



X good things in life: Processing fluency effects in the “Three good things in life” exercise



Štěpán Bahník^{a,*}, Marek Vranka^{b,1}, Jana Dlouhá^c

^a Department of Psychology, University of Würzburg, Würzburg, Germany

^b Department of Psychology, Faculty of Arts, Charles University in Prague, Prague, Czech Republic

^c Independent Researcher, Lovosice, Czech Republic

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ABSTRACT

The present study examined whether difficulty of recollection may influence the effectiveness of the “Three good things in life” exercise that has previously been shown to increase happiness. Participants were randomly assigned to write 1–10 good things that happened to them during the day in the course of two weeks. We measured life satisfaction, positive and negative affect before the exercise and three times after the exercise. We found no effect of the number of good things participants wrote each day. Life satisfaction and positive affect of participants did not increase after the two weeks of the exercise, but we found a reduction in negative affect. We further investigated various aspects of the exercise in exploratory analyses.

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1. Introduction

Since the pioneering publication of Seligman and Csikszentmihalyi (2000), the scope of therapeutic interventions has expanded greatly. Nowadays it comprises not only traditional treatments focused on negative symptoms, but also positive interventions aimed at raising well-being and life satisfaction. Some of them have undergone randomized controlled trials that suggest that the interventions are effective in improving life satisfaction and well-being (Bolier et al., 2013; Sin & Lyubomirsky, 2009). Among these exercises is the “Three good things in life” exercise (TGT exercise for short) that requires people to write down each night three things that went well that day. They should also state a cause of each good thing and provide an explanation for why it happened (Seligman, Steen, Park, & Peterson, 2005). Despite evidence suggesting that the TGT exercise can increase happiness and lower depressive symptoms, and the fact that it is routinely presented as a proven positive psychology exercise (Vella-Brodrick, 2013), its working mechanism remains unclear (Mongrain & Anselmo-Matthew, 2012). Based on a different series of studies showing that the number of recalled good memories can influence reported life satisfaction (O’Brien, 2013), we hypothesized that the number of things and the subjective ease with which they can be recalled could play an important role in the TGT exercise. An

examination of our hypothesis might not only have significant consequences for optimization of the TGT exercise (e.g. making it easier and therefore more effective by asking people to recall fewer things) but also shed some light on its working mechanism.

1.1. Previous studies

In the study introducing the TGT exercise, Seligman and colleagues randomly assigned the exercise to a group of 59 volunteers who signed up via link advertising “Happiness Exercises” on a website accompanying one of Seligman’s popular books about happiness (Seligman et al., 2005). Participants’ happiness (measured by the Steen Happiness Index, SHI) kept increasing on each measurement after completion of the exercise (i.e. immediately after completion, one week, and one, three, and six months afterwards). The increase from the baseline happiness was statistically significant after one month. Participants’ depressive symptoms (measured by the Center for Epidemiological Studies–Depression Scale, CES-D [Radloff, 1977]) already significantly decreased on the first measurement after the completion and stayed on a lower level in all subsequent measurements. A comparison group of 70 volunteers was given a “placebo” exercise consisting of writing about early memories each day for a week. Although their happiness also increased on the first measurement after finishing the exercise, it returned to the baseline level on all subsequent measurements. Similarly, their depressive symptoms lowered only by a negligible amount.

* Corresponding author.

E-mail address: bahniks@seznam.cz (Š. Bahník).

¹ These authors contributed equally to this work.

Mongrain and Anselmo-Matthews (2012) replicated the results of Seligman and colleagues. The only substantial change they made consisted of an addition of a new condition based on the placebo exercise in which they asked the participants to recall *positive* childhood memories each day for a week. Participants in the original placebo condition improved only initially and then returned to the pre-intervention level of well-being, while participants in the TGT group remained happier on all subsequent measurements. However, participants in the newly added “positive childhood memories” group improved to the similar extent as those in the TGT group. This raises the possibility that stating the causes of good things and thinking about why they happened are not important elements of the intervention. Solely thinking about positive things each day may be sufficient as an explanation of the observed effect (Mongrain & Anselmo-Matthews, 2012). In contrast with the original study, Mongrain and Anselmo-Matthews did not observe larger decrease of depressive symptoms (measured by the CES-D) in the treatment condition than in the placebo group.

Other studies also examined the effects of the TGT exercise on well-being. Gander, Proyer, Ruch, and Wyss (2013) followed closely the design of the original study (Seligman et al., 2005) and investigated one- and two-weeks long versions of the TGT exercise. The authors used the same measurements, means of administration, and times of data collection as the original study. However, there was no effect of the exercise on depressive symptoms and happiness increased only in the group with the shorter period of the exercise. Moreover, even this increase was not distinguishable from a change of happiness in the placebo group.

