006.39	04.80 ± 011.78
Disgust	25.43 ± 057.88	33.80 ± 082.07	25.43 ± 080.49	048.79 ± 127.45
Fear	04.26 ± 009.27	04.88 ± 012.18	4.26 ± 010.16	06.22 ± 013.75
Sadness	09.36 ± 021.56	10.00 ± 024.61	9.36 ± 026.35	013.44 ± 059.88
Anger	00.64 ± 002.03	01.00 ± 004.27	0.64 ± 002.83	01.06 ± 003.25

Note: SD represents the standard deviation.
M represents the mean value.

TABLE 9 Vocabulary frequency influenced by living condition and gender

	F		
Category	Living condition	Gender	Interaction
Goodness	76.59***	83.90***	9.78***
Happiness	0.37***	8.23***	0.80***
Surprise	7.26***	56.24***	13.24***
Disgust	50.80***	54.53***	5.56***
Fear	13.26***	23.66***	5.07***
Sadness	6.64***	54.53***	6.09***
Anger	3.85***	37.94***	0.11***

Note: Table entries are F-tests (F).
*p < .05; **p < .01; ***p < .001.

communicate which might decrease emotional problems of relationship in reality (Qi, Huawei, Huan, & Qi, 2014). Since ENs leave their family, they live alone and feel lonely. D, A, and E (1980) found that college students consider leaving family and friends as the main source of loneliness. Leaving family has an impact on family intimacy, which in turn affects the individual's mood and behavior (Xiusheng & Jinfang, 2006). Family function, loneliness and emotional expression have a close relationship with each other (Lifang & Richang, 2013). The ENs, who lack close family bond and suffer from loneliness, may have higher demands to express their emotions.

On the other hand, the empirical study found that the emergence of EN state is a common problem faced by all mobile youth during the period of rapid social transformation. Although there are significant differences among a few indicators, ENs and NENs are basically consistent in terms of living and mental state (Jinfeng, 2017; Wei & Xiaotian, 2017). Since the reform and opening up, social transformation with industrialization and marketization as the main content has greatly changed the way of life of Chinese people. The technological advancement brought about by industrialization strengthens the professionalism of the work, but it diminishes the collective cooperation and promotes the individualization of the lifestyle. At the same time, rapid social mobility transforms urban communities from an acquaintance society to a stranger society, where everyone experiences the individualization of life (Yi, 2017). That is to say, in the process of social transformation, everyone is affected. It's just that youth living alone need to face the loneliness of being temporarily or permanently separated from the group. They hope that there is a collective space in the society to make up for their lack of belonging, which leads to the social phenomenon of EN youth. Therefore, the difference in emotional expression between ENs and NENs is not practically significant.

It is worth noting that the variance of word-freq of each category of ENs is higher than that of NENs, and ENs express both positive emotions (goodness) and negative emotions (disgust, sadness, fear, and surprise) more than NENs. According to Xiaohong (2018), ENs can be further divided into two types: "active EN" and "passive EN." The former refers to the people who choose to live alone on their own, have healthy living habits and enjoy the lifestyle of one person alone. The latter refers

to the people who have to live alone passively. Accordingly, it can be divided into "positive EN" and "negative EN." The former usually have a positive mental state and choose to live alone since they have ideal ambition and pursuit of excellence. The latter chooses to live alone since they want to escape from the constraint of their family and hope to live freely. It is possible that active, positive ENs expressed more goodness and passive, while negative ENs expressed more negative emotions. Future study can further compare the emotional expressions differences between positive EN youth and negative EN youth.

6.2 | Region difference in various dimensions of emotional expression

We found that people from northern China express more emotions. ENs from the North express more "surprise," "disgust," and "sadness" than ENs from the South. This result is consistent with the rice theory (Talhelm et al., 2014). According to the rice theory, people who grow wheat in the North tended to support individualist culture, while the people who grow rice in the South behaved more like collectivist culture. It is more desirable to inhibit emotional expression in a collectivist culture, while the opposition is true in an individualist culture (Wei, Su, Carrera, Lin, & Yi, 2013). Thus, it is not surprising that ENs from northern China express themselves more.

However, it was interesting that while northern ENs express more negative expression than southern ENs, all ENs express nearly the same degree of happiness. Several reasons could account for this difference. Firstly, since the economy is more prosperous in southern China, ENs from the North may have a more economic burden, which results in more negative emotion. Secondly, northern people are generally more independent, thus they tend to express more positive emotion in public. Thirdly, since the original posts last for only 1 year, it may be possible that more negative events occurred in the North and result in negative expression. Future researchers can further investigate the reasons for such difference.

