



What Emotions to Encourage? The Role of High and Low Arousal Positive Emotions in Three Randomized Controlled Trials of Different Positive Psychology Interventions

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Abstract

Growing evidence shows that positive psychology interventions (PPIs) are able to enhance positive emotions. However, less is known about the specific role of high and low arousal positive emotions within such interventions. The goal of the current study is to examine the effect of different types of PPIs on high and low arousal emotions and to explore whether high and low arousal positive emotions serve as mediators for the intervention effects on mental well-being. Post-hoc tests of three formerly published randomized controlled trials were conducted in comparison with waitlist control: (1) a multicomponent PPI ($N=275$), (2) a comprehensive gratitude intervention ($N=144$), and (3) an acts of kindness intervention ($N=216$). Findings showed that the multicomponent PPI improved low arousal emotions, while the gratitude intervention marginally improved high arousal positive emotions. The acts of kindness intervention was not more effective in improving positive emotions compared to waitlist control. Similar conclusions could be drawn from the mediation analyses, yielding most pronounced results for low arousal positive emotions mediating the effect of the multicomponent PPI on mental well-being. The current study provides first evidence that the upward spiral of positive emotions might depend on the type of PPI and its impact on high and in particular low arousal positive emotions.

Keywords Positive emotion · High arousal · Low arousal · Positive psychology intervention · Mental well-being

Positive emotions are subjective, positively valenced feelings such as feeling happy, calm, satisfied or excited (Moskowitz et al., 2021). Positive affect is uniquely

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related to better psychological and physical well-being (Folkman, 1997; Folkman & Moskowitz, 2000; Fredrickson et al., 2008; Kok et al., 2013; Tice et al., 2007; Wichers et al., 2007; Zautra et al., 2005). Also, positive emotions are positively associated with creativity, performing prosocial behavior, problem solving skills and coping skills, and with having positive perceptions of self and others (Lyubomirsky et al., 2005). In addition, people who experience more positive affect tend to live longer (Chida & Steptoe, 2008; Liu et al., 2016; Moskowitz, 2003; Moskowitz et al., 2008; Steptoe & Wardle, 2011).

An influential theory that explains the beneficial role of positive emotions is the broaden-and-build theory (Fredrickson, 2001, 2013b). According to this theory, the experience of positive emotions *broadens* an individual's visual awareness, attention, thoughts and behaviors in the short-term (Fredrickson & Branigan, 2005). This broadened repertoire facilitates the *building* of long-term personal resources, such as social support, problem-solving skills, physical health and life-fulfillment (Fredrickson et al., 2008; Kok et al., 2013). An upward spiral is set in motion, in which increased attention and personal resources lead to sustained positive emotions, personal growth and mental well-being in the long-term (Fredrickson & Joiner, 2002, 2018; Fredrickson, 2013b).

The emerging field of positive psychology focuses on understanding and promoting mental well-being and optimal functioning, in addition to understanding and alleviating psychological distress and malfunctioning (Seligman & Csikszentmihalyi, 2014). Research has shown that mental well-being protects against the recurrence of psychopathology and enhances recovery from mental disorders (Iasiello et al., 2019; Keyes et al., 2010; Lamers et al., 2015; Schotanus-Dijkstra et al., 2017b, 2019a; Trompeter et al., 2017; Wood & Joseph, 2010). For this purpose, a vast array of positive psychology interventions (PPIs) has been developed, aimed at raising positive feelings, cognitions and behaviors (Sin & Lyubomirsky, 2009). PPIs, for example targeting gratitude, meaning, kindness and savoring, have shown to be effective in improving emotional well-being in non-clinical (Bolier et al., 2013; Hendriks et al., 2020; Sin & Lyubomirsky, 2009; van Agteren et al., 2021b) and clinical samples (Chakhssi et al., 2018; Geerling et al., 2020; van Agteren et al., 2021b). Meta-analyses about specific PPIs such as loving-kindness meditation (Zeng et al., 2015), gratitude interventions (Davis et al., 2016) and acts of kindness interventions (Curry et al., 2018) also suggest that these interventions are effective in enhancing positive emotions. However, most studies have investigated the effects of PPIs on positive emotions as general outcome, while positive emotions can also be further distinguished.

One possible distinction stems from the circumplex model of affect, in which an emotional state is described along the two dimensions of pleasure versus displeasure and high arousal versus low arousal (Russell, 1980; Russell et al., 1989). High arousal positive emotions refer to affective states associated with increased action readiness and behavioral activation (Bradley & Lang, 2007; Harmon-Jones et al., 2013; Lowe, 2011), such as feelings of elatedness, excitement and surprise. In other words, people are more motivated to move towards something in the environment when they are highly aroused. For example, you are excited to see your best friend at a party and search for this person as soon as you arrive. In contrast, low arousal positive emotions refer to affective states associated with lower motivation and

behavioral activation and include feelings such as satisfaction, content and calmness (Watson et al., 1999). For example, you feel at ease and content at a party and welcome different people who approach you for a talk.

Earlier studies suggest that it is relevant to distinguish between high and low arousal positive emotions when examining their influence on physiology, cognitions and behavior. For instance, happiness and joy have been associated with sympathetic nervous system activation (e.g., Neumann & Waldstein, 2001), while amusement and contentment have been associated with sympathetic recovery from negative emotions and stress (Behnke et al., 2022; Fredrickson & Levenson, 1998). One of the few physiological studies examining more than two positive emotions, demonstrated that the autonomic nervous system of participants in a laboratory experiment responded differently when they watched a slide show with emotional images to elicit anticipatory enthusiasm, attachment love, nurturant love, amusement and awe (Shiota et al., 2011). Each emotion showed different patterns on specific physiological changes, although most of these emotions elicited arousal to some extent.

Gable and Harmon-Jones (2010) argue that low arousal states—both negative and positive valenced—are associated with broadened attention because there is a lower motivation to approach a goal or desire. By contrast, high arousal states are associated with rather narrow cognitive processing due to increased motivational intensity which leads to a focus on the desired goal or object. This idea has been supported by experimental studies (Gable & Harmon-Jones, 2008; Harmon-Jones & Gable, 2009). For example, when participants viewed pictures of desserts, they felt more enthusiasm and excitement compared to participants who viewed neutral pictures (e.g., rocks, paper plates), especially when the participants were also told that they could choose whatever they had seen on the pictures after the experiment (Gable & Harmon-Jones, 2008). More importantly, the increased desire for desserts narrowed participants cognitive attention which was also visible by increased left frontal-central activity in the brain (Gable & Harmon-Jones, 2008, 2010; Harmon-Jones & Gable, 2009). These findings indicate that the solid knowledge about the benefits of positive emotions might not automatically apply to both high and low arousal positive emotions.

Despite the relevance to distinguish high and low arousal positive emotions, only few experimental studies examined intervention effects on these specific positive emotions. A recent study demonstrated that more time meditating within a mindfulness meditation intervention was associated with an increase of low arousal positive emotions, but not with an increase of high arousal positive emotions (Jones et al., 2018). Zeng et al. (2019) reported similar findings, showing that a meditation intervention exclusively increased low arousal positive affect. Another study mainly focused on high arousal positive emotions and found that a short gratitude intervention improved a mix of emotional states in a community sample, namely feeling moved, uplifted, increasingly connected to others, and indebtedness (Layous et al., 2017). Nelson-Coffey et al. (2019) focused their study on awe and found that awe-eliciting virtual reality and movie manipulations in undergraduate students impacted mainly feelings of compassion, gratitude, love and connectedness, while feelings of interest and contentment were not influenced.

These initial findings indicate that specific positive emotions might be differently impacted depending on the type of intervention. However, previous studies did not

specifically examine PPIs (Jones et al., 2018; Nelson-Coffey et al., 2019; Zeng et al., 2019) or mainly focused on high arousal positive emotions (Layous et al., 2017). An exception was a study by Gander et al. (2020), in which participants were instructed to write about three good things or three funny things at the end of each day for one week. Results revealed that both interventions improved contentment, hope and joy significantly more compared to a placebo control condition (i.e., writing about an early memory). The three funny things-exercise also significantly improved amusement more compared to placebo control (Gander et al., 2020). However, the impact of longer practiced and different types of PPIs on high and low arousal positive emotions remains largely unclear.

Considering that high and low arousal positive emotions might have different effects on cognitions and behavior (Gable & Harmon-Jones, 2008; Harmon-Jones & Gable, 2009), it is relevant to better understand which PPIs lead to an increase in which kind of positive emotions. In addition, it is important to better understand through which specific positive emotions PPIs unfold their effect on mental well-being. For instance, positive emotions have previously been found to mediate the effects of a kindness intervention on well-being (Nelson et al., 2016), but the mediating role of high and low arousal positive emotions in PPIs is yet unknown.

1 The Present Study

The first aim of the current study was to post-hoc explore the effects of a 9-week multicomponent PPI (Schotanus-Dijkstra et al., 2017a), a comprehensive 6-week gratitude intervention (Bohlmeijer et al., 2020), and a 6-week acts of kindness intervention (Nelson-Coffey et al., 2021) on positive emotions and on high and low arousal positive emotions compared to waitlist control. The second aim was to explore whether high and low arousal positive emotions mediate the effects of these PPIs on mental well-being.

It is hypothesized that the three different PPIs lead to more high and low arousal positive emotions compared to waitlist control, but that mainly low arousal emotions serve as the working mechanism of the three interventions on mental well-being. Low arousal positive emotions have been found to broaden people's attention (Gable & Harmon-Jones, 2008; Harmon-Jones & Gable, 2009) and might be more likely to contribute to the upward spiral of building personal growth and long-term mental well-being than high arousal emotions. In the following, study 1 describes the results of a randomized controlled trial about the multicomponent intervention, while Study 2 and 3 describe the results of the gratitude and kindness intervention, respectively.