Similarly, in a large recent study Sekizawa and Yoshitake (2015) found only partial support for the effectiveness of a four weeks version of the TGT exercise. Participants in the TGT and placebo group did not differ on the CES-D measure, as well as on measures of life satisfaction, optimism, pessimism, and belief in trustworthiness of others. The sole observed difference between the two groups was in positive affect.

As many authors from this area of research admit (e.g. Burton & King, 2004; Pennebaker & Beall, 1986; Seligman et al., 2005), their studies are focused primarily on testing whether their proposed interventions can increase well-being more than a placebo exercise. Clear understanding of the underlying working mechanism is therefore missing. Our study attempts to examine a possible moderating factor of the success of the exercises, namely the number of good things that participants should recall.

1.2. The present study

Several authors suggested that the ease with which people can complete an assigned exercise (or the lack of it) influence induced positive affect and therefore the effect of the exercise. For example participants who are more imaginative (Odou & Vella-Brodrick, 2013), in touch with their emotions (Greenberg, Wortman, & Stone, 1996), or mindful (Seear & Vella-Brodrick, 2013) are supposed to complete exercises like the TGT more easily and feel more competent while doing them. On the other hand, when an exercise evokes negative affect, presumably because it is too difficult or too boring (Lyubomirsky, Sheldon, & Schkade, 2005), its positive effect can be limited or canceled out completely. Even Seligman et al. (2005) mentioned that one week may not be enough time for participants doing the TGT exercise to develop sufficient skill and therefore it could be difficult for at least some of them. Additionally, they suggested that the long-term benefits had been mediated by willingness to continue the exercise voluntarily after the end of the prescribed one-week period. This also points to a possible connection between difficulty of the exercise, willingness to continue doing it, and resulting benefits. Hence, we believe that it is possible that some of the previously found effects can be explained

if we take into account the difficulty of the exercise and its subsequent change.

This line of reasoning is supported by a study of O'Brien (2013), who showed that people report lower life satisfaction when they perceive recollection of good memories as hard. According to O'Brien, the metacognitive ease (i.e. fluency) with which one can recall positive or negative memories influences judgment of overall “goodness” or “badness” of a given period. This can be explained in the framework of attribute-substitution theory of heuristics (Kahneman & Frederick, 2002) with fluency of recollection of good memories functioning as a sign of how many good events happened in the past. For example, if it is hard to recall good memories from the last day, people may use such difficulty as a heuristic cue resulting in a judgment that the day was probably not so good. The ease of recollection is usually a valid cue for such judgment. However it may be misleading when there is another source of ease or difficulty. For example, when people are asked to recall many instances of good events from the last day, it may be difficult because of the task at hand and not because of any property of the day to which the experienced difficulty is nevertheless misattributed. This misattribution of difficulty of recollection is well supported by past research (O'Brien, 2013; Schwarz et al., 1991). Consequently, people who are asked to recall only a few good things from the last day can do so more easily than people who are asked to recall many positive things. This may in turn influence perceived quality of the day or result in higher positive affect. A similar reasoning may be applicable in case of the TGT exercise. The lower effectiveness at the beginning of the exercise may be a result of initial difficulties in recalling good things which may decrease with practice. It is also possible that the exercise would be more effective if the number of things to be recalled was initially lower and increased later on or if it was adjusted to particular conditions of each person.

The goal of the present study was to test this possibility. We hypothesized that having people write more good things may result in lower improvement of life satisfaction than having people write less good things. Our hypothesis was, however, not confirmed by the results. We also explored various further questions related to difficulty of the exercise and its effectiveness.

2. Methods

2.1. Pretest

To explore whether it is possible that people find it hard to recall three good things that happened to them during a day, we conducted a pretest in which we asked participants to report as many good (or bad) things that happened to them during a previous day as possible. Then we asked them how many things it was still easy to recall and how satisfied they were with their life on a scale from 1 (not satisfied) to 10 (satisfied).

One hundred and eighty-three anonymous participants volunteered to fill in a short questionnaire on a Czech web survey platform. The median age of the participants was 23 years and 87% percent of them were female. We initially considered using both good and bad things in our main study; therefore, we randomly assigned people to one of two groups – reporting either good, or bad things that happened to them during a previous day. Although we did not use the bad things condition in the main study, it enabled us to test whether recalling bad things results in higher reported life satisfaction than recalling good things. This might happen because people were asked to provide as many events as possible, which might have felt difficult. As seen in O'Brien (2013), this should result in higher reported life satisfaction by

participants recalling bad events in comparison with participants recalling good events.

