



Cognitive-affective structure of gratitude and its relationships with subjective well-being

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ABSTRACT

Gratitude is considered to be a multidimensional construct consisting of both cognitive (cognitive appraisals of benefaction) and affective (feelings of gratitude) components, which is crucial for health and well-being. However, few studies have examined the cognitive-affective structure of gratitude and its associations with subjective well-being. Thus, the present study explored the two-dimensional structure of gratitude and its predictive effects on subjective well-being. Study 1 showed that the bi-factor structure of gratitude had the best fit with the data compared with the one- and two-factor models, and both general and affective gratitude positively predicted subjective well-being at the cross-sectional level. Study 2 further found that general gratitude positively predicted life satisfaction and positive affect after 3 months. However, cognitive gratitude negatively predicted subjective well-being at both cross-sectional and longitudinal levels. Therefore, future gratitude studies should consider the two-dimensional structure of gratitude.

1. Introduction

Gratitude, which is defined as “part of a wider life orientation towards noticing and appreciating the positive in the world” (Wood, Froh, & Geraghty, 2010), can be conceptualized on trait and state levels. Trait gratitude reflects the predisposition to respond to benefits from others, while state gratitude represents a temporary emotional response to a benefactor (McCullough, Tsang, & Emmons, 2004). Extensive studies have revealed the beneficial effects on well-being from gratitude (Jans-Beken, Lataster, Peels, Lechner, & Jacobs, 2018; Kong, Zhao, You, & Xiang, 2020; Sun & Kong, 2013; Wood, Maltby, Gillett, Linley, & Joseph, 2008; Yang, Yan, Jia, Wang, & Kong, 2020), while the nature and process of gratitude have not been sufficiently explored. Accordingly, we argued that gratitude may be elicited through two processes: cognitive appraisals of the benefactor's behaviors and affective experience elicited by these behaviors, and that the tendencies of these two processes are different. Therefore, in this study, we focused on the trait approach and tested whether trait gratitude consists of cognitive and affective components, and how these two components relate to subjective well-being.

1.1. The cognitive-affective structure of gratitude

It has been frequently proposed that gratitude involves cognitive and affective elements. For example, McCullough (2002) argued that gratitude is “a cognitive-affective response” (p. 303). Additionally, gratitude is a complex emotion that can be described in a cognitive-affective context (Clare, Ortony, & Foss, 1987) in which the term has both affective and cognitive elements. Furthermore, previous research suggested that gratitude was more than an affective response but had cognitive components as well (Gibson & Sluss, 2012). And the affective component (e.g., I feel grateful), and cognitive component (e.g., I am grateful for specific things) had different effects on many aspects of daily well-being (e.g., negative affect, anxiety) (Nezlek, Newman, & Thrash, 2017; Sztachańska, Krejtz, & Nezlek, 2019). Thus, it is logical to propose that gratitude may have two distinct facets: cognition and affect. Specifically, cognitive gratitude may reflect one's positive appraisals about the benefits (e.g., making attribution and acknowledgment for the benefaction), while affective gratitude may reflect grateful feelings towards a benefactor.

In support of this view, the differences between these two components have been evidenced in some studies. For instance, results of confirmatory factor analyses showed that gratitude consisted of

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cognitive, emotional, and behavioral components (Liang et al., 2021). Empirical evidence has uncovered that the correlation between cognitive gratitude and affective gratitude is medium-sized (McCullough et al., 2004), which suggests that cognitive and affective elements of gratitude may be distinct constructs. In addition, a task-related neuroimaging study found that cognitive gratitude was correlated with the neural activity in the supplementary motor area (SMA) related to the desire to help, while affective gratitude was correlated with the activity in the medial prefrontal cortex (MPFC) related to gratitude expression (Kini, Wong, McInnis, Gabana, & Brown, 2016).