2 Study 1

2.1 Method

2.1.1 Participants

A self-selected convenience sample recruited via advertisements in Dutch national newspapers and an online newsletter of a popular psychology magazine completed

the baseline survey ($N=275$, 85.8% female). Participants were predominantly of Dutch nationality (90.9%), higher educated (74.5% attended post-secondary education) and in paid employment (68.4%). Ages ranged from 20 to 67 ($M=48.9$, $SD=10.9$).

2.1.2 Procedure

This study was approved by the Ethics Committee of the University of Twente (no. 13212) and registered in The Netherlands Trial Register (NTR4297) (Schotanus-Dijkstra et al., 2017a). Recruited participants who gave online written informed consent received a screening questionnaire. Participants were excluded from the study when they possessed flourishing mental health as assessed with the Mental Health Continuum Short Form (MHC-SF; Lamers et al., 2011) or moderate or severe anxiety or depressive symptoms assessed with the Hospital Anxiety and Depression Scale, indicated by a score > 10 on either the anxiety or depression subscale (Spinhoven et al., 1997; Zigmond & Snaith, 1983). The remaining 275 participants who completed the baseline survey were randomly allocated (1:1)—stratified by gender and low, medium and high education level—to a multicomponent PPI ($n = 137$) or a waitlist control condition ($n = 138$). At baseline, the two conditions did not significantly differ by any demographic variable ($\chi^2s < 1.50$, $ps > 0.286$), $F(1, 273) = 0.16$, $p = 0.106$. At posttest, 122 participants completed the assessment in the intervention group (89%), and 131 in the control group (95%). There were marginally more drop-outs in the intervention condition (10.9%) versus control (5.1%), $\chi^2(1) = 3.23$, $p = 0.072$. Based on a sensitivity power analyses with 80% power and a two-sided alpha level of 0.05, we are able to detect a Cohen's d effect size of at least 0.35 with this sample size at posttest.

2.1.3 Conditions

Participants in the intervention condition received the Dutch self-help book '*This is your life*' (English version: Using positive psychology every day) (Bohlmeijer & Hulsbergen, 2013) which covers psycho-education and evidence-based positive psychology exercises about positive emotions, discovering and using strengths, optimism, hope, self-compassion, resilience and post-traumatic growth, positive relations and spirituality. Participants were instructed to use a 9-week time schedule of reading one chapter per week and practicing a minimum of two of the recommended exercises per chapter (e.g. 'the three good things exercise', 'imagine your best possible selves', 'active constructive responding', 'writing a gratitude letter'). Participants had up to 12 weeks to complete the program and they received weekly asynchronous email support from one of the five senior positive psychology students at the University of Twente.

Participants in the waitlist control condition completed the posttest and a 3-months follow-up survey before they received the self-help book by mail.

2.1.4 Measures

The focus in the current study lies on positive emotions which was a secondary outcome measure in the original study (Schotanus-Dijkstra et al., 2017a). Positive emotional states were measured with eight items of the 16-item modified Differential Emotions Scale (mDES) (Schaefer et al., 2010). The other eight items measure negative emotional states which were not included in the current study. Participants indicated how intense each group of three discrete positive emotions (e.g. *interested, concentrated, alert* or *joyful, amused, happy*) was experienced at the present moment on a 7-point scale (1 = *not at all*, 7 = *very intense*). Higher total mean scores indicate higher levels of positive emotional states. A slightly different version of this scale has been developed by Fredrickson and colleagues (Fredrickson et al., 2003) showing good internal reliability. The scale showed modest reliability at baseline in the current study (Cronbach's $\alpha=0.56$). The relatively low reliability might be related to asking about *the present moment* while the mDES was assessed towards the end of a long survey. In later studies, we changed the question to *the past 24 h* in accordance with prior studies (e.g., Fredrickson et al., 2003) showing good reliability rates in similar samples (see Study 2 and 3). Therefore, the mDES data from Study 2 and 3 were used for the explanatory factor analysis to be able to distinguish high and low arousal emotions.

Exploratory factor analysis with maximum likelihood and oblique rotation was used on the 8 items of positive emotions. Parallel analysis and scree plots suggested three factors, with 2 items loading on high arousal emotions (i.e., *jovial, excited, elated*; and *joyful, amused, happy*) and 3 items loading on low arousal emotions (i.e., *interested, concentrated, alert*; *calm, serene, relaxed*; and *satisfied, content, pleased*). The third factor consisted of the 2 items *surprised, astonished, amazed* and *moved, touched*, which seem ambivalent regarding the level of arousal and therefore excluded from further subscale analyses. The item *warm-hearted, loving, friendly* was removed because it loaded on two factors. The internal consistency of the subscales in the current study were $\alpha=0.65$ for high arousal and $\alpha=0.34$ for low arousal positive emotions. The intercorrelation of the two subscale scores was small with $r=0.28$ ($p < 0.001$).

Mental well-being was measured with the 14-item MHC-SF about emotional, social and psychological well-being (Keyes et al., 2008). On a continuous scale that runs from 0 (*never*) to 5 (*almost always*), higher mean scores indicate higher levels of well-being. The MHC-SF showed good psychometric properties at baseline (Cronbach's $\alpha=0.88$) analogous to prior studies, including a validation study in the general Dutch population (Lamers et al., 2011).

2.1.5 Statistical Analyses

Statistical analyses were conducted in SPSS version 25.0 using two-tailed tests with $\alpha < 0.05$. Linear mixed models (LMMs) including fixed factors for group, time (coded from 0 to 2) and time-by-group interactions were used to determine the effect of the interventions on positive emotions and high and low arousal positive emotions. LMMs

adequately deal with the nested structure of repeated-measures data and missing data at random (Singer et al., 2003). The covariance matrix was specified as unstructured. In addition, restricted expectation maximization likelihood was used to estimate missing data. Between-group effect sizes (Cohen's d) with 95% confidence intervals were calculated using the estimated marginal means from the mixed models. Effect sizes and the corresponding confidence intervals were calculated in R (R Core Team, 2020) using the *esc* package (Lüdtke, 2019). Cohen's d effect sizes <0.30 were considered as small, effect sizes between 0.3 and 0.8 as medium and >0.8 as large effect (Cohen, 2013).

For the mediation analyses, we used the PROCESS tool in SPSS (Hayes, 2012) for both simple and multiple mediation analyses. Since data was missing at random (Schootanus-Dijkstra et al., 2019b), missing values were imputed using the expectation maximization (EM) algorithm (Dempster et al., 1977). In the mediation models, X was the condition (0 = control condition, 1 = intervention condition) and Y was the point estimate of well-being at posttest. Furthermore, point estimates of positive emotions and high and low arousal positive emotions at posttest were included as mediators (M). For the multiple mediation analyses, a model was run with high and low arousal emotions entered simultaneously as mediators in the model. Baseline levels of mental well-being and the mediators were entered as covariates in the models (Hayes, 2017). Unstandardized regression coefficients were calculated for all paths in the mediation models based on 5,000 bootstrap resamples (Hayes, 2017). A mediation effect was found when the bias-corrected (BC) 95% confidence intervals of the indirect effects did not include zero.

2.2 Results

2.2.1 Effect on Positive Emotions

The multicomponent PPI significantly improved positive emotions over time compared to waitlist control, $F(2, 249) = 5.42, p = 0.005$ (see Table 1). Between-group effect sizes were moderate at posttest ($d = 0.36$) and follow-up ($d = 0.39$). The interaction term was not significant for high arousal positive emotions, $F(2, 255) = 0.70, p = 0.500$, but significant for low arousal positive emotions, $F(2, 248) = 6.60, p = 0.002$, with small to medium effect sizes at posttest ($d = 0.29$) and follow-up ($d = 0.38$).

2.2.2 Mediating Role of Positive Emotions

The simple mediation models showed that positive emotions, $ab = 0.07$, BC 95% CI = 0.02 to 0.13, and low arousal positive emotions, $ab = 0.06$, BC 95% CI = 0.02 to 0.12, mediated the effect of the intervention on mental well-being at posttest (see Table 2). No mediating effect of high arousal positive emotions was found, $ab = 0.02$, BC 95% CI = -0.01 to 0.06. The multiple mediation analyses also revealed that low arousal positive emotions mediated the effects of the multicomponent PPI on mental well-being ($ab = 0.05$, BC 95% CI = 0.01 to 0.10, Fig. 1).

Table 1 Estimated marginal means, effect sizes (Cohen's *d*) and outcomes of linear mixed model analyses comparing the multicomponent PPI with waitlist control (Study 1; *N* = 275)

	Multicomponent PPI	Waitlist control	Cohen's <i>d</i> [95% CI]	LMM	
	Mean (SE)	Mean (SE)		Group x time	
				<i>F</i>	<i>p</i>
Positive emotions					
Baseline	3.56 (0.06)	3.61 (0.06)			
Posttest	3.87 (0.07)	3.61 (0.06)	0.36 [0.11; 0.61]		
6-month follow-up	4.02 (0.08)	3.68 (0.08)	0.39 [0.13; 0.65]	5.42	.005
High arousal positive emotions					
Baseline	3.59 (0.10)	3.42 (0.10)			
Posttest	3.79 (0.11)	3.60 (0.11)	0.15 [-0.09; 0.40]		
6-month follow-up	4.02 (0.11)	3.64 (0.11)	0.32 [0.06; 0.57]	0.70	.500
Low arousal positive emotions					
Baseline	3.81 (0.07)	3.89 (0.07)			
Posttest	4.13 (0.08)	3.85 (0.08)	0.29 [0.04; 0.54]		
6-month follow-up	4.26 (0.09)	3.89 (0.09)	0.38 [0.12; 0.63]	6.60	.002

2.3 Discussion

Consistent with prior meta-analyses (e.g., Bolier et al., 2013; Hendriks et al., 2020; van Agteren et al., 2021a), the findings of the first study revealed that the multicomponent PPI was more effective in improving positive emotions than waitlist control. A significant effect of the intervention on low arousal positive emotions was found, but – in contrast to expectations – not on high arousal positive emotions. Prior studies have also found that positive interventions specifically help to improve low arousal positive emotions (e.g., Jones et al., 2018; Zeng et al., 2019), but these interventions were shorter in duration (1 to 4 weeks) and mainly focused on meditation practice. The current study addressed a wide variety of topics and single component positive interventions during a 9-week intervention. Therefore, it was legitimate to expect that both high and low arousal positive emotions would improve.