6.3 | Gender difference in various dimensions of emotional expression

In gender, we found that males express more emotions than females. For EN group, males express more of "goodness," "surprise," "disgust," and "sadness" than females did. While these results are contrary to some research (Deng-Feng & Zhang-Ming, 2017; McRae et al., 2008; Xie et al., 2015), using the scale as a tool and finding that males are more likely to express anxiety, depression, and loneliness than females (Jinfa & Luhuo, 2018).

However, Xiaohong (2018) found that compared with females, EN status is more detrimental to the mental health, life satisfaction and well-being of males, which is consistent with our results. One of the characteristics of ENs is that the emotional state is dominated by singles (Rong, 2019). In the marriage market of China, if male ENs want to improve their competitiveness, they have to raise their income levels, which will increase their pressure, making them have higher depression and lower happiness. Besides, male ENs have less social

entertainment and social support than female ENs, and male ENs have lower utilization of social support than females (Yun, 2018). It is easier to express their emotions through the OSNs to seek emotional support and build relationships. However, females have a greater capacity to provide support and a greater dependence upon social support for psychological well-being (Flaherty & Richman, 1989). Accordingly, females tend to actively seek the support of families and friends when they feel lonely or encounter problems. Furthermore, female ENs and NENs may have similar social support in total. Therefore, the gender difference in the emotional expression of ENs is higher than that of NENs.

Male ENs are more likely to express four types of negative emotions than female ENs. On one hand, males have more social pressure and responsibility to earn money and support family. ENs are mainly males who work and live alone in big cities away from their hometown. They have a higher degree of negative emotions including anxiety, loneliness, depression, and lack of security. However, they have no other ways than OSNs to express their negative emotions. On the other hand, males tend to suppress their emotions and use the expressions of introversion in daily life. However, in OSNs without the social and cultural constraints in real life, males are more likely to publicly express their true emotions.

In addition, male ENs also expressed more goodness than the females. The Internet provides a good outlet for male ENs to regulate their emotion, which is called "online emotional regulation" (Xie et al., 2015). Young people with the same experience and identity, gather in OSNs. While they are trying to get rid of negative emotions and seek for understanding and emotional attachment, they will also express certain positive emotions and encourage each other to establish interpersonal relationships (Yuning, Binbin, & Xuefang, 2017).

7 | CONCLUSION

In summary, by analyzing posts on Weibo, we found that EN youths and NEN youths are basically consistent with emotional expression. But we must notice that male EN youths and northern EN youths do express more emotion than other youths. On one hand, the results show that it is not that EN state has formed a social problem, but that EN youths have socialized their life problems. In the process of social transformation, this group affected by the imbalance of transformation is easy to feel the pressure, so they hope that the society will produce a collectivized space to make up for their lack of sense of belonging. On the other hand, this means that Weibo is a proper way to express themselves for youths, especially those who are male EN youths or northern EN youths and a better way for researchers to investigate the mental state of this group. Future studies can use Weibo to further investigate why there are differences in individual emotional expression among EN youths of different genders and regions. These researches may provide a comprehensive understanding of EN youth.

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REFERENCES

Alibaba (2017). *China Empty Nest Youth Report.* Retrieved from https://dt.alibaba.com/page10.htm

Anlong, Y. (2017). "empty nest youth": Phenomenon, performance, cause and cognitive attitude [dictionary of the Chinese language]. *Forward Position*, 7, 78–82. https://doi.org/10.14129/j.cnki.forwordposition.2017.07.013

Bollen, J., Pepe, A., & Mao, H. (2012). *Modeling public mood and emotion: Twitter sentiment and socio-economic phenomena.* Paper presented at the Fifth International AAAI Conference on Weblogs and Social Media, Barcelona, Spain. https://doi.org/10.1016/0006-2952(92)90681-8

Center, S. W. D. (2017). *Weibo user development report.* Retrieved from http://data.weibo.com/report/reportDetail?id=404

Chiu, C., Ip, C., & Silverman, A. (2012). Understanding social media in China. *McKinsey Quarterly*, 2(2012), 78–81.