One participant was removed from analysis because she provided an invalid answer for one of the questions. In general, we found that it was easier for participants to list good things than bad things. Participants recalling good things wrote more events than participants recalling bad things, $t(180) = 4.58, p < .001, d = 0.68, 95\% \text{ CI } [0.38, 0.98], M_{\text{positive}} = 4.53 (SD = 3.34), M_{\text{negative}} = 2.60 (SD = 2.18)$, and reported that it was still easy to write more things, $t(180) = 4.16, p < .001, d = 0.62, 95\% \text{ CI } [0.32, 0.91], M_{\text{positive}} = 2.83 (SD = 2.49), M_{\text{negative}} = 1.56 (SD = 1.48)$. Importantly, 52% of participants recalling good things answered that it was easy for them to provide only 2 or fewer events. This suggests that writing three good things as required by the TGT exercise might be difficult for some people.

Participants recalling good things reported somewhat lower life satisfaction than participants recalling bad things, $t(180) = -1.66, p = .10, d = -0.25, 95\% \text{ CI } [-0.54, 0.05], M_{\text{positive}} = 6.40 (SD = 2.36), M_{\text{negative}} = 6.95 (SD = 2.11)$. While the difference was not significant, the results were in the direction expected from the results of O'Brien (2013).

2.2. Main study

Design, procedure, materials, hypothesis and analysis plan were registered before the beginning of data collection on the Open Science Framework (osf.io/buqh7/). Full wording of materials, analysis scripts, and data are also included therein.

2.3. Participants

Two hundred and four students (74% female) of business administration programs at two Czech universities registered for the study and completed a pre-exercise questionnaire. Their average age was 21.8 ($SD = 2.5$). Participants were offered partial course credit for their participation. After the exclusions described in the Analysis section, 172 participants remained. We aimed for a sample as large as possible given our limited resources. A sample of 172 participants results in statistical power $1 - \beta = .80$ for a correlation $r = .21$ given an α level of .05, which means that the study had sufficient power to find a small-to-moderate effect.

2.4. Design

Participants were randomly assigned to one of ten groups at the time of their registration. The groups differed only in the number of good things that participants were supposed to report each day (from 1 to 10). The number of things to report stayed constant throughout the two weeks of the exercise. All other aspects of the study were the same for everyone. Life satisfaction measured immediately after the two weeks of the exercise served as the primary dependent variable.

2.5. Procedure

The study was introduced in a classroom setting, where participants were informed about the conditions of participation and asked to register at a study website. Participants were able to give their informed consent and complete the entry questionnaire on the study website for 5 days, after which the registration closed. The exercise began the following day. Participants were asked to log in on the web page and fill in the given number of good things (from 1 to 10 as specified by their random assignment to one of the ten respective conditions) that happened to them during the day each day for two weeks. Before submitting their answers, all participants were reminded about the importance of following the

instructions closely (nevertheless, they were allowed to report a lower number of good things than stated in the instructions). The web page was accessible each day from 20:00 to 12:00 of the following day. After two weeks, the exercise ended and the participants were sent the first post-exercise questionnaire the following day. The questionnaire contained measures described in Section 4.6 and suggested that the participants continue with the exercise even after the end of the study. Participants were sent two further questionnaires one and six weeks after the end of the exercise. The time schedule along with the numbers of participants completing each part of the study can be found on osf.io/shtkf/.

2.6. Materials

As described above, participants filled four questionnaires in total – one before and three after the completion of the exercise. All questionnaires were presented online in Czech on the website specifically designed for the study.

For measuring the main dependent variable of interest, we used an altered version of the Satisfaction with Life Scale (SWLS) (Diener, Emmons, Larsen, & Griffin, 1985). The altered version contained three questions instead of the original five and was focused on current life satisfaction instead of long-term life satisfaction (e.g. “In most ways my **current** life is close to my ideal.” – the word “current” was added). Answers were provided on a scale from 1 (strongly disagree) to 7 (strongly agree). The three questions showed good internal consistency, Cronbach’s $\alpha = .84, 95\% \text{ CI } [.73, .96]$.