More specifically, the multicomponent PPI has a strong focus on self-compassion and on writing and meditation-related exercises. Such activities might activate the biological system of the body that is responsible for rest and relaxation (Gilbert, 2010; Koelsch et al., 2015; Richardson et al., 2016), and could lower the motivation to approach a goal or desire. By contrast, the multicomponent intervention also targeted high activating or goal-oriented exercises such as enhancing flow, actively challenging one's thoughts, making a list of needs and formulate concrete goals and actions. Because we do not know which exercises were chosen by the participants each week, it is possible that most participants did not practice these latter type of exercises. However, a more likely explanation for not finding an effect on high arousal emotions is that emotions were measured after

Table 2 Outcomes of simple mediation analyses in the multicomponent PPI, gratitude and acts of kindness intervention compared to waitlist control

Mediators	a-path	b-path	Total effect <i>c</i>	Direct effect <i>c'</i>	Indirect effect <i>a x b</i> (95% CI) ^a
Study 1: Multicomponent PPI vs waitlist control (N = 275)					
Positive emotions	0.29**	0.24***	0.48***	0.41***	0.07 (0.02; 0.13)
High arousal positive emotions	0.20	0.10***	0.47***	0.45***	0.02 (-0.01; 0.06)
Low arousal positive emotions	0.33**	0.19***	0.48***	0.42***	0.06 (0.02; 0.12)
Study 2: Gratitude vs. waitlist control (N = 144)					
Positive emotions	0.57***	0.12*	0.27**	0.21*	0.07 (-0.01; 0.14)
High arousal positive emotions	0.38	0.18***	0.27**	0.21*	0.07 (0.00; 0.15)
Low arousal positive emotions	0.50**	0.08	0.28**	0.24*	0.04 (-0.02; 0.10)
Study 3: Kindness vs. waitlist control (N = 216)					
Positive emotions	0.21	0.13**	0.15*	0.13	0.03 (-0.00; 0.06)
High arousal positive emotions	0.27	0.09**	0.15*	0.13	0.03 (-0.00; 0.06)
Low arousal positive emotions	0.24	0.09*	0.16*	0.13	0.02 (-0.00; 0.06)

^aBias correct bootstrap results for the indirect effect, number of resamples 5,000

* $p < .05$, ** $p < .01$, *** $p < .001$

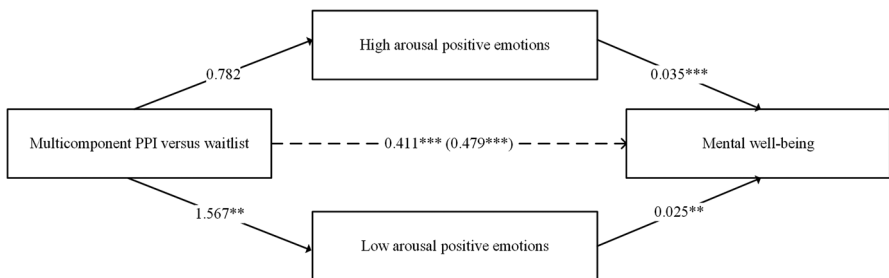


Fig. 1 Multiple mediation of high and low arousal positive emotions (posttest) of the multicomponent PPI versus waitlist control on mental well-being (posttest), controlled for baseline levels of mediators and well-being. Total effect (*c*-path) is given in parentheses (Study 1)

completing the whole intervention, while the last 2–3 weeks mainly consisted of low activating activities (Bohlmeijer & Hulsbergen, 2018; Schotanus-Dijkstra et al., 2017a). Thus, the strong focus on accepting and appreciating oneself and one’s life as it is while writing and meditating – especially in the final weeks of the intervention – might have contributed to finding an effect on low arousal but not high arousal positive emotions.

The current study also adds to the literature that low arousal positive emotions mediated the positive impact of the multicomponent intervention on mental well-being, and not high arousal positive emotions. This finding is in line with Gable and Harmon-Jones (2008), who suggest that only low arousal emotions lead to broadened attention, which is needed to build long-term well-being. However, the results might also be explained by the fact that the multicomponent PPI was most successful in improving self-compassion, with effect sizes of 0.82 at posttest and 0.92 at 6-months follow-up respectively (Schotanus-Dijkstra et al., 2019b), and the lack of effect on enhancing high arousal positive emotions. Future studies should clarify how multicomponent PPIs can benefit both high and low arousal emotions and then test if low arousal emotions are indeed the main drivers of the broaden-and-build theory.

A limitation of the current study is that a great variety of exercises were included in the multicomponent intervention, which makes it impossible to detect what intervention components have led to improvements in which positive emotions. Another limitation of Study 1 is the low reliability of the mDES measurement, which might be explained by using a momentary contextualization while referring to a whole day would fit better when using long surveys (Hall et al., 2021). In addition, positive emotions and mental well-being were only measured before and after the intervention, while mediating timepoints during the intervention were lacking. Therefore, the results should be interpreted with caution as they do not fulfil the time criteria proposed by Kazdin (2009). To address these uncertainties of Study 1, the second and third study focus on single-component interventions, using a time-frame of positive emotions over the past 24-h, and add measurements during the intervention.

3 Study 2

3.1 Method

3.1.1 Participants

A self-selected convenience sample recruited via advertisements on Facebook, LinkedIn, an online newsletter of a popular psychology magazine and Dutch regional newspapers ($N=144$, 89.6% female) completed the baseline survey. Participants were predominantly of Dutch nationality (91.7%), higher educated (78.5% attended post-secondary education) and in paid employment (70.1%). Ages ranged from 23 to 64 years ($M=48.7$, $SD=9.5$ years).

3.1.2 Procedure

This study was approved by the Ethics Committee of the University of Twente (BCE17240) and registered in The Netherlands Trial Register (NTR6786) (Bohlmeijer et al., 2020). Recruited participants who gave online written informed

consent received a screening questionnaire. Eligible participants were not flourishing and had no severe depressive or anxiety symptoms, indicated by a score < 34 on the Center for Epidemiological Studies Depression (CES-D) questionnaire (Bouma et al., 1995; Radloff, 1977; Santor et al., 1995) and a score < 15 on the Generalized Anxiety Disorder-7 (GAD-7) questionnaire (Donker et al., 2009; Spitzer et al., 2006). The remaining 144 participants who completed the baseline survey were randomly allocated (1:1) via randomizer.org—stratified by gender, low, medium and high education level—to a 6-week gratitude intervention ($n=73$) or a waitlist control condition ($n=71$). At baseline, the two conditions did not significantly differ by any demographic variable, $\chi^2s < 3.09$, $ps > 0.079$, $F(1, 143) = 2.79$, $p = 0.097$. At posttest, 27 (18.8%) participants had dropped out of the study, of which there were significantly more drop-outs in the intervention condition (30.1%) versus control (7.0%), $\chi^2(1) = 12.60$, $p < 0.001$. Based on a sensitivity power analyses with 80% power and a two-sided alpha level of 0.05, we are able to detect a Cohen's d effect size of at least 0.49 with this sample size at posttest.

3.1.3 Conditions

The 6-week comprehensive gratitude intervention consisted of psycho-education and evidence-based gratitude exercises (Emmons & McCullough, 2003; Emmons & Stern, 2013) about counting your blessings, taking another perspective, expressing gratitude (e.g. writing a gratitude letter), grateful memories, writing about gratitude in times of misfortune and gratitude as an attitude in life. Also, participants received questions that trigger reflection about cultivating gratitude (e.g. 'What did you feel when practicing the gratitude exercise of this week?', 'What did it mean for your daily activities?'). Intervention instructions were sent via email to the participants on each Sunday, for 6 weeks. As a manipulation check, participants were instructed to write about five grateful experiences or aspects of their lives in an online diary at the end of each week.

Participants in the waitlist control condition were told that they were allocated to the flexible group: 'You can choose the activity that fits best to your needs to improve your happiness and well-being. However, before you can choose this activity, we would like to monitor your normal fluctuations in your level of well-being.' After the 6 weeks follow-up, the participants in this condition chose their activity for which they received the instructions during the following 6 weeks.

3.1.4 Measures

The same measures were used as in Study 1, but positive emotions were now assessed over the past 24 h instead of at the present moment. Positive emotions (Cronbach's $\alpha = 0.85$) and mental well-being (Cronbach's $\alpha = 0.87$) were assessed at baseline, posttest and 6-week follow-up. Positive emotions were also measured during the intervention, after 2 and 4 weeks practicing. Notable, positive emotion was a secondary outcome measure in the original study (Bohlmeijer et al., 2020). The subscales for high and low arousal positive emotions were moderately correlated

($r=0.64$, $p<0.001$) with internal consistencies of $\alpha=0.88$ for high arousal and $\alpha=0.76$ for low arousal positive emotions.

3.1.5 Statistical Analyses

Statistical analyses were similar to the procedures we used in Study 1. Data was missing at random, Little's MCAR test: $\chi^2(471)=510.37$, $p=0.102$, and we therefore used EM to impute the data. In order to improve the limitations of the first study regarding mediation analyses, we included the mean of the two mid-treatment point estimates $\left(\frac{\text{week2}+\text{week4}}{2}\right)$ for positive emotions and for high and low arousal positive emotions.

3.2 Results

3.2.1 Effect on Positive Emotions

We found a positive effect of practicing gratitude on positive emotions as general outcome up to 6-week follow-up, $F(4, 116)=3.48$, $p=0.010$ (Table 3). Between-group effect sizes were small to moderate at posttest ($d=0.51$) and at follow-up ($d=0.35$). A marginal significant interaction effect was found for high arousal positive emotions, $F(4, 113)=2.15$, $p=0.079$, and a non-significant interaction effect for low arousal positive emotions up to 6-week follow-up, $F(4, 115)=1.88$, $p=0.119$.