What's more, most items of the Gratitude Questionnaire (GQ, McCullough, Emmons, & Tsang, 2002) focused on what elicited the feelings of gratitude (an object-focused or intentional state) (Nezlek et al., 2017) which highlights the cognitive element of gratitude, whereas the Gratitude Adjectives Checklist (GAC, Emmons & McCullough, 2003) focused on feelings of gratitude without explicit reference to anything in particular (Nezlek et al., 2017), which emphasizes the affective component of gratitude. Lots of studies have utilized these two measures to evaluate cognitive and affective gratitude (Krejtz et al., 2016; Nezlek et al., 2017; Sztachańska et al., 2019). For example, Sztachańska et al. (2019) use three questions taken from the GQ to evaluate cognitive gratitude (e.g., There are many things that I can be grateful for), and "grateful" and "appreciative" from GAC to measure affective gratitude. Therefore, although the GQ and GAC were developed and used to evaluate trait and state gratitude, respectively, we assumed they could be of use to measure cognitive and affective gratitude if the affective items in the GQ were excluded and the instruction of GAC was altered to evaluate trait gratitude.

However, even though many studies have suggested the presence of cognitive-affective structure of gratitude, as far as we know, no study has directly explored whether there exists a two-dimensional structure of gratitude. Thus, the first attempt of our study is to investigate the two-dimensional construct of gratitude.

1.2. The beneficial effect of gratitude on subjective well-being

Subjective well-being, also known as hedonic well-being, is defined as pursuits of positive emotional experiences and ease in life (Diener, 1984). It is comprised of an affective component (i.e., the balance between positive and negative affect) and a cognitive component (i.e., life satisfaction) (Diener, Suh, Lucas, & Smith, 1999). The positive effect on subjective well-being from gratitude has theoretical and empirical support. Referring to the broaden and build theory (Fredrickson, 2004), positive emotions can broaden people's minds to adopt the behavioral and cognitive activities that would build helpful resources to overcome stressful time. As a positive emotion, gratitude works in the similar fashion. For example, gratitude broadens an individual's mind to repay the benefactor, which strengthens the friendship with the benefactor. Then, the social bond would create a supportive resource and further increase the individual's subjective well-being.

In addition, numerous studies have collectively supported the relation between gratitude and subjective well-being. First, cross-sectional research has discovered the positive associations between gratitude and subjective well-being (Datu, 2013; Guse, Vescovelli, & Croxford, 2017; Kong, Ding, & Zhao, 2015; Kong, Yang, Yan, & Li, 2021; McCullough et al., 2002; Tian, Du, & Huebner, 2014). Second, some studies using a longitudinal design also found the temporal relation between gratitude and subjective well-being. For instance, Jans-Beken et al. (2018) revealed that gratitude could positively predict subjective well-being after a 7.5-month interval in Dutch adults. Similarly, Yang et al. (2020) found that gratitude had a prospective influence on positive components of subjective well-being (i.e., positive affect and life satisfaction) over two months. Furthermore, some research using gratitude intervention also reported that gratitude practice contributed to the improvement of subjective well-being (Deng et al., 2018; Jackowska et al., 2016; Killen & Macaskill, 2015; Watkins, Uher, & Pichinevskiy,

2014). Besides, utilizing a daily diary design, Nezlek et al. (2017) reported that gratitude on the current day could positively predict the positive aspects of subjective well-being on the next day.

Even though these studies have uncovered the advantageous impact of gratitude on subjective well-being, several limitations need to be pointed out. First, previous research did not make a distinction between cognitive and affective components of gratitude, which may confound the effect of these two components. Second, to our knowledge, cross-sectional research accounted for a relatively large portion of previous studies, so less is known about the temporal effect on subjective well-being from gratitude. Accordingly, the second goal of our study is to explore the effect on subjective well-being from gratitude with a two-dimensional structure using cross-sectional and longitudinal data.