Apart from the SWLS, we used a short form of the Positive and Negative Affect Schedule (PANAS) (Thompson, 2007) for measuring current affective state of participants. The PANAS asks participants to rate to what extent they have felt 10 different emotions – 5 negative and 5 positive (we used only 4 positive emotions in analyses due to an error in translation of an item “alert”) on a scale from 1 (very slightly or not at all) to 5 (extremely). Answers for negative and positive emotions are averaged to form two separate measures of negative and positive affect. Both measures showed reasonably good internal consistency, Cronbach’s $\alpha = .71, 95\% \text{ CI } [.60, .83]$ for positive affect, and Cronbach’s $\alpha = .70, 95\% \text{ CI } [.60, .81]$ for negative affect. The PANAS was intended for exploratory analyses and had only a supportive role for the SWLS.

We administered the SWLS and PANAS in all four questionnaires. In the questionnaire filled immediately after the two weeks of exercise, we also asked participants how difficult they had found recalling good things (on a 7-point scale ranging from *not at all* to *very*), how many minutes per day they had spent on the exercise, whether the exercise had been getting easier with practice, and whether they thought the exercise could have made them more satisfied and happier. The last two questions used a 5-point scale from *no* to *yes* with an *I don't know* midpoint. We report the two answers above the midpoint (*rather yes* and *yes*) as positive answers (analogously for the two answers below the midpoint).

In the questionnaires completed one and six weeks after the exercise, in addition to the SWLS and PANAS, we asked participants whether they had continued with the exercises on their own and if so, how often.

2.7. Analysis

Following pre-registered exclusion criteria, data from 26 participants who failed to provide at least one good event in their daily exercise questionnaire at least on five occasions were excluded from analysis. Whether a participant provided at least one good event was determined after the end of the exercise in the following manner: All reported events from all participants were pooled and

shuffled. Afterwards, an assistant coded whether the events referred to good things (i.e. whether they made sense and could be reasonably considered good things). The information about validity of events was then connected back to the data from participants. Altogether, participants provided 13194 events, out of which 2.9% were not valid (mainly answers such as “nothing” or “I can’t remember.”). Additionally, we excluded data from 6 participants who failed to fill the SWLS in the entry questionnaire or in the post-study questionnaire. This left 172 participants for the analysis. Data from participants who did not answer the SWLS in the two remaining questionnaires were not excluded because they were (together with the PANAS and other additional questions) intended only for exploratory analyses. Some of these exploratory analyses were therefore conducted with data from a lower number of participants.

Confirmatory pre-registered analysis of the primary hypothesis was conducted with a linear regression with life satisfaction measured immediately after the exercise as a dependent variable. Pre-exercise life satisfaction and the number of good things to be reported each day served as independent variables. We did not have any reason to expect that there is any particular threshold where the recollection of good things leads to more negative life satisfaction. Therefore, we used linear and quadratic contrasts for the number of good things to be reported. A negative parameter for either of the contrasts would be consistent with our hypothesis.

The remaining measures were used for exploratory analyses which were not pre-registered and aimed only to clarify the results.

3. Results

3.1. Confirmatory analysis

Linear regression with post-study life satisfaction as a dependent variable found an effect of pre-study life satisfaction, $t(168) = 14.57, p < .001, \beta = 0.75, 95\% \text{ CI} = [0.65, 0.85]$, but no effect of either linear, $t(168) = 0.44, p = .66, \beta = 0.02, 95\% \text{ CI} = [-0.08, 0.13]$, or quadratic, $t(168) = 0.45, p = .66, \beta = 0.02, 95\% \text{ CI} = [-0.08, 0.12]$, contrasts for the number of things reported each day. This shows that the number of things had no influence on effectiveness of the exercise. The results are virtually unchanged when we use data from all 184 participants who completed both measures without excluding those who failed to complete the exercise five or more times.

3.2. Exploratory analyses

3.2.1. Long-term effect

Seligman et al. (2005) found an effect of the exercise only after one month. We therefore analyzed whether there was any effect of the number of good things on life satisfaction one and six weeks after the end of the exercise. However, life satisfaction did not depend on the number of things after one or six weeks. For life satisfaction after one week, the effect of pre-exercise life satisfaction was significant, $t(137) = 12.40, p < .001, \beta = 0.75, 95\% \text{ CI} = [0.63, 0.87]$, but linear, $t(137) = -1.54, p = .13, \beta = -0.09, 95\% \text{ CI} = [-0.21, 0.03]$, or quadratic trends for the number of things, $t(137) = -0.98, p = .33, \beta = -0.06, 95\% \text{ CI} = [-0.18, 0.06]$, were not. Similarly, pre-exercise life satisfaction was associated with life satisfaction after six weeks, $t(115) = 10.08, p < .001, \beta = 0.69, 95\% \text{ CI} = [0.55, 0.82]$, but linear, $t(115) = -0.51, p = .61, \beta = -0.04, 95\% \text{ CI} = [-0.17, 0.10]$, or quadratic trend for the number of things, $t(115) = 0.14, p = .89, \beta = 0.01, 95\% \text{ CI} = [-0.13, 0.15]$, were not. However, it should be noted that life satisfaction correlated highly

($.68 < r_s < .87$) between all SWLS measurements, so the results are not independent.