3.2.2 Mediating Role of Positive Emotions

The BC 95% CIs of the indirect effects (ab) of the simple mediation models, showed that high arousal positive emotions during the intervention mediated the effect of the gratitude intervention on mental well-being, $ab=0.07$, BC 95% CI=0.00 to 0.15. By contrast, no mediating effect was found for positive emotions in general and low arousal positive emotions (Table 2). In addition, the multiple mediation analyses revealed neither a significant mediation effect of high nor low arousal positive emotions, $ab_{\text{high arousal}}=0.08$, BC 95% CI=-0.00 to 0.19 and $ab_{\text{low arousal}}=-0.03$, BC 95% CI=-0.11 to 0.03 (Fig. 2).

3.3 Discussion

Findings of Study 2 revealed that a 6-week comprehensive gratitude intervention was effective in improving positive emotions compared to waitlist control, supporting prior evidence about the efficacy of practicing gratitude (Davis et al., 2016; Lambert et al., 2009; McCullough et al., 2002). Since evidence about the sustainability of the effects of gratitude interventions is scarce (Davis et al., 2016), it is relevant that the effects in the current study were visible up to 6-week follow-up (Bohlmeijer et al., 2020). Compared to the multicomponent PPI, effect sizes of the gratitude intervention on positive emotions were similar at 6-week

Table 3 Estimated marginal means, effect sizes and outcomes of linear mixed model analyses comparing the gratitude intervention with waitlist control (Study 2; N = 144)

	Gratitude Mean (SE)	Waitlist Mean (SE)	Cohen’s <i>d</i> [95% CI]	LMM	
				Group x time	
				<i>F</i>	<i>p</i>
Positive emotions					
Baseline	3.71 (0.12)	3.79 (0.13)			
2-week	4.04 (0.14)	3.86 (0.14)	0.16 [-0.19; 0.51]		
4-week	4.31 (0.16)	3.88 (0.13)	0.44 [0.01; 0.86]		
Posttest	4.44 (0.13)	3.94 (0.13)	0.51 [0.14; 0.88]		
6-week follow-up	4.39 (0.16)	4.00 (0.15)	0.35 [-0.04; 0.73]	3.48	.010
High arousal positive emotions					
Baseline	3.58 (0.17)	3.64 (0.17)			
2-week	3.97 (0.19)	3.93 (0.18)	0.03 [-0.32; 0.38]		
4-week	4.27 (0.23)	3.86 (0.18)	0.30 [-0.13; 0.72]		
Posttest	4.49 (0.18)	3.90 (0.17)	0.45 [0.08; 0.82]		
6-week follow-up	4.36 (0.20)	4.02 (0.19)	0.24 [-0.14; 0.62]	2.15	.079
Low arousal positive emotions					
Baseline	4.17 (0.14)	4.29 (0.14)			
2-week	4.47 (0.15)	4.32 (0.14)	0.13 [-0.22; 0.48]		
4-week	4.71 (0.18)	4.44 (0.14)	0.25 [-0.18; 0.68]		
Posttest	4.88 (0.15)	4.46 (0.13)	0.40 [0.03; 0.77]		
6-week follow-up	4.83 (0.17)	4.40 (0.15)	0.37 [-0.01; 0.76]	1.88	.119

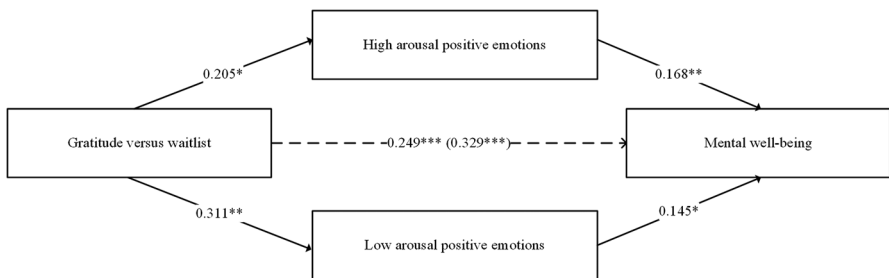


Fig. 2 Multiple mediation of high and low arousal positive emotions during the comprehensive gratitude intervention versus waitlist control on mental well-being (posttest), controlled for baseline levels of mediators and well-being. Total effect (c-path) is given in parentheses (Study 2)

follow-up, but larger at posttest. However, these larger effect sizes could have been due to the smaller sample size or shorter duration of the gratitude intervention, possibly leading to an overestimation of the effects (Cuijpers et al., 2010).

In contrast with the multicomponent PPI, the gratitude intervention was marginally more effective in improving high arousal emotions and not effective in improving low arousal positive emotions. High arousal positive emotions also mediated the effect of the gratitude intervention on mental well-being, but this effect disappeared when low arousal emotions were taken into account. A possible explanation for finding only a marginal effect of high arousal positive emotions, is that a composite score was used for feeling elevated and joyful. Prior studies from Layous et al. (2017) showed that participants who practiced gratitude felt more moved and uplifted, but not more happy or joyful compared to control. Future studies should use single positive emotions to gain more insight in the role of discrete high arousal positive emotions within PPIs.

Not finding an effect on low arousal positive emotions was unexpected because participants in the gratitude condition learned to appreciate the small things in life. This appreciation is likely to elicit lower-activated feelings such as serenity and fulfillment and to reduce the motivation to approach specific goals or desires (Watkins et al., 2003). In fact, previous work categorized gratitude as low-arousal positive emotion, being on a similar arousal level as contentment (Cavanaugh et al., 2016). Furthermore, a prior experience sampling study has shown that both cheerfulness as indicator of high arousal emotions and satisfaction as indicator of low arousal emotions reciprocally predicted state gratitude from one moment to the next (Jans-Beken et al., 2019).

A possible explanation for not finding an effect on low arousal positive emotions and only a marginal effect on high arousal positive emotions, is that the waitlist control condition gradually improved on these emotions as well. This improvement was mainly visible between 4-week assessment and 6-week follow-up, limiting the possibility of finding significant between-group differences over time. This steeper increase at the end of the study might have been a result of the instructions given to the participants in the waitlist control group. After the 6-week follow-up, they could choose their happiness exercise and start with their intervention. Participants might have anticipated to this upcoming positive event and felt interested, joyful and satisfied to be able to start soon with improving their happiness and well-being (Monfort et al., 2015; Van Boven & Ashworth, 2007). However, comparison with prior studies is limited due to the largely absence of research on gratitude interventions that distinguish between high and low arousal emotions, making it impossible to draw any firm conclusions. Future studies are needed to indicate which positive emotions are enhanced by practicing gratitude.

Both the multicomponent PPI and the 6-week comprehensive gratitude intervention consisted of multiple exercises which makes it difficult to study the relation between a specific activity and high and low positive emotions in isolation. Therefore, we repeated the same analyses using a single exercise in Study 3, and tested the efficacy of practicing kindness on positive emotions.

4 Study 3

4.1 Method

4.1.1 Participants

A self-selected convenience sample recruited via advertisements on Facebook/Linked, an online newsletter of a popular psychology magazine and Dutch regional newspapers ($N=216$, 89.4% female) completed the baseline survey (Nelson-Coffey et al., 2021). Participants were predominantly of Dutch nationality (87.5%), higher educated (78.7% attended post-secondary education) and in paid employment (73.6%). Ages ranged from 23 to 70 ($M=48.9$, $SD=9.6$).

4.1.2 Procedure

The procedure was similar to Study 2, as advertisement budget was used efficiently to recruit participants for two studies simultaneously (i.e. gratitude versus control; acts of kindness versus control). The 216 participants who completed the baseline survey were randomly allocated (1:1:1) to practicing acts of kindness with reflection ($n=73$), practicing acts of kindness without reflection ($n=72$) or a waitlist control condition ($n=71$). At baseline, the three conditions did not significantly differ by any demographic variable, $\chi^2s < 4.28$, $ps > 0.118$; $F(1, 215)=0.83$, $p=0.439$, except for Dutch nationality which was more pronounced in the waitlist condition (95.8%) versus the two kindness conditions (80.8% and 86.1% respectively), $\chi^2(2)=7.55$, $p=0.023$. At posttest, 47 (21.8%) participants had dropped out of the study, of which there were significantly more drop-outs in the two intervention conditions (21.9% and 36.1% respectively) versus control (7.0%; $\chi^2(2)=17.75$, $p < 0.001$). Based on a sensitivity power analyses with 80% power and a two-sided alpha level of 0.05, we are able to detect a Cohen's d effect size of at least 0.41 with this sample size at posttest.

4.1.3 Conditions

Participants in both intervention conditions were instructed to perform five acts of kindness for others on one day per week, for 6 weeks. As a manipulation check, the day after their kindness-day, participants were instructed to list their actions relevant to their assigned conditions in an online diary. Participants in the kindness condition with reflection were also asked to write briefly about their experiences performing the activity, including how they felt, who they were with, and what the activity meant to them and the recipient. The waitlist control condition was the same condition as described in Study 2.

4.1.4 Measures

The same measures were used as described in Study 1. In parallel with Study 2, well-being (Cronbach's $\alpha=0.83$) and positive emotions (Cronbach's $\alpha=0.82$) were

assessed at baseline, posttest and 6-week follow-up, and positive emotions were also measured during the intervention, 2 and 4 weeks after beginning of the intervention. Again, well-being was the primary outcome in the original study of which the results have been described elsewhere (Nelson-Coffey et al., 2021). The Cronbachs alpha's were 0.85 and 0.68 for high and low arousal positive emotions, respectively. The intercorrelation between high and low arousal scores was 0.54 ($p < 0.001$).

4.1.5 Statistical Analyses

Statistical analyses were the same as explained in Study 2. However, the two kindness conditions were combined in one kindness condition as preliminary analyses revealed that the two conditions did not significantly differ on positive emotions, $F = 1.53(4, 95)$, $p = 0.200$ and mental well-being over time, $F = 0.21(2, 91)$, $p = 0.811$. Data was missing at random (Little's MCAR test: $\chi^2(471) = 450.11$, $p = 0.748$). Similar to Study 1 and 2, we used EM to impute the data.