1.3. The present study

Inspired by the literature gap mentioned above, we conducted two studies. First, in order to provide greater clarity and insight as to the construct of gratitude, Study 1 tested the cognitive-affective structure of gratitude. Based on the consistent statements (Emmons & McCullough, 2004; McCullough, 2002) and empirical findings of cognitive and affective gratitude (Kini et al., 2016; McCullough et al., 2004), there would be two separate factors that explain different facets of gratitude. Additionally, there might be a general factor that reflects an individual's global tendency to experience gratitude. Thus, we formulated a hypothesis that the bi-factor model of gratitude would exist. Second, we examined how the general factor of gratitude predicts subjective well-being at both cross-sectional (Study 1) and longitudinal (Study 2) levels. Based on the broaden and build theory (Fredrickson, 2004) and evidence on the positive effect on subjective well-being from gratitude (Guse et al., 2017; Jans-Beken et al., 2018; Yang et al., 2020), we assumed that there would be positive predictive links of the general factor of gratitude to subjective well-being.

Third, to provide more evidence on the different nature of affective and cognitive components, we further examined the predictive effects of these two components of gratitude on subjective well-being. For affective gratitude, grounded on the appraisal theory of emotion (Scherer, 2004), emotions are viewed as processes elicited by changes in different components. Specifically, the feeling component is a monitoring system that integrates the representations of changes in other components, including cognitive appraisal and expression of emotional experience. Therefore, individuals with more experience of affective gratitude might be more likely to have verbal and behavioral expressions of gratitude, which is beneficial for building relationships with the benefactor. Moreover, positive relationships may become helpful resources that enhance subjective well-being in the long term (Fredrickson, 2004). Thus, we hypothesized that affective gratitude would positively predict subjective well-being. As to cognitive gratitude, alongside recognition of benefits, there are mixed feelings such as indebtedness, frustration, and pity (Greenberg & Westcott, 1983). And after being aware of things to be grateful, individuals would resent the obligations (Elster, 1999), and indebtedness may emerge out of this (Oishi, Koo, Lim, & Suh, 2019). Thus, we assumed that cognitive gratitude would have no or negative association with subjective well-being, especially its affective components.

2. Study 1

2.1. Method

2.1.1. Participants and procedure

A total of 2998 local college students were recruited to take part in this study. After receiving the informed consents from all participants, we sent the online link of questionnaires to every participant through an instant message service. The free online questionnaire platform (www.wjx.cn) was utilized to collect the data. Finally, after we deleted the

data from 550 respondents who finished the questionnaire too quickly, 2448 participants ($Mage = 23.33$; $SDage = 1.73$; 21.3% males) were included in further analyses. This study was approved by the ethics committee of a local university.

2.1.2. Measures

2.1.2.1. Gratitude. Cognitive gratitude was measured by the Gratitude Questionnaire-6 item (McCullough et al., 2002). Because of the affective nature of item 4 and a low factor loading of Item 6 (Chen, Chen, Kee, & Tsai, 2009; Froh et al., 2011), we just included the other four items in the analyses. This questionnaire was rated on a 7-point Likert scale ranging from strongly disagree = 1 to strongly agree = 7. Sample items contained “I have so much in life to be thankful for.” and “When I look at the world, I don't see much to be grateful for.” This measure showed good internal consistency with Cronbach's alpha of 0.821.

Affective gratitude was evaluated through the 3-item Gratitude Adjectives Checklist (Emmons & McCullough, 2003). Participants evaluated their usual degree of gratitude feeling such as “Thankful” and “Grateful” using a 5-point Likert scale (never = 1 to very often or always = 5). The internal consistency was high for this scale, with Cronbach's alpha of 0.935.