3.2.2. Positive and negative affect

While we did not find an effect of the number of things on life satisfaction, it is possible that it could have influenced positive or negative affect. We tested this hypothesis using the measures of positive and negative affect obtained from the PANAS. We conducted separate regressions for the two measures of affect and three post-exercise questionnaires, which resulted in total six regressions. The measures of positive and negative affect correlated with life satisfaction, $.50 < r_s < .60$ for positive affect, and $-.55 < r_s < -.37$ for negative affect, and between themselves, $-.51 < r_s < -.29$. The effects of linear or quadratic trends for the number of things provided did not approach statistical significance in any analysis with the exception of the linear trend for negative affect measured one week after the end of the exercise, $t(137) = 1.93, p = .06, \beta = 0.12, 95\% \text{ CI} = [-0.00, 0.25]$. This effect would suggest that reporting more things led to higher negative affect. However, since the result is inconsistent with all other analyses, it is possible it could be a false positive. Detailed results of the analyses can be found on osf.io/m8ti5/.

3.2.3. Following instructions

One possible reason why we did not find any effect of the number of good things could have been that participants did not follow the instructions. That is, that they did not write down the number of things they were asked to. However, participants that were asked to recall more things were only slightly less likely not to do the exercise on any given day. The average number of times participants did not do the exercise ranged from 1.08 for the group writing one thing to 2.25 for the group writing 8 things. Furthermore, participants wrote the full required number of things only slightly less often in groups recalling more things. The average number of days when participants provided the full number of things ranged from 7.57 for the group writing 6 things to 9.31 for the group writing 1 thing. The summary results can be found in Table 1.

3.2.4. Difficulty

Another possibility why we did not find the predicted effect of the number of good things may be that participants did not actually consider the task to be more difficult when they were supposed to write more things. Not surprisingly, participants in groups recalling more things reported spending more time doing the exercise per day, $r_s = .34, 95\% \text{ CI} = [.21, .46], p < .001$ (see Table 1), and the perceived difficulty seemed to be dependent on reported time spent working on the exercise, $r_s = .37, 95\% \text{ CI} = [.23, .50], p < .001$. However, while people writing more good things considered the exercise more difficult, the association was small and not significant, $r(170) = .13, 95\% \text{ CI} = [-.02, .27], p = .09$.

Most of the participants ($n = 99$) reported that the exercise became easier in the course of the study (15 answered that they don't know whether the exercise became easier and 59 answered that it did not). Participants from groups listing more things were somewhat more likely to report that the exercise became easier during the days, $r_s = .12, 95\% \text{ CI} = [-.03, .27], p = .12$, which may partially explain why the difference in perceived difficulty was not larger.

3.2.5. Improvement

The study did not use a control group with a placebo exercise. However, it is still of interest to see whether life satisfaction and affect changed during the exercise. To explore the improvement in life satisfaction and affect, we compared pre-exercise measures

Table 1
Summary results of selected variables for the ten experimental groups.

Group [number of things]	Number of participants	Difference in pre- and post-exercise life satisfaction	Did not do the exercise [number of days]	Wrote all things [number of days]	Perceived difficulty [1 (not at all) – 7 (very)]	Recollection becoming easier [1 (no) – 5 (yes)]	Belief in exercise causing happiness [1 (no) – 5 (yes)]	Estimated duration the exercise took daily [min]
1	13	0.15 (0.94)	1.08 (1.12)	9.31 (0.75)	3.62 (1.66)	3.38 (0.96)	2.62 (1.04)	2.69 (1.65)
2	16	−0.18 (0.70)	1.69 (1.25)	8.56 (1.26)	4.56 (1.50)	3.12 (1.09)	2.88 (1.15)	5.31 (2.89)
3	18	0.22 (0.65)	1.50 (1.38)	9.00 (1.14)	4.28 (1.90)	3.06 (1.16)	2.50 (1.10)	5.22 (3.32)
4	21	0.22 (0.77)	1.81 (1.29)	8.62 (1.02)	4.52 (1.75)	3.19 (0.98)	2.52 (1.21)	5.05 (4.65)
5	13	0.03 (0.98)	1.23 (1.09)	9.08 (1.19)	3.85 (1.41)	3.46 (0.97)	2.62 (0.96)	5.15 (4.12)
6	23	0.10 (1.14)	2.13 (1.22)	7.57 (2.86)	4.74 (1.66)	3.00 (1.28)	2.52 (1.34)	8.09 (5.79)
7	14	−0.21 (0.66)	2.00 (1.41)	8.43 (1.45)	3.50 (1.34)	3.50 (1.16)	3.36 (1.22)	6.71 (4.86)
8	12	0.08 (0.90)	2.25 (1.60)	8.33 (1.61)	4.33 (1.23)	4.17 (0.39)	3.17 (1.03)	7.33 (4.25)
9	19	−0.07 (0.96)	2.05 (1.18)	8.05 (2.53)	4.47 (1.68)	3.74 (1.05)	2.79 (1.03)	7.53 (7.54)
10	23	0.22 (0.74)	1.91 (1.16)	8.26 (2.09)	5.09 (1.28)	3.17 (1.27)	2.78 (1.24)	7.78 (3.94)
Correlation	–	−.01 [−.15, .15]	.18 [.04, .33]	−.12 [−.27, .02]	.11 [−.05, .26]	.12 [−.03, .27]	.09 [−.05, .24]	.34 [.21, .46]