4.2 Results

4.2.1 Effect on Positive Emotions

No significant interaction effects were found for the kindness intervention versus waitlist control for positive emotions in general, $F(4, 157) = 1.13$, $p = 0.344$, high arousal positive emotions, $F(4, 156) = 1.13$, $p = 0.345$, and low arousal positive emotions, $F(4, 163) = 1.23$, $p = 0.302$ (Table 4).

4.2.2 Mediating Role of Positive Emotions

No mediating effects were found for positive emotions in general, high arousal and low arousal positive emotions (Table 2). In addition, no mediating effect was found when high and low arousal positive emotions were simultaneously analyzed in the multiple mediation model, $ab_{high\ arousal} = 0.02$, BC 95% CI = -0.01 to 0.07; $ab_{low\ arousal} = 0.00$, BC 95% CI = -0.04 to 0.04 (Fig. 3).

4.3 Discussion

Findings from Study 3 suggest that a simple 6-week kindness intervention did not have a significant effect on positive emotions as general outcome and on high and low arousal positive emotions compared to waitlist control. These findings are contradictory to prior research in which positive emotions were significantly enhanced by acts of kindness (Alden & Trew, 2013; Nelson et al., 2016; Ouweneel et al., 2014). The findings are also in contrast with evidence about the importance of positive emotions as an underlying mechanism of practicing kindness (Nelson et al., 2016) and positive psychological interventions more in general (Fredrickson & Branigan, 2005; Fredrickson, 2001, 2013b; Hendriks et al., 2020; Lyubomirsky &

Table 4 Estimated marginal means, effect sizes and outcomes of linear mixed model analyses comparing the acts of kindness intervention with waitlist control (Study 3; N = 216)

	Kindness Mean (SE)	Waitlist Mean (SE)	Cohen’s <i>d</i> [95% CI]	LMM	
				Group x time	
				<i>F</i>	<i>p</i>
Positive emotions					
Baseline	3.83 (0.08)	3.79 (0.11)			
2-week	4.07 (0.09)	3.86 (0.12)	0.23 [-0.08; 0.54]		
4-week	4.20 (0.10)	3.88 (0.12)	0.35 [0.02; 0.68]		
Posttest	4.25 (0.09)	3.93 (0.12)	0.35 [0.03; 0.66]		
6-week follow-up	4.29 (0.11)	4.00 (0.14)	0.28 [-0.05; 0.62]	1.13	.344
High arousal positive emotions					
Baseline	3.69 (0.11)	3.64 (0.16)			
2-week	4.08 (0.13)	3.94 (0.16)	0.11 [-0.20; 0.42]		
4-week	4.39 (0.15)	3.86 (0.18)	0.39 [0.05; 0.72]		
Posttest	4.24 (0.13)	3.90 (0.17)	0.26 [-0.06; 0.57]		
6-week follow-up	4.20 (0.15)	4.01 (0.18)	0.14 [-0.20; 0.47]	1.13	.345
Low arousal positive emotions					
Baseline	4.26 (0.08)	4.29 (0.12)			
2-week	4.60 (0.10)	4.32 (0.12)	0.29 [-0.03; 0.60]		
4-week	4.64 (0.11)	4.44 (0.13)	0.20 [-0.13; 0.53]		
Posttest	4.74 (0.10)	4.46 (0.13)	0.28 [-0.04; 0.59]		
6-week follow-up	4.72 (0.12)	4.39 (0.15)	0.30 [-0.04; 0.64]	1.23	.302

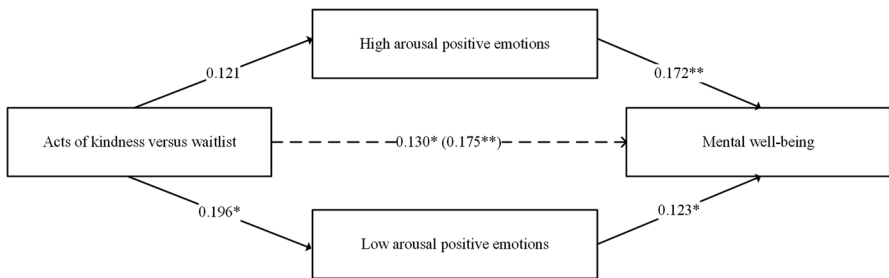


Fig. 3 Multiple mediation of high and low arousal positive emotions during the acts of kindness intervention versus waitlist control on mental well-being (posttest), controlled for baseline levels of mediators and well-being. Total effect (c-path) is given in parentheses (Study 3)

Layouts, 2013). On the contrary, one prior study in socially anxious participants also found no effect of performing kindness on positive emotions (Trew & Alden, 2015).

The kindness intervention was compared with the same waitlist control group as used in the RCT of the comprehensive gratitude intervention. The non-significant effects of the kindness intervention on high and low arousal positive emotions might

therefore also be explained by the gradual improvement in positive emotions in the waitlist control condition. Another possible explanation for the non-significant results of the kindness intervention on positive emotions is the lack of variation during the 6-week intervention period. Kindness interventions typically last between 1 and 4 weeks, with only brief follow-up measures (Curry et al., 2018). Participants in the current study were followed up to 6 weeks follow-up and practiced the same kindness intervention each week during 6 weeks. In accordance with the positive-activity model (Lyubomirsky & Layous, 2013), more variation in positive activities is needed to increase the level of performance and to obtain larger effects on positive emotions and positive behaviors. Participants might have felt disappointed to receive the same instructions every week to enhance their happiness and well-being, or found it difficult to find the motivation to put in as much effort as in the first weeks of learning their new behavior (Schiffer & Roberts, 2018).

5 General Discussion

The aim of the current set of studies was to examine the effects of a 9-week multi-component PPI, a 6-week comprehensive gratitude intervention and a 6-week kindness intervention on positive emotions and high and low arousal positive emotions compared to waitlist control. The mediating role of high and low arousal positive emotions on mental well-being was also examined. The findings demonstrated that the multicomponent PPI and the comprehensive gratitude intervention improved positive emotions, but the multicomponent PPI mainly enhanced low arousal emotions while the gratitude intervention marginally enhanced high arousal emotions in comparison with the control conditions. No significant effects were found for the kindness intervention.

The current results suggest that more sustainable effects on increased positive emotions can be expected from more comprehensive interventions using a variability of activities than from simple positive interventions. This is in line with findings from recent meta-analyses (Carr et al., 2020; Hendriks et al., 2020), and the positive activity model (Lyubomirsky & Layous, 2013). However, the great variability of activities makes it difficult to gain insight about which activities within a comprehensive approach elicit which discrete emotions. To better understand what emotions to encourage, the use of experience sampling method is recommended (Larson et al., 1980; Trull & Ebner-Priemer, 2009). However, this is a time-consuming methodology, which is difficult to use over a longer period of time. A solution might be that intensive measures are taken on only 2 days per week during the 6–9 weeks interventions, instead of the usually 7 to 10 days of intensive inquiry (Hall et al., 2021).

The results of the current study also underscore the mediating role of positive emotions for human flourishing in line with the broaden-and-build theory (Fredrickson & Branigan, 2005; Fredrickson, 2001, 2013a, b). However, the current study could not add evidence for the hypothesis of Gable and Harmon-Jones (2010), in which it is suggested that mainly low arousal emotions are needed to build human flourishing. Although the findings of the multicomponent PPI were supportive for

this hypothesis, none of the interventions were successful in improving both high and low arousal positive emotions. This limits the ability to find a mediating effect of either high or low arousal emotions, albeit not completely impossible (Hayes, 2009).

6 Limitations

An important limitation of the current study is that all three studies were not originally designed to specifically focus on the efficacy of positive emotions, and also not to detect high and low arousal emotions as mediator variables. Therefore, the findings of these post-hoc analyses must be seen as an example for future trials on the role of specific positive emotions. In addition, although the samples of the three studies were comparable regarding demographic characteristics, the high proportion of higher-educated Dutch females make the results not generalizable to the general population or other cultures (Hendriks et al., 2018).

Furthermore, there are some limitations concerning the use of the mDES to assess positive emotions. First, there seem to be multiple versions of the mDES available in scientific research (Fredrickson, 2013a; Schaefer et al., 2010). We used the Dutch version of the mDES which is based on Schaefer et al. (2010), assessing positive emotions at the present moment. We discovered that reliability was low, which could have been due to its use in a larger survey. For example, participants were occupied in completing questionnaires for several minutes before they had to indicate how they felt at that particular moment. The reliability of the mDES was much higher when we asked participants about their emotional states in the past 24 h (see Study 2 and 3), which is in accordance with Fredrickson (2013b). However, the exact items seem to differ between the Dutch version and the version used by Fredrickson (2013b), and perhaps from other labs as well (e.g., van Agteren et al., 2021b).

Second, the mDES uses groups of three emotions which limits the ability to distinguish between discrete high and low arousal positive emotions. Still, the mDES seemed the best option to assess high and low arousal emotions. To date, the majority of studies within positive psychology and beyond use the Positive and Negative Affect Schedule to assess positive (and negative) emotions (Watson et al., 1988). However, this scale mainly measures high arousal emotions omitting half of the arousal spectrum. Another questionnaire that is aimed at measuring positive emotions is the Scale of Positive and Negative Experience (SPANE; Diener et al., 2010). The SPANE, however, also includes some generic feelings (e.g., feeling positive) and does only include one item that is specifically a low arousal positive emotion (feeling content). Therefore, the PANAS and SPANE do not allow for creating multi-item subscales for high and low arousal positive emotions.

Third, the mDES was not originally designed to measure low and high arousal positive emotions separately. Based on our own data, which might differ from other versions of the mDES, we made two subscales using EFA. Although the current study provides initial evidence that different PPIs might have different effects on different positive emotions, future research is necessary to further

explore the role of high and low arousal positive emotions within the efficacy of PPI's and their effect on long-term personal recourses.