2.1.2.2. Subjective well-being. The measurements of subjective well-being included life satisfaction, positive affect, and negative affect. Representing the cognitive component of subjective well-being (Diener et al., 1999; Linley, Maltby, Wood, Osborne, & Hurling, 2009), life satisfaction was estimated using the 5-item Satisfaction with Life Scale (SWLS) (Diener, Emmons, Larsen, & Sharon, 1985). Participants responded on a 7-point Likert scale (strongly disagree = 1 to strongly agree = 7). Sample items included “I am satisfied with my life” and “In most ways, my life is close to my ideal”. This scale showed high reliability with Cronbach's alpha of 0.850. As the affective component of subjective well-being (Diener et al., 1999; Linley et al., 2009), positive affect and negative affect were estimated utilizing the 12-item Positive and Negative Experience scale created by Diener et al. (2010), using a 5-point Likert type (1 = very rarely or never to 5 = very often or always). Participants reported the degree of how they felt for last month on every item (positive affect: positive, good, pleasant, happy, joyful, and contented; negative affect: negative, bad, unpleasant, sad, afraid, and angry). Cronbach's alphas for positive affect and negative affect subscales were 0.927 and 0.834, respectively.

2.1.3. Statistical analyses

We ran all main analyses in R V4.1.0 (R Development Core Team, 2008) and used Maximum likelihood estimation (ML) in all analyses. First, common method variance might have an influence on our results, so we performed Harmon's single factor test (Podsakoff & Organ, 1986) which was to construct a one-factor model with all items loading on a single latent factor to examine the severity of common method variance. Next, to test the two-dimensional structure of gratitude, lavaan package in R (Rossee, 2012) was used to conduct a Confirmatory Factor Analysis (CFA) to assess three measurement models: (1) a bi-factor model specifying a general factor indicated by all items, along with cognitive gratitude and affective gratitude as two specific factors indicated by respective items; (2) a unidimensional model assuming that all items of GQ and GAC are indicators of a single factor; (3) a two-factor model specifying that cognitive gratitude and affective gratitude indicating two separate factors respectively. As recommended by Hair, Black, Babin, and Anderson (2010), the Tucker-Lewis index (TLI) and comparative fit index (CFI) should be >0.90 and the root mean square error of approximation (RMSEA) should be <0.08 to suggest an acceptable fit of a model. To compare models, we referred to the suggestions from Chen, Hayes, Carver, Laurenceau, and Zhang (2012) that a rise in CFI of 0.005–0.010 and a decline in RMSEA of 0.010–0.015 shows a significant

development in fit to the data. We also calculated Coefficient Omega (for all factors), Omega Hierarchical (OmegaH; for all factors), Explained Common Variance (ECV; for the general factor), and Percentage of Uncontaminated Correlations (PUC; for the whole model) using BifactorIndicesCalculator package in R (Dueber, 2019) to evaluate the bi-factor model following the instructions of Rodriguez, Reise, and Haviland (2016b). Then, we used the general and specific factors of gratitude as predictors of subjective well-being. In this model, the respective items were utilized as indicators to represent life satisfaction, positive affect, and negative affect.

2.2. Results

2.2.1. Confirmatory factor analysis

The one-factor model constructed to examine common method variance fitted poorly to the data (CFI = 0.633, TLI = 0.598, RMSEA = 0.147), indicating that common method variance might not be a problem in our study. The results of CFA were presented in Table 1. The model fit indexes showed that the bi-factor model showed an adequate fit to the data. Besides, the bi-factor model was the most satisfactory compared with the single- and two-factor structures (ΔCFI and $\Delta TLI > +0.01$; $\Delta RMSEA < -0.01$). The descriptive statistics and factor loadings for the bi-factor model of gratitude were displayed in Table 2. Thus, the bi-factor structure of gratitude was supported.

Then, we used some indices to evaluate the bi-factor model of gratitude. First, Omega for the general factor (0.931), cognitive factor (0.860) and affective factor (0.936) were high, indicating relatively high reliability for all factors. Second, OmegaH for the general factor was 0.767, implying that the general factor accounted for a relatively large source of systematic variance. Besides, OmegaH for each specific factor reflects the specific factor reliability with the general factor controlled for. In our study, OmegaH for the cognitive factor was 0.068 and 0.511 for the affective factor. Third, the ECV and PUC were computed to assess whether the data was essentially one-dimensional. Referring to Rodriguez, Reise, and Haviland (2016a), if either ECV or PUC is lower than 0.70, one could assume a multi-dimensional structure. In the present study, the ECV for the general factor was 0.659, and the PUC for the bi-factor structure was 0.571, which surpassed the benchmark. Given above, the bi-factor model was reliable and gratitude could be considered as a construct with a general and two specific facets.