The table contains averages and standard deviations for selected measures separately for each of the ten experimental groups. The last row shows Spearman correlation coefficient (along with 95% confidence intervals) between the number of good things recalled each day and a given measure.

with post-exercise measures using paired t-tests. The results are displayed in Fig. 1.

We found no difference in life satisfaction and positive affect before and after the exercise. However, a decrease of negative affect can be seen after the exercise. While we cannot confidently attribute the change to the exercise, the results suggest that if the exercise work, it might be primarily by reducing negative affect. This is compatible with the results of Seligman et al. (2005), where the effect of the exercise was especially visible in a decrease of depressive symptoms.

3.2.6. Continuing the exercise

Seligman et al. (2005) reported that the effect of the exercise was more pronounced for people who continued to do the exercise even after the end of the week they were supposed to do it. We also asked our participants whether they continued to do the exercise in the questionnaires one week and six weeks after the exercise. Thirty-two participants (23%) reported continuing the exercise after one week and 20 participants (17%) after six weeks. This shows that participants in our study did not generally continue with the exercise when they had no external incentive to do so. The participants continuing the exercise did so on average 3.56 times in the one week following the end of the exercise and on average 3.67 times per week in the five weeks afterwards.

Next, we tested whether life satisfaction of participants continuing the exercise improved during the course of the study. We found no indication of improvement in life satisfaction either after one week, $t(31) = -0.96$, $p = .34$, $d = -0.17$, 95% CI [−0.52, 0.18], or after six weeks, $t(19) = 0.08$, $p = 0.94$, $d = 0.02$, 95% CI [−0.42, 0.46].

3.2.7. Belief in the exercise

Unlike in the study of Seligman et al. (2005), our participants had an external motivation to do the exercise. Participants in Seligman et al. were volunteers interested in positive psychology, so it is probable that they were more likely to believe in the effectiveness of the exercise. Indeed, less than one third of our participants ($N = 51$) reported that they thought that the exercise could have caused them to feel more content and happier (34 reported that they did not know whether the exercise could have caused them to feel more content and happier and 87 reported that they did not think so). The belief was not associated with the number of things to be recalled each day, $r_5 = .09$, 95% CI [−.05, .24], $p = .22$, and with reported time spent doing the exercise daily, $r_5 = .01$, 95% CI [−.13, .16], $p = .88$. However, the participants who reported that they believed that the exercise could have caused them to feel more content and happier were less likely to

consider the exercise to be difficult, $r_5 = -.34$, 95% CI [−.47, −.20], $p < .001$, and were more likely to do the exercise even after the end of the two weeks, $r_5 = .41$, 95% CI [.25, .57], $p < .001$.

The participants who believed that the exercise could have caused them to feel more content and happier reported higher life satisfaction than before the exercise, immediately after the exercise, $t(50) = 2.79$, $p = .007$, $d = 0.39$, 95% CI [0.10, 0.67], one week after the exercise, $t(36) = 2.53$, $p = .02$, $d = 0.42$, 95% CI [0.08, 0.75], but not six weeks after the exercise, $t(35) = 0.17$, $p = .87$, $d = 0.03$, 95% CI [−0.30, 0.35]. However, it is not clear whether it was the belief that influenced participants' life satisfaction or whether the improvement in life satisfaction affected their belief in the exercise.