CNNIC. (2019). *Statistical report on internet development in China.* Retrieved from http://www.cnnic.cn/gywm/xwzx/rdxw/20172017_7056/201902/t20190228_70643.htm

CYD. (2016). *64.3% of respondents said that there are more "empty nest youths" around them.* Retrieved from http://zqb.cyol.com/html/2016-09/06/nw.D110000zgqnb_20160906_2-07.htm

D, R., A, P. L., & E, C. C. (1980). The revised ucla loneliness scale: Concurrent and discriminant validity evidence. *Journal of Personality & Social Psychology*, 39(3), 472–480. https://doi.org/10.1037/0022-3514.39.3.472

Deng-Feng, X., & Zhang-Ming, X. (2017). Application of latent class analysis in online emotion regulation in college students [dictionary of the Chinese language]. *Chinese Mental Health Journal*, 31(3), 252–256. https://doi.org/10.3969/j.issn.1000-6729.2017.03.014

Derks, D., Fischer, A. H., & Bos, A. E. R. (2008). The role of emotion incomputer-mediated communication: A review. *Computers in Human Behavior*, 24(3), 766–785. https://doi.org/10.1016/j.chb.2007.04.004

Eid, M., & Diener, E. (2009). *Norms for experiencing emotions in different cultures: Inter-and intranational differences. Culture and Well-Being* (pp. 169–202). Dordrecht: Springer. https://doi.org/10.1037/0022-3514.81.5.869

Fischer, A. H., Rodriguez Mosquera, P. M., Van Vianen, A. E. M., & Manstead, A. S. R. (2004). Gender and culture differences in emotion. *American Psychological Association*, 4(1), 87. https://doi.org/10.1037/1528-3542.4.1.87Flaherty

Hu, B. (2017). From "Nest Space" to "Heart Reality": Re-discussing the Problem of "Empty Nest Youth" in China in the New Era [dictionary of the Chinese language]. *China Youth Study*, 2018(4), 40–46. https://doi.org/10.19633/j.cnki.11-2579/d.2018.0054

Jinfa, Z., & Luhuo, C. (2018). Research on the influencing factors of negative emotion and loneliness of college students [dictionary of the Chinese language]. *Journal of Lanzhou Institute of Education*, 34(08), 155–157. https://doi.org/10.3969/j.issn.1008-5823.2018.08.061

Jinfeng, C. (2017). Why "empty nest youth" is "empty nest"—An interpretation of time and space sociology[dictionary of the Chinese language]. *China Youth Study*, 2017(5), 79–83. https://doi.org/10.3969/j.issn.1002-9931.2017.05.011

Jing, Z., Bo, Z., Linlin, L., Min, H., & Yonglin, T. (2014). Recognition and classification of emotions in the Chinese microblog based on emotional factor [dictionary of the Chinese language]. *Acta Scientiarum Naturalium Universitatis Pekinensis*, 50(1), 79–84. https://doi.org/10.13209/j.0479-8023.2014.016

Flaherty, J., & Richman, J. (1989). Gender differences in the perception and utilization of social support: Theoretical perspectives and an empirical test. *Social Science & Medicine*, 28(12), 1221–1228. https://doi.org/10.1016/0277-9536(89)90340-7

McRae, K., Ochsner, K. N., Mauss, I. B., JJD, G., & Gross, J. J. (2008). Gender differences in emotion regulation: An fmri study of cognitive reappraisal. *Group Processes & Intergroup Relations*, 11(2), 143–162. https://doi.org/10.1177/1368430207088035

Lifang, D., & Richang, Z. (2013). Relationships among family functioning, emotional expression and loneliness in college students [dictionary of the Chinese language]. *Studies of Psychology and Behavior*, *11*(2), 223–228. http://doi.org/10.3969/j.issn.1672-0628.2013.02.014

Linhong, X., Hongfei, L., & Yu, P. (2008). Constructing the afective lexicon ontology [dictionary of the Chinese language]. *Journal of The China Society for Scientific and Technical Information(2)*, *27*(02), 180–185. https://doi.org/10.3969/j.issn.1000-0135.2008.02.004

Liu, B. (2012). *Sentiment analysis and opinion mining*. In C. Sammut & G.I. Webb (Eds.), Encyclopedia of Machine Learning and Data Mining (pp. 1–10). Boston, MA: Springer US. https://doi.org/10.1007/978-1-4899-7502-7_907-1

Qi, Y., Huawei, M., Huan, Y., & Qi, C. (2014). Analysis of social network users' online behavior from the perspective of psychology [dictionary of the Chinese language]. *Advances in Psychological Science*, *22*(10), 1647–1659. https://doi.org/10.3724/SP.J.1042.2014.01647

Rajaraman, J., A. Ullman. (2011). *Data mining*. Mining of Massive Datasets, (pp. 1–17). Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9781139058452.002

Rong, L. (2019). Analysis of the living dilemma and social support status of "Empty Nest Youth" [dictionary of the Chinese language]. *Hebei Youth Administrative Cadres College*, *31*(01), 25–32.