2.2.2. Predictive relations from gratitude to subjective well-being

Then, we examined the predictive effects from two specific and one general factors of gratitude on subjective well-being. The results indicated that the general factor positively predicted life satisfaction ($\beta = 0.760, p < .001$) and positive affect ($\beta = 0.867, p < .001$), and negatively predicted negative affect ($\beta = -0.615, p < .001$). Affective gratitude positively predicted life satisfaction ($\beta = 0.134, p < .05$) and positive affect independently ($\beta = 0.373, p < .001$). Cognitive gratitude negatively predicted life satisfaction ($\beta = -0.242, p < .05$) and positive affect ($\beta = -0.288, p < .05$), and positively predicted negative affect ($\beta = 0.350, p < .05$).

3. Study 2

3.1. Method

3.1.1. Participants and procedure

At Time 1 (T1), 402 college students participated in Study 2 and completed the surveys. After around 3 months, we invited the respondents at T1 to finish the same questionnaire at Time 2 (T2). There were 299 participants who finished the surveys at T2. Finally, after we rejected the data from 1 participant who finished the surveys too quickly, there were 298 participants ($Mage = 20.12$; $SDage = 2.10$; 11.41% males) who had completed the surveys at both time points, with the attrition rate of 17.8%.

Table 1
Model fit information for all models.

Model	χ^2	df	RMSEA	CFI	TLI	Comparison	Δ CFI	Δ TLI	Δ RMSEA
Study 1									
Model 1 Bi-factor model	7.944	7	0.007	1.000	1.000	–	–	–	–
Model 2 Single-factor model	2349.646	14	0.261	0.797	0.695	M1-M2	0.203	0.305	–0.254
Model 3 Two-factor model	46.776	13	0.033	0.997	0.995	M1-M3	0.003	0.005	–0.026
Study 2									
Model 4 Configural invariance	1770.378	982	0.052	0.929	0.918	–	–	–	–
Model 5 Metric invariance	1835.953	1013	0.052	0.926	0.917	M4-M5	0.003	0.001	–0.000
Model 6 Scalar invariance	1907.988	1037	0.053	0.921	0.914	M4-M6	0.008	0.004	–0.001
Model 7 Lagged analysis	1999.126	1058	0.055	0.915	0.909	–	–	–	–

Note. CFI, comparative fit index; TLI, Tucker–Lewis index; RMSEA, root mean square error of approximation.

Table 2
Descriptive statistics and CFA loadings for the bi-factor model of gratitude.

Item	<i>M</i> (<i>SD</i>)	Gratitude	Cognitive gratitude	Affective gratitude
GQ1	6.150 (0.934)	0.768 (0.025)***	0.238 (0.066)***	
GQ2	6.050 (1.042)	0.849 (0.032)***	0.343 (0.069)***	
GQ3	5.843 (1.223)	0.702 (0.026)***	–0.021 (0.082)	
GQ5	6.210 (0.907)	0.665 (0.019)***	0.047 (0.068)	
GAC1	4.000 (0.766)	0.469 (0.018)***		0.520 (0.015)***
GAC2	4.080 (0.716)	0.432 (0.017)***		0.485 (0.014)***
GAC3	3.980 (0.792)	0.477 (0.019)***		0.542 (0.015)***

Note. GQ, Gratitude Questionnaire; GAC, Gratitude Adjectives Checklist; *M*, mean; *SD*, standard deviation.

*** $p < .001$.

All participants joined in the current study voluntarily and signed the informed consents before the study, and then received an online survey link through QQ. The multi-section survey contained the measurements of cognitive gratitude, affective gratitude and subjective well-being. This study gained approval from the ethics committee of a local university.