4. Discussion

The main research question of the present study was whether the number of good things to be recalled each day can influence the effectiveness of the TGT exercise. Intuitively, one could believe that recalling a higher number of good things might lead to a higher improvement of life satisfaction. However, following the previous study by O'Brien (2013), we hypothesized that recalling a higher number of good events can be perceived as difficult by some participants. The difficulty (also termed as experienced disfluency) may lead them to infer that their lives do not contain many positive experiences, and thus induce negative affect. This negative affect would then in turn lower or cancel any positive influence of the TGT exercise. If our hypothesis was correct, we would expect to find a negative relationship between the number of things that participants were asked to recall each day (ranging from 1 to 10) and the change in their life satisfaction. However, we found no relationship. Moreover, we did not find such a relationship even with the later post-exercise measurements of life satisfaction or with measures of positive and negative affect. Even though the results constitute a complete lack of support for our hypothesis, there are a few limitations of our study that prevent us from making definitive conclusions.

One possible reason why we did not find any effect might have been that writing more good things was not perceived as much more difficult than writing fewer things. Based on the results of the pretest, it seemed plausible that as much as half of participants would consider recalling even three things difficult. Yet, this estimate concerned only a recall on a single occasion and it is possible that with practice even recalling as much as ten things each day might become relatively easy. Participants in groups writing more good things might have learned to better notice and remember

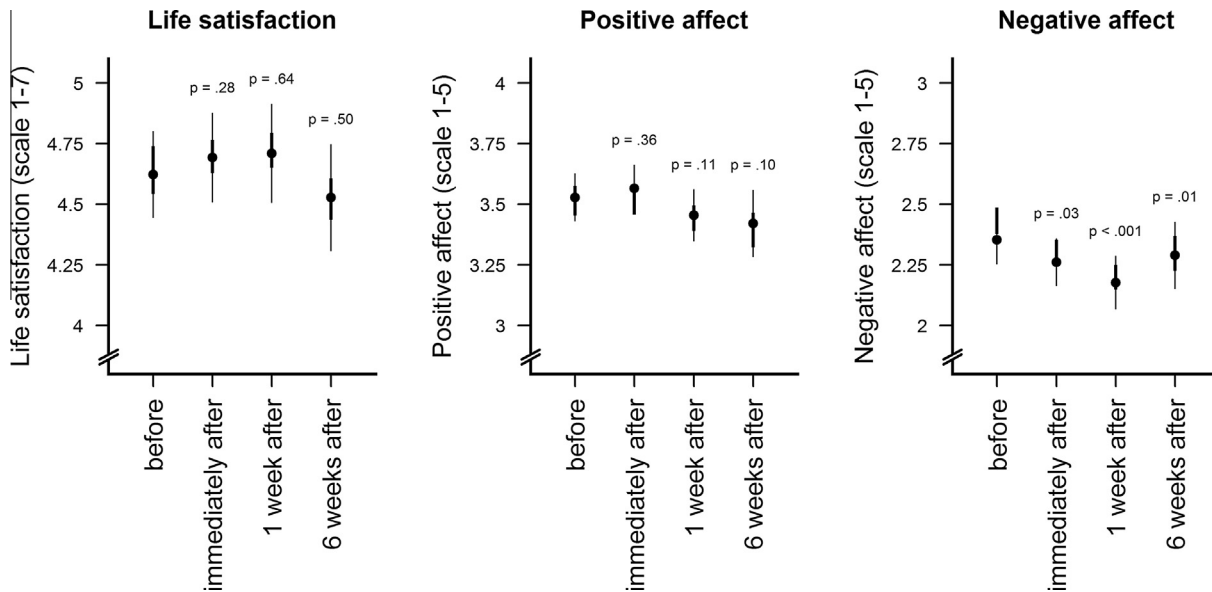


Fig. 1. Life satisfaction and affect measured at four points during the study. The figure displays mean values of measures of life satisfaction and affect measured before the exercise and immediately, one week and six weeks after the exercise. Thin error bars represent unadjusted 95% confidence intervals around means. Thick error bars show 95% confidence intervals around means corrected for dependence in measurements (Cousineau-Morey intervals; see Baguley, 2012). These intervals were computed using only data from participants with no missing values for a given measure, so inference from them can differ from a result of comparison between measurements before and after the exercise. The results of such comparisons using paired t-tests are displayed above the error bars. Note that a range of values displayed on ordinate does not contain all possible values obtainable using a given scale.

good things or they might have simply listed more mundane things (Folkman & Moskowitz, 2000). The results from exploratory analyses generally support this possibility: There was no strong association between the number of things to be recalled and the rating of difficulty of the exercise, and most people thought that the exercise was getting easier with time – especially participants in the groups recalling more things. These findings fit with the notion that the recall of more things is difficult only initially and is becoming easier afterwards. It is therefore still possible that difficulty of recalling good things could negatively affect change of life satisfaction, but this possibility does not seem to have any practical consequences for the TGT exercise.