7 Directions for Future Research

Our results have several important implications for future research. First, researchers might want to develop a new scale that can reliably distinguish between high and low arousal positive emotions in a uniform way. This instrument might consist of even more emotional states as used in educational science (Nathanson et al., 2016), and measure discrete emotions instead of groups of discrete emotions. Despite the limitations of the mDES and the exploratory nature of the current study, we hope to encourage researchers to widen their scope of measuring and analyzing positive emotions more thoroughly within intervention studies.

Second, future research could explore the role of specific types of positive emotions to a greater extent. For example, experience sampling method is especially suitable to assess the fluctuating nature of emotions (Grosse Rueschkamp et al., 2020; Kuppens & Verduyn, 2017; Verduyn et al., 2009), distinguish between- and within-person variability in positive emotions (Curran & Bauer, 2011; Hamaker, 2012), examine effects of interventions (May et al., 2020; Van der Gucht et al., 2019) and explore what interventions influence discrete positive emotions (Gander et al., 2020). A new scale could be helpful for scholars to accomplish this.

Third, for practitioners working with PPIs it is important to acknowledge that each intervention might have different effects on eliciting positive emotions. Future research could focus on the interaction between personality characteristics, needs and intervention fit to gain optimal results for each individual in counseling and clinical practice (Lyubomirsky & Layous, 2013; Sheldon & Lyubomirsky, 2021). More research in this area might also contribute to establishing a more nuanced use of the broaden-and-build theory, in case evidence shows that low arousal emotions are the driving force of PPIs in enhancing human flourishing (Gable & Harmon-Jones, 2008; Harmon-Jones & Gable, 2009).

8 Conclusion

The current study is among the first to examine the effect of different PPIs on high and low arousal positive emotions, and to explore the role of high and low arousal positive emotions within PPIs to improve mental well-being. Our findings provide first evidence that different PPIs might have different effects on high and low arousal positive emotions, and that low arousal emotions might be the main driver of multi-component PPIs. The current study is a first step towards broadening our knowledge about the effects of different PPIs on discrete emotions. However, more research is needed to better understand how positive interventions can help people to flourish.

Acknowledgements This study was approved by the Behavioural, Management and Social Sciences (BMS) Ethics Committee of the University of Twente (no. 13212 and BCE17240) and registered in The Netherlands Trial Register (NTR4297; NTR6786).

Data Availability The data used for this study is available upon request. After acceptance of the manuscript, the data will become available via a depository and a link will be shared to use within the manuscript before publication.

Declarations

Informed Consent All participants gave online written informed consent before the start of the study.

Conflict of Interest The authors have no conflict of interest to disclose.

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References

- Alden, L. E., & Trew, J. L. (2013). If it makes you happy: Engaging in kind acts increases positive affect in socially anxious individuals. *Emotion, 13*(1), 64. <https://doi.org/10.1037/a0027761>.
- Behnke, M., Pietruch, M., Chwiłkowska, P., Wessel, E., Kaczmarek, L. D., Assink, M., & Gross, J. J. (2022). The undoing effect of positive emotions: A meta-analytic review. *Emotion Review, 15*(1), 45–62. <https://doi.org/10.1177/17540739221104457>
- Bohlmeijer, E., & Hulsbergen, M. (2013). *Dit is jouw leven: ervaar de effecten van de positieve psychologie*. Uitgeverij Boom.
- Bohlmeijer, E., & Hulsbergen, M. (2018). *Using positive psychology every day*. Routledge.
- Bohlmeijer, E. T., Kraiss, J. T., Watkins, P., & Schotanus-Dijkstra, M. (2020). Promoting gratitude as a resource for sustainable mental health: Results of a 3-armed randomized controlled trial up to 6 months follow-up. *Journal of Happiness Studies, 1*–22. <https://doi.org/10.1007/s10902-020-00261-5>.
- Bolier, L., Haverman, M., Westerhof, G. J., Riper, H., Smit, F., & Bohlmeijer, E. (2013). Positive psychology interventions: A meta-analysis of randomized controlled studies. *BMC Public Health, 13*, 119. <https://doi.org/10.1186/1471-2458-13-119>.
- Bouma, J., Ranchor, A., Sanderman, R., & Van Sonderen, E. (1995). *Het meten van symptomen van depressie met de CES-D. Een handleiding*. Noordelijk Centrum voor Gezondheidsvraagstukken, Rijksuniversiteit Groningen.
- Bradley, M. M., & Lang, P. J. (2007). Emotion and motivation. In J. T. Cacioppo, L. G. Tassinary, & G. G. Berntson (Eds.), *Handbook of psychophysiology*. Cambridge University Press. <https://doi.org/10.1017/CBO9780511546396.025> (Handbook of psychophysiology).
- Carr, A., Cullen, K., Keeney, C., Canning, C., Mooney, O., Chinesallaigh, E., & O'Dowd, A. (2020). Effectiveness of positive psychology interventions: a systematic review and meta-analysis. *The Journal of Positive Psychology, 1*–21. <https://doi.org/10.1080/17439760.2020.1818807>.
- Cavanaugh, L. A., MacInnis, D. J., & Weiss, A. M. (2016). Perceptual dimensions differentiate emotions. *Cognition and Emotion, 30*(8), 1430–1445. <https://doi.org/10.1080/02699931.2015.1070119>.
- Chakhssi, F., Kraiss, J. T., Spijkerman, M., & Bohlmeijer, E. T. (2018). The Effect of Positive Psychology Interventions on Well-Being and Distress in Clinical samples with Psychiatric or Somatic

- Disorders: A Systematic Review and Meta-Analysis. *BMC Psychiatry*, 18, 211. <https://doi.org/10.1186/s12888-018-1739-2>.
- Chida, Y., & Steptoe, A. (2008). Positive psychological well-being and mortality: A quantitative review of prospective observational studies. *Psychosomatic Medicine*, 70(7), 741–756. <https://doi.org/10.1097/PSY.0b013e31818105ba>.
- Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. Routledge.
- Cuijpers, P., van Straten, A., Bohlmeijer, E., Hollon, S., & Andersson, G. (2010). The effects of psychotherapy for adult depression are overestimated: A meta-analysis of study quality and effect size. *Psychological Medicine*, 40(2), 211–223. <https://doi.org/10.1017/S0033291709006114>
- Curran, P. J., & Bauer, D. J. (2011). The disaggregation of within-person and between-person effects in longitudinal models of change. *Annual Review of Psychology*, 62, 583–619. <https://doi.org/10.1146/annurev.psych.093008.100356>
- Curry, O. S., Rowland, L. A., Van Lissa, C. J., Zlotowitz, S., McAlaney, J., & Whitehouse, H. (2018). Happy to help? A systematic review and meta-analysis of the effects of performing acts of kindness on the well-being of the actor. *Journal of Experimental Social Psychology*, 76, 320–329. <https://doi.org/10.1016/j.jesp.2018.02.014>
- Davis, D. E., Choe, E., Meyers, J., Wade, N., Varjas, K., Gifford, A., Quinn, A., Hook, J. N., Van Tongeren, D. R., & Griffin, B. J. (2016). Thankful for the little things: A meta-analysis of gratitude interventions. *Journal of Counseling Psychology*, 63(1), 20. <https://doi.org/10.1037/cou0000107>
- Dempster, A. P., Laird, N. M., & Rubin, D. B. (1977). Maximum likelihood from incomplete data via the EM algorithm. *Journal of the Royal Statistical Society: Series B (methodological)*, 39(1), 1–22.
- Diener, E., Wirtz, D., Tov, W., Kim-Prieto, C., Choi, D.-W., Oishi, S., & Biswas-Diener, R. (2010). New well-being measures: Short scales to assess flourishing and positive and negative feelings. *Social Indicators Research*, 97(2), 143–156. <https://doi.org/10.1007/s11205-009-9493-y>
- Donker, T., van Straten, A., Marks, I. M., & Cuijpers, P. (2009). A brief Web-based screening questionnaire for common mental disorders: development and validation. *Journal of Medical Internet Research*, 11(3), e19. <https://doi.org/10.2196/jmir.1134>.
- Emmons, R., & McCullough, M. E. (2003). Counting blessings versus burdens: An experimental investigation of gratitude and subjective well-being in daily life. *Journal of Personality and Social Psychology*, 84(2), 377–389. <https://doi.org/10.1037/0022-3514.84.2.377>
- Emmons, R. A., & Stern, R. (2013). Gratitude as a psychotherapeutic intervention. *Journal of Clinical Psychology*, 69(8), 846–855. <https://doi.org/10.1002/jclp.22020>
- Folkman, S. (1997). Positive psychological states and coping with severe stress. *Social Science & Medicine*, 45(8), 1207–1221. [https://doi.org/10.1016/S0277-9536\(97\)00040-3](https://doi.org/10.1016/S0277-9536(97)00040-3)
- Folkman, S., & Moskowitz, J. T. (2000). Positive affect and the other side of coping. *American Psychologist*, 55(6), 647. <https://doi.org/10.1037/0003-066X.55.6.647>
- Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist*, 56(3), 218. <https://doi.org/10.1037/0003-066X.56.3.218>.
- Fredrickson, B. L. (2013a). Positive emotions broaden and build. In E. A. Plant, Devine, P. G. (Eds.), *Advances on experimental social psychology* (Vol. 47, pp. 1–53). Academic Press.
- Fredrickson, B. L. (2013b). Positive emotions broaden and build. *Advances in Experimental Social Psychology*, 47(1), 53. <https://doi.org/10.1016/B978-0-12-407236-7.00001-2>
- Fredrickson, B. L., & Branigan, C. (2005). Positive emotions broaden the scope of attention and thought-action repertoires. *Cognition & Emotion*, 19(3), 313–332. <https://doi.org/10.1080/02699930441000238>.
- Fredrickson, B. L., Cohn, M. A., Coffey, K. A., Pek, J., & Finkel, S. M. (2008). Open hearts build lives: Positive emotions, induced through loving-kindness meditation, build consequential personal resources. *Journal of Personality and Social Psychology*, 95(5), 1045. <https://doi.org/10.1037/a0013262>
- Fredrickson, B. L., & Joiner, T. (2002). Positive emotions trigger upward spirals toward emotional well-being. *Psychological Science*, 13(2), 172–175. <https://doi.org/10.1111/1467-9280.00431>
- Fredrickson, B. L., & Joiner, T. (2018). Reflections on positive emotions and upward spirals. *Perspectives on Psychological Science*, 13(2), 194–199. <https://doi.org/10.1177/1745691617692106>
- Fredrickson, B. L., & Levenson, R. W. (1998). Positive emotions speed recovery from the cardiovascular sequelae of negative emotions. *Cognition & Emotion*, 12(2), 191–220.
- Fredrickson, B. L., Tugade, M. M., Waugh, C. E., & Larkin, G. R. (2003). What good are positive emotions in crisis? A prospective study of resilience and emotions following the terrorist attacks on the