3.1.2. Measures

3.1.2.1. Gratitude. As Study 1, we utilized the same scales to measure cognitive gratitude (T1: $\alpha = 0.706$; T2: $\alpha = 0.742$) and affective gratitude (T1: $\alpha = 0.839$; T2: $\alpha = 0.887$).

3.1.2.2. Subjective well-being. Identical to Study 1, we used Satisfaction with Life Scale (T1: $\alpha = 0.830$; T2: $\alpha = 0.857$) and Positive and Negative Experience scale with positive affect (T1: $\alpha = 0.950$; T2: $\alpha = 0.946$) and negative affect subscales (T1: $\alpha = 0.880$; T2: $\alpha = 0.901$) to access subjective well-being.

3.1.3. Statistical analyses

We completed all main analyses in R language version 4.1.0 with the packages identical to Study 1, and ML was used. Firstly, descriptive analysis and Pearson correlations between variables were conducted using SPSS 25.0. Secondly, we set up a CFA model with gratitude, positive affect, negative affect and life satisfaction at both time points utilizing respective items as indicators to test the invariance of configural, metric and scalar over time. We constrained the factor's structure, loadings and intercepts that symbolized the configural, metric and scalar invariance (Model 4–6). Additionally, the same measurement models were launched at both two waves and the measurement errors for the

same item across the two time points were allowed to covary (Little, Preacher, Selig, & Card, 2007). Thirdly, we set up a lagged analysis to assess autoregressive effects and the predictive effect of gratitude with the bi-factor structure on subjective well-being across two waves. In this model, all autoregressive paths and lagged paths from the general and two specific factors of gratitude to subjective well-being were estimated (Model 7). We also correlated the residual errors of the same item across two time points. The loadings and intercepts of the same item were constrained to be equal across two time points. Two recommended criteria representing invariance of longitudinal measurement were inferred: changes in the comparative fit index of <0.01 (Cheung & Rensvold, 2002) and changes in the Tucker-Lewis index of <0.05 (Little, 1997). The same criteria for acceptable model fit as Study 1 were used.

3.2. Results

3.2.1. Preliminary analyses

The means, deviations and bivariate correlations of study variables across two time points were displayed in Table 3. These variables remained relatively stable over time. Both cognitive and affective gratitude related positively to life satisfaction and positive affect, and negatively related to negative affect. Furthermore, the correlations between cognitive gratitude and affective gratitude were above 0.40 at the same time point and at different time points.

3.2.2. Longitudinal measurement models of gratitude and invariance tests

After that, we included gratitude with the bi-factor structure and separate factors of positive affect, negative affect and life satisfaction to examine the configural, metric and scalar invariance across two time points. As shown in Table 1, the measurement model fitted the data acceptably. Besides, the loading and intercept constraints caused changes less than 0.01 in CFI and TLI, suggesting metric and scalar invariance over time.

3.2.3. Lagged effect from gratitude to subjective well-being

Then, we examined the temporal influence on subjective well-being from the general and two specific factors of gratitude. As indicated in Table 1, Model 7 was acceptable. The standard mean standardized path estimates for Model 7 were shown in Fig. 1. Model 7 indicated that T1 general and affective factors of gratitude, positive affect, negative affect and life satisfaction all predicted their T2 counterparts significantly, suggesting the temporal stability of these constructs. Most importantly, the general gratitude factor significantly and positively predicted life satisfaction and positive affect. The cognitive factor of gratitude significantly and negatively predicted life satisfaction and positive affect, while no significant effects from the affective factor of gratitude to subjective well-being were found. These results partially replicated the findings of Study 1, suggesting the differential predictive effects of cognitive gratitude and affective gratitude on subjective well-being.

Table 3
Descriptive statistics for study variables in Study 2.