Shaohui, H. (2017). Multidimensional interpretation of the "empty nest youth" group [dictionary of the Chinese language]. *Journal of Chinese Youth Social Science*, *36*(190), 45–50. https://doi.org/10.16034/j.cnki.10-1318/c.2017.03.006

ShuQie, W. (2017). *A stranger in a foreign land [dictionary of the Chinese language]*. (Unpublished master's thesis). Nanjing University.

Taboada, M., Brooke, J., Tofiloski, M., Voll, K. D., & Stede, M. (2011). Lexicon-based methods for sentiment analysis. *Computational Linguistics*, *37*(2), 267–307. https://doi.org/10.1162/COLI_a_00049

Talhelm, T., Zhang, X., Oishi, S., Shimin, C., Duan, D., Lan, X., & Kitayama, S. (2014). Large-scale psychological differences within China explained by rice versus wheat agriculture. *Science*, *344*(6184), 603–608. https://doi.org/10.1126/science.1246850

Wei, M., Su, J. C., Carrera, S., Lin, S. P., & Yi, F. (2013). Suppression and interpersonal harmony: a cross-cultural comparison between Chinese and European Americans. *Journal of Counseling Psychology*, *60*(4), 625–633. https://doi.org/10.1037/a0033413

Wei, N., & Xiaotian, F. (2017). Empty nest and hollow?——Analysis and countermeasure of survival status of "empty nest youth" [dictionary of the Chinese language]. *China Youth Study*, *258*(8), 57–63. https://doi.org/10.19633/j.cnki.11-2579/d.2017.08.008

Xiaohong, D. (2018). Social psychological diagnosis and support of the group of the empty nest youth [dictionary of the Chinese language]. *Gansu Social Sciences*, *2018*(1), 179–185. https://doi.org/10.15891/j.cnki.cn62-1093/c.2018.01.028

Xie, D., Lu, J., & Xie, Z. (2015). Online emotion regulation questionnaire for adolescents: Development and preliminary validation. *Social Behavior & Personality An International Journal*, *43*(6), 955–965. https://doi.org/10.2224/sbp.2015.43.6.955

Xiusheng, W., & Jinfang, Y. (2006). Family cohesion and asaptability associated with coping style in college students [dictionary of the Chinese language]. *Chinese Journal of Clinical Rehabilitation*, *10*(14), 38–40. https://doi.org/10.3321/j.issn:1673-8225.2006.14.017

Xue, B., Chen, F., & Zhan, S. (2014). A study on sentiment computing and classification of sina weibo with word2vec. In 2014 *Ieee international congress on big data*. Anchorage, AK: IEEE. https://doi.org/10.1109/BigData.Congress.2014.59

Yi, Z. (2017). *The phenomenon of "empty nest youth" will appear sooner or later [dictionary of the Chinese language]*. Retrieved from http://news.youth.cn/jsxw/201703/t20170327_9358437.htm

Yingying, C. (2016). *"Empty nest youth" consumption concept: Quality, not yielding*. Retrieved from http://www.xinhuanet.com/local/2017-01/14/c_1120309603.htm

Yun, M. (2018). *Research on correlation of loneliness to social support and psychological capttal of Empty nest youth [dictionary of the Chinese language]*. (Master's thesis). Yunnan Normal University.

Yuning, H., Binbin, Q., & Xuefang, Z. (2017). From the "empty nest" mentality to the "cluster behavior": "empty nest youth" phenomenon perspective and network mapping [dictionary of the Chinese language]. *China Youth Study*, *2017*(8), 36–43. https://doi.org/10.19633/j.cnki.11-2579/d.2017.08.005

Zhitao, W., Zhiwen, Y., & Bin, G. (2015). Sentiment analysis of Chinese micro blog based on lexicon and rule set [dictionary of the Chinese language]. *Computer Engineering and Applications*, *51*(8), 218–225. https://doi.org/10.3778/j.issn.1002-8331.1308-0187
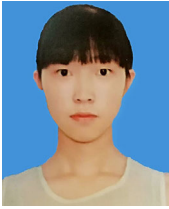
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