We were not primarily interested in the effectiveness of the exercise and for that reason our study did not use a placebo control group. Given the lack of the effect of the number of good things to be recalled, we also evaluated the effectiveness of the exercise itself, although only in an explorative fashion without attempting to come to any strong general conclusions.

We found no difference between life satisfaction and positive affect before and after the exercise at any of the three post-exercise measurements. However, participants reported less negative affect at all measurements after the exercise. Therefore, it seems that the exercise could have worked by reducing negative affect. Still, as we mentioned above, without a placebo control group, any difference or lack of difference before and after the exercise might be due to other factors than the exercise itself such as change of workload due to the progression of an academic term.

Up to this date, there has only been one successful direct replication of the original TGT study by Mongrain and Anselmo-Matthews (2012), who however failed to find any effect of the exercise on depressive symptoms. Another replication study by Gander et al. (2013) brought only mixed results for the original one week version of the exercise and no evidence of effectiveness for the two week version. The authors hypothesized that asking people to do the exercise for two weeks could be counterproductive as it could feel too forced, and thus evoke negative affect. If

true, this issue could have had even more serious consequences in the present study as our participants' reward of partial course credit was conditioned on their adherence to the prescribed task, making the possible negative effect more pronounced.

This brings us to probably the most important difference between the present and the original study, which is the recruitment and composition of the study sample. Seligman and colleagues, similarly to the authors of replication studies, used a self-selected sample recruited by advertising of an exercise aimed to rise happiness or build character strengths (Gander et al., 2013; Mongrain & Anselmo-Matthews, 2012; Seligman et al., 2005). Lyubomirsky, Dickerhoof, Bohem, and Sheldon (2011) showed that self-selection is one of the key moderators of the overall success of happiness-increasing interventions, although it is not clear what exactly causes the moderating effect. It is therefore possible that the self-selected sample of participants in Seligman et al. (2005) was more intrinsically motivated to follow the instruction of the exercise and believed more strongly in its effectiveness than participants in our study. This may be important because Seligman and colleagues found that the effect of the exercise was especially pronounced in participants who continued the exercise on their own. Less than one quarter of the participants in our study continued the exercise on their own and participants generally did not state that they had believed that the exercise could have made them more content or happier. Additionally, the participants that believed in the effectiveness of the exercise reported higher life satisfaction after the two weeks of the exercise, which further indicates that the effectiveness of the exercise can be dependent on belief and motivation. This result is in accord with the study of Odou and Vella-Brodrick (2013), that found that motivation and the number of times participants voluntarily completed the TGT exercise during a week were positively correlated with its effects. Given the expectancy effect, selection bias, and high attrition rates, previous studies might have overestimated the effect of the exercise. Our study may have been less likely to suffer from this problem due to the low attrition resulting from the strong external motivation.

It is necessary to note a few additional differences between the present and the original study by Seligman et al. (2005). The original TGT exercise included writing causes and explanations of the good things, an aspect which was not used in our study since we were primarily interested in the effect of the number of good things. It is possible that the effectiveness of the exercise might be due to thinking about reasons for the good things to some extent and not due to recalling and writing them per se. On the other hand, Mongrain and Anselmo-Matthews (2012) found that writing about happy childhood memories without any causal explanation had a similar effect to the TGT exercise, which would suggest that thinking about reasons and their explanations is not essential for effectiveness of the exercise. Second, our measure of life satisfaction differed from the measure used by Seligman and colleagues, who used the Steen Happiness Index (Seligman et al., 2005). However, the SHI has similar psychometric properties to the SWLS and both measure a similar construct (Kaczmarek, Bujacz, & Eid, in press). We used a shortened version of the SWLS in our study, but this did not seem to significantly affect its reliability.

In conclusion, we found that the number of good things recalled does not have any practical impact on effectiveness of the TGT exercise. We did not use a placebo control group, so we cannot confidently infer effectiveness of the exercise from our study. Nevertheless, our results further corroborated previous findings related to the importance of expectations for the effects of the TGT exercise. Further studies that can carefully differentiate a placebo effect from the genuine contribution of recalling good things are needed in order to evaluate the true value of the exercise. And whatever the genuine benefits of recalling good things might be, the number of things, as our study suggests, is not an important factor.

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