Measure	M	SD	1	2	3	4	5	6	7	8	9	10
1.T1 CG	5.581	0.871	–									
2.T1 AG	3.753	0.640	0.473***	–								
3.T1 LS	4.532	1.042	0.236***	0.321***	–							
4.T1 PA	3.704	0.700	0.303***	0.442***	0.633***	–						
5.T1 NA	2.300	0.639	–0.312***	–0.288***	–0.451***	–0.561***	–					
6.T2 CG	5.439	0.881	0.560***	0.457***	0.286***	0.351***	–0.420***	–				
7.T2 AG	3.750	0.689	0.430***	0.511***	0.310***	0.341***	–0.316***	0.606***	–			
8.T2 LS	4.750	1.031	0.231***	0.275***	0.601***	0.481***	–0.398***	0.365***	0.467***	–		
9.T2 PA	3.750	0.687	0.233***	0.388***	0.437***	0.584***	–0.435***	0.433***	0.533***	0.638***	–	
10.T2 NA	2.326	0.700	–0.169**	–0.244***	–0.392***	–0.424***	0.601***	–0.400***	–0.283***	–0.452***	–0.586***	–

Note. T1, Time 1; T2, Time 2; CG, cognitive gratitude; AG, affective gratitude; LS, life satisfaction; PA, positive affect; NA, negative affect; M, mean; SD, standard deviation.

** $p < .01$.
*** $p < .001$.

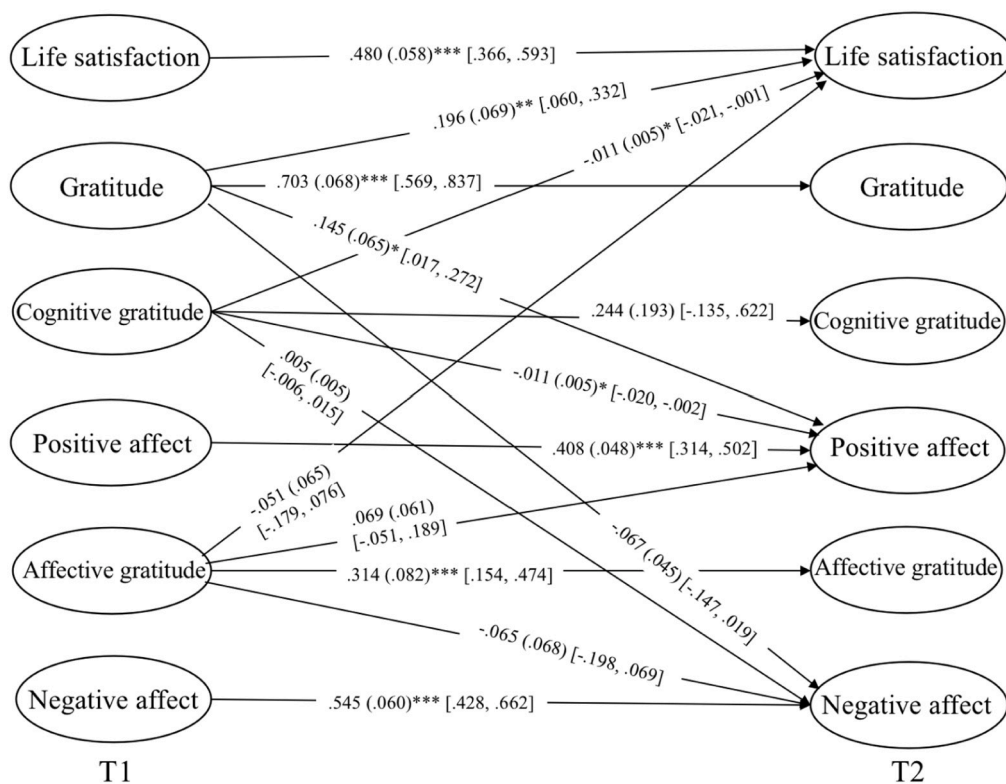


Fig. 1. Standardized path estimates for the cross-lagged analysis.
Note. T1, Time 1; T2, Time 2; Standardized path coefficients and corresponding standard errors were presented. * $p < .05$; ** $p < .01$; *** $p < .001$.