- United States on September 11th, 2001. *Journal of Personality and Social Psychology*, 84(2), 365. <https://doi.org/10.1037/0022-3514.84.2.365>
- Gable, P., & Harmon-Jones, E. (2010). The motivational dimensional model of affect: Implications for breadth of attention, memory, and cognitive categorisation. *Cognition and Emotion*, 24(2), 322–337. <https://doi.org/10.1080/02699930903378305>
- Gable, P. A., & Harmon-Jones, E. (2008). Approach-motivated positive affect reduces breadth of attention. *Psychological Science*, 19(5), 476–482. <https://doi.org/10.1111/j.1467-9280.2008.02112.x>
- Gander, F., Proyer, R. T., Hentz, E., & Ruch, W. (2020). Working mechanisms in positive interventions: A study using daily assessment of positive emotions. *The Journal of Positive Psychology*, 15(5), 633–638. <https://doi.org/10.1080/17439760.2020.1789698>
- Geerling, B., Kraiss, J. T., Kelders, S. M., Stevens, A. W. M. M., Kupka, R. W., & Bohlmeijer, E. T. (2020). The effect of positive psychology interventions on well-being and psychopathology in patients with severe mental illness: A systematic review and meta-analysis. *The Journal of Positive Psychology*, 15(5), 572–587. <https://doi.org/10.1080/17439760.2020.1789695>
- Gilbert, P. (2010). An Introduction to Compassion Focused Therapy in Cognitive Behavior Therapy. *International Journal of Cognitive Therapy*, 3(2), 97–112. <https://doi.org/10.1521/ijct.2010.3.2.97>
- Grosse Rueschkamp, J. M., Kuppens, P., Riediger, M., Blanke, E. S., & Brose, A. (2020). Higher well-being is related to reduced affective reactivity to positive events in daily life. *Emotion*, 20(3), 376. <https://doi.org/10.1037/emo0000557>
- Hall, M., Scherner, P. V., Kreidel, Y., & Rubel, J. A. (2021). A systematic review of momentary assessment designs for mood and anxiety symptoms. *Frontiers in Psychology*, 12, 1716.
- Hamaker, E. L. (2012). Why researchers should think "within-person": A paradigmatic rationale. In M. R. Mehl & T. S. Conner (Eds.), *Handbook of research methods for studying daily life* (pp. 43–61). The Guilford Press.
- Harmon-Jones, E., & Gable, P. A. (2009). Neural activity underlying the effect of approach-motivated positive affect on narrowed attention. *Psychological Science*, 20(4), 406–409. <https://doi.org/10.1111/j.1467-9280.2009.02302.x>
- Harmon-Jones, E., Harmon-Jones, C., & Price, T. F. (2013). What is approach motivation? *Emotion Review*, 5(3), 291–295. <https://doi.org/10.1177/1754073913477509>
- Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. *Communication Monographs*, 76(4), 408–420.
- Hayes, A. F. (2012). *PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modeling [White paper]*. <http://www.afhayes.com/public/process2012.pdf>. Accessed 19 Apr 2022
- Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford Publications.
- Hendriks, T., Schotanus-Dijkstra, M., Hassankhan, A., de Jong, J., & Bohlmeijer, E. (2020). The efficacy of multi-component positive psychology interventions: A systematic review and meta-analysis of randomized controlled trials. *Journal of Happiness Studies*, 1–34. <https://doi.org/10.1007/s10902-019-00082-1>
- Hendriks, T., Schotanus-Dijkstra, M., Hassankhan, A., Graafsma, T. G. T., Bohlmeijer, E., & de Jong, J. (2018). The efficacy of positive psychological interventions from non-western countries: a systematic review and meta-analysis. *International Journal of Wellbeing*, 8(1). <https://doi.org/10.5502/ijw.v8i1.711>
- Iasiello, M., van Agteren, J., Keyes, C. L., & Cochrane, E. M. (2019). Positive mental health as a predictor of recovery from mental illness. *Journal of Affective Disorders*, 251, 227–230. <https://doi.org/10.1016/j.jad.2019.03.065>
- Jans-Beken, L., Jacobs, N., Janssens, M., Peeters, S., Reijnders, J., Lechner, L., & Lataster, J. (2019). Reciprocal relationships between state gratitude and high-and low-arousal positive affects in daily life: A time-lagged ecological assessment study. *The Journal of Positive Psychology*, 14(4), 512–527. <https://doi.org/10.1080/17439760.2018.1497684>
- Jones, D. R., Graham-Engeland, J. E., Smyth, J. M., & Lehman, B. J. (2018). Clarifying the associations between mindfulness meditation and emotion: Daily high-and low-arousal emotions and emotional variability. *Applied Psychology: Health and Well-Being*, 10(3), 504–523. <https://doi.org/10.1111/aphw.12135>
- Kazdin, A. E. (2009). Understanding how and why psychotherapy leads to change. *Psychotherapy Research*, 19(4–5), 418–428. <https://doi.org/10.1080/10503300802448899>

- Keyes, C. L., Dhingra, S. S., & Simoes, E. J. (2010). Change in Level of Positive Mental Health as a Predictor of Future Risk of Mental Illness. *American Journal of Public Health, 100*(12), 2366–2371. <https://doi.org/10.2105/AJPH.2010.192245>
- Keyes, C. L., Wissing, M., Potgieter, J. P., Temane, M., Kruger, A., & Van Rooy, S. (2008). Evaluation of the mental health continuum—short form (MHC–SF) in setswana-speaking South Africans. *Clinical Psychology & Psychotherapy, 15*(3), 181–192. <https://doi.org/10.1002/cpp.572>
- Koelsch, S., Jacobs, A. M., Menninghaus, W., Liebal, K., Klann-Delius, G., Von Scheve, C., & Gebauer, G. (2015). The quartet theory of human emotions: An integrative and neurofunctional model. *Physics of Life Reviews, 13*, 1–27. <https://doi.org/10.1016/j.plprev.2015.03.001>
- Kok, B. E., Coffey, K. A., Cohn, M. A., Catalino, L. I., Vacharkulksemsuk, T., Algeo, S. B., Brantley, M., & Fredrickson, B. L. (2013). How positive emotions build physical health: Perceived positive social connections account for the upward spiral between positive emotions and vagal tone. *Psychological Science, 24*(7), 1123–1132. <https://doi.org/10.1177/0956797612470827>
- Kuppens, P., & Verduyn, P. (2017). Emotion dynamics. *Current Opinion in Psychology, 17*, 22–26. <https://doi.org/10.1016/j.copsyc.2017.06.004>
- Lambert, N. M., Graham, S. M., Fincham, F. D., & Stillman, T. F. (2009). A changed perspective: How gratitude can affect sense of coherence through positive reframing. *The Journal of Positive Psychology, 4*(6), 461–470. <https://doi.org/10.1080/17439760903157182>
- Lamers, S. M. A., Westerhof, G. J., Bohlmeijer, E. T., ten Klooster, P. M., & Keyes, C. L. (2011). Evaluating the psychometric properties of the mental health continuum-short form (MHC-SF). *Journal of Clinical Psychology, 67*(1), 99–110. <https://doi.org/10.1002/jclp.20741>
- Lamers, S. M. A., Westerhof, G. J., Glas, C. A. W., & Bohlmeijer, E. T. (2015). The bidirectional relation between positive mental health and psychopathology in a longitudinal representative panel study. *The Journal of Positive Psychology, 10*(6), 553–560. <https://doi.org/10.1080/17439760.2015.1015156>
- Larson, R., Csikszentmihalyi, M., & Graef, R. (1980). Mood variability and the psychosocial adjustment of adolescents. *Journal of Youth and Adolescence, 9*(6), 469–490.
- Layous, K., Sweeny, K., Armenta, C., Na, S., Choi, I., & Lyubomirsky, S. (2017). The proximal experience of gratitude. *PLoS ONE, 12*(7), e0179123. <https://doi.org/10.1371/journal.pone.0179123>
- Liu, B., Floud, S., Pirie, K., Green, J., Peto, R., Beral, V., & Collaborators, M. W. S. (2016). Does happiness itself directly affect mortality? The prospective UK Million Women Study. *The Lancet, 387*(10021), 874–881. [https://doi.org/10.1016/S0140-6736\(15\)01087-9](https://doi.org/10.1016/S0140-6736(15)01087-9)
- Lowe, R. (2011). The feeling of action tendencies: On the emotional regulation of goal-directed behavior. *Frontiers in Psychology, 2*, 346. <https://doi.org/10.3389/fpsyg.2011.00346>
- Lüdtke, D. (2019). *Esc: effect size computation for meta-analysis (Version 0.5.1)*. In <https://CRAN.R-project.org/package=esc>. Accessed 19 Apr 2022
- Lyubomirsky, S., King, L., & Diener, E. (2005). The benefits of frequent positive affect: Does happiness lead to success? *Psychological Bulletin, 131*(6), 803. <https://doi.org/10.1037/0033-2909.131.6.803>
- Lyubomirsky, S., & Layous, K. (2013). How Do Simple Positive Activities Increase Well-Being? *Current Directions in Psychological Science, 22*(1), 57–62. <https://doi.org/10.1177/0963721412469809>
- May, C. J., Ostafin, B. D., & Snippe, E. (2020). The relative impact of 15-minutes of meditation compared to a day of vacation in daily life: An exploratory analysis. *The Journal of Positive Psychology, 15*(2), 278–284. <https://doi.org/10.1080/17439760.2019.1610480>
- McCullough, M. E., Emmons, R. A., & Tsang, J.-A. (2002). The grateful disposition: A conceptual and empirical topography. *Journal of Personality and Social Psychology, 82*(1), 112. <https://doi.org/10.1037/0022-3514.82.1.112>
- Monfort, S. S., Stroup, H. E., & Waugh, C. E. (2015). The impact of anticipating positive events on responses to stress. *Journal of Experimental Social Psychology, 58*, 11–22. <https://doi.org/10.1016/j.jesp.2014.12.003>
- Moskowitz, J. T. (2003). Positive affect predicts lower risk of AIDS mortality. *Psychosomatic Medicine, 65*(4), 620–626. <https://doi.org/10.1097/01.PSY.0000073873.74829.23>
- Moskowitz, J. T., Cheung, E. O., Freedman, M., Fernando, C., Zhang, M. W., Huffman, J. C., & Addington, E. L. (2021). Measuring positive emotion outcomes in positive psychology interventions: A literature review. *Emotion Review, 13*(1), 60–73. <https://doi.org/10.1177/1754073920950811>
- Moskowitz, J. T., Epel, E. S., & Acree, M. (2008). Positive affect uniquely predicts lower risk of mortality in people with diabetes. *Health Psychology, 27*(1S), S73. <https://doi.org/10.1037/0278-6133.27.1.S73>

- Nathanson, L., Rivers, S. E., Flynn, L. M., & Brackett, M. A. (2016). Creating emotionally intelligent schools with RULER. *Emotion Review*, 8(4), 305–310.
- Nelson, S. K., Layous, K., Cole, S. W., & Lyubomirsky, S. (2016). Do unto others or treat yourself? The effects of prosocial and self-focused behavior on psychological flourishing. *Emotion*, 16(6), 850. <https://doi.org/10.1037/emo0000178>
- Nelson-Coffey, S. K., Bohlmeijer, E. T., & Schotanus-Dijkstra, M. (2021). Practicing Other-Focused Kindness and Self-Focused Kindness Among Those at Risk for Mental Illness: Results of a Randomized Controlled Trial. *Frontiers in psychology*, 4469. <https://doi.org/10.3389/fpsyg.2021.741546>.
- Nelson-Coffey, S. K., Ruberton, P. M., Chancellor, J., Cornick, J. E., Blascovich, J., & Lyubomirsky, S. (2019). The proximal experience of awe. *PLoS ONE*, 14(5), e0216780. <https://doi.org/10.1371/journal.pone.0216780>.
- Neumann, S. A., & Waldstein, S. R. (2001). Similar patterns of cardiovascular response during emotional activation as a function of affective valence and arousal and gender. *Journal of Psychosomatic Research*, 50(5), 245–253.
- Ouweneel, E., Le Blanc, P. M., & Schaufeli, W. B. (2014). On being grateful and kind: Results of two randomized controlled trials on study-related emotions and academic engagement. *The Journal of Psychology*, 148(1), 37–60. <https://doi.org/10.1080/00223980.2012.742854>
- R Core Team. (2020). *R: A language and environment for statistical computing*. In R Foundation for Statistical Computing. <https://www.R-project.org/>. Accessed 19 Apr 2022
- Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, 1(3), 385–401. <https://doi.org/10.1177/014662167700100306>
- Richardson, M., McEwan, K., Maratos, F., & Sheffield, D. (2016). Joy and calm: How an evolutionary functional model of affect regulation informs positive emotions in nature. *Evolutionary Psychological Science*, 2(4), 308–320. <https://doi.org/10.1007/s40806-016-0065-5>
- Russell, J. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology*, 39(6), 1161. <https://doi.org/10.1037/h0077714>
- Russell, J. A., Weiss, A., & Mendelsohn, G. A. (1989). Affect grid: A single-item scale of pleasure and arousal. *Journal of Personality and Social Psychology*, 57(3), 493. <https://doi.org/10.1037/0022-3514.57.3.493>
- Santor, D. A., Zuroff, D. C., Ramsay, J., Cervantes, P., & Palacios, J. (1995). Examining scale discriminability in the BDI and CES-D as a function of depressive severity. *Psychological Assessment*, 7(2), 131. <https://doi.org/10.1037/1040-3590.7.2.131>
- Schaefer, A., Nils, F., Sanchez, X., & Philippot, P. (2010). Assessing the effectiveness of a large database of emotion-eliciting films: A new tool for emotion researchers. *Cognition and Emotion*, 24(7), 1153–1172. <https://doi.org/10.1080/02699930903274322>
- Schiffer, L. P., & Roberts, T.-A. (2018). The paradox of happiness: Why are we not doing what we know makes us happy? *The Journal of Positive Psychology*, 13(3), 252–259. <https://doi.org/10.1080/17439760.2017.1279209>
- Schotanus-Dijkstra, M., Drossaert, C. H. C., Pieterse, M. E., Boon, B., Walburg, J. A., & Bohlmeijer, E. T. (2017a). An early intervention to promote well-being and flourishing and reduce anxiety and depression: A randomized controlled trial. *Internet Interventions*, 9, 15–24. <https://doi.org/10.1016/j.invent.2017.04.002>
- Schotanus-Dijkstra, M., Keyes, C. L. M., de Graaf, R., & ten Have, M. (2019a). Recovery from mood and anxiety disorders: The influence of positive mental health. *Journal of Affective Disorders*, 252, 107–113. <https://doi.org/10.1016/j.jad.2019.04.051>
- Schotanus-Dijkstra, M., Pieterse, M. E., Drossaert, C. H., Walburg, J. A., & Bohlmeijer, E. T. (2019b). Possible mechanisms in a multicomponent email guided positive psychology intervention to improve mental well-being, anxiety and depression: A multiple mediation model. *The Journal of Positive Psychology*, 14(2), 141–155. <https://doi.org/10.1080/17439760.2017.1388430>
- Schotanus-Dijkstra, M., Ten Have, M., Lamers, S. M., de Graaf, R., & Bohlmeijer, E. T. (2017b). The longitudinal relationship between flourishing mental health and incident mood, anxiety and substance use disorders. *The European Journal of Public Health*, 27(3), 563–568. <https://doi.org/10.1093/eurpub/ckw202>
- Seligman, & Csikszentmihalyi, M. (2014). Positive Psychology: An Introduction. In: Csikszentmihalyi, M. (Ed.), *Flow and the Foundations of Positive Psychology: The Collected Works of Mihaly Csikszentmihalyi* (pp. 279–298). Springer. https://doi.org/10.1007/978-94-017-9088-8_18.

- Sheldon, K. M., & Lyubomirsky, S. (2021). Revisiting the sustainable happiness model and pie chart: Can happiness be successfully pursued? *The Journal of Positive Psychology, 16*(2), 145–154.
- Shiota, M. N., Neufeld, S. L., Yeung, W. H., Moser, S. E., & Perea, E. F. (2011). Feeling good: Autonomic nervous system responding in five positive emotions. *Emotion, 11*(6), 1368.
- Sin, N. L., & Lyubomirsky, S. (2009). Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: A practice-friendly meta-analysis. *Journal of Clinical Psychology, 65*(5), 467–487. <https://doi.org/10.1002/jclp.20593>
- Singer, J. D., Willett, J. B., & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. Oxford University Press.
- Spinhoven, P., Ormel, J., Sloekers, P., Kempen, G., Speckens, A., & Van Hemert, A. (1997). A validation study of the Hospital Anxiety and Depression Scale (HADS) in different groups of Dutch subjects. *Psychological Medicine, 27*(2), 363–370. <https://doi.org/10.1017/s0033291796004382>
- Spitzer, R. L., Kroenke, K., Williams, J. B., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: The GAD-7. *Archives of Internal Medicine, 166*(10), 1092–1097. <https://doi.org/10.1001/archinte.166.10.1092>
- Steptoe, A., & Wardle, J. (2011). Positive affect measured using ecological momentary assessment and survival in older men and women. *Proceedings of the National Academy of Sciences, 108*(45), 18244–18248. <https://doi.org/10.1073/pnas.1110892108>
- Tice, D. M., Baumeister, R. F., Shmueli, D., & Muraven, M. (2007). Restoring the self: Positive affect helps improve self-regulation following ego depletion. *Journal of Experimental Social Psychology, 43*(3), 379–384. <https://doi.org/10.1016/j.jesp.2006.05.007>
- Trew, J. L., & Alden, L. E. (2015). Kindness reduces avoidance goals in socially anxious individuals. *Motivation and Emotion, 39*(6), 892–907. <https://doi.org/10.1007/s11031-015-9499-5>
- Trompeter, H. R., de Kleine, E., & Bohlmeijer, E. T. (2017). Why Does Positive Mental Health Buffer Against Psychopathology? An Exploratory Study on Self-Compassion as a Resilience Mechanism and Adaptive Emotion Regulation Strategy. *Cognitive Therapy and Research, 41*(3), 459–468. <https://doi.org/10.1007/s10608-016-9774-0>
- Trull, T. J., & Ebner-Priemer, U. W. (2009). Using Experience Sampling Methods/Ecological Momentary Assessment (ESM/EMA) in Clinical Assessment and Clinical Research: Introduction to the Special Section. *Psychological Assessment, 21*(4), 457–462. <https://doi.org/10.1037/a0017653>
- van Agteren, J., Iasiello, M., Lo, L., Bartholomaeus, J., Kopsaftis, Z., Carey, M., & Kyrios, M. (2021a). A systematic review and meta-analysis of psychological interventions to improve mental