4. Discussion

Our study was the first to test the cognitive-affective structure of gratitude and explore the effect of gratitude with the bi-factor structure on subjective well-being. As we expected, the bi-factor structure of gratitude had the best fit with the data compared with the single- and two-factor models which supported the cognitive-affective construct of gratitude. In addition, using cross-sectional and longitudinal analyses, we consistently found that general gratitude positively predicted life satisfaction and positive affect, and cognitive gratitude negatively predicted life satisfaction and positive affect. In addition, affective gratitude positively predicted life satisfaction and positive affect at the cross-sectional level. Based on different associations between two aspects of gratitude and subjective well-being, the present study can provide practical implication for researchers to design optimal intervention for improving subjective well-being.

First and foremost, the bi-factor model of gratitude had a more satisfactory fit with the data compared with the single- and two-factor structure. What's more, the bi-factor structure of gratitude was reliable, suggesting that gratitude can be explained by a general factor and two distinct components. Grounded on the Schachter theory of emotion (Reisenzein, 1983), the benefaction elicits the initiate appraisal. Then, the beneficiary makes a more comprehensive explanation and attribution of the benefaction, which shapes cognitive gratitude. Additionally, the grateful feeling towards the benefactor might be elicited (i.e., affective gratitude). The illuminating findings on the acceptable bi-factor model of gratitude indicated that cognition and affective feeling might be two essential elements of gratitude.

Furthermore, through analyses of cross-sectional and longitudinal data, we had convergent findings that the general gratitude factor positively predicted life satisfaction and positive affect. Our findings suggested that the commonality shared by cognitive and affective

factors was positively associated with the positive components of subjective well-being, which is in accordance with the broaden and build theory (Fredrickson, 2004). To be more specific, gratitude might broaden people's minds to repay their benefactors, which is beneficial for interpersonal relationships. Then, positive social connections may become useful resources that facilitate subjective well-being.

Interestingly, our results suggested that affective gratitude positively predicted life satisfaction and positive affect cross-sectionally, while cognitive gratitude negatively predicted life satisfaction and positive affect both at cross-sectional and longitudinal levels. To some degree, the differential patterns of predictive links of subjective well-being with two components of gratitude may reflect the different nature between cognitive gratitude and affective gratitude. For affective gratitude, which might be a monitoring system that reflects the changes in cognitive component and expressive behavior (Scherer, 2004). Consistent with this, affective gratitude was found to be associated with the activity in the MPFC related to gratitude expression (Kini et al., 2016). Thus, persons with a high level of affective gratitude are more likely to express gratitude, which strengthens the social ties with others and further improves subjective well-being. As to cognitive gratitude, the indebtedness and responsibility to return the favor come along with the recognition of benefits from others (Mathews & Green, 2010) would increase the level of negative affect. In Chinese culture, people tend to tie gratitude to indebtedness and obligation to reciprocate others to a higher degree than people from individualistic cultures (Kee, Tsai, & Chen, 2008), and they will try to return the favor with all they can even if they just receive a little help (Lin, 2014). In this way, students with higher proneness of recognizing things to be grateful for would burden with more obligations to reciprocate others, and then have a lower level of subjective well-being.

There were some unsolved questions raised by our study. First, due to the relatively small sample size of our longitudinal study, the statistical power may not be enough to detect a weak effect from affective gratitude to subjective well-being, so a larger sample size may be helpful to validate the results of our study. Second, our longitudinal study utilized an interval of three months, so it would be meaningful to test whether our findings can be replicated with a longer interval. Third, our findings were based on self-report questionnaires, so future studies can use experimental design, such as inducing gratitude through writing gratitude lists or making gratitude contemplation.

Overall speaking, the present study is the first step investigating the cognitive-affective construct of gratitude and how cognitive and affective gratitude relate to subjective well-being at both cross-sectional and longitudinal levels. Our research produces a starting point for future studies to explore the nature and process of gratitude. When examining the positive effect of gratitude on other constructs, it may be necessary for future research to differentiate cognitive gratitude and affective gratitude.

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Informed consent

Written informed consents were gained from all participants included in the study.

Declaration of competing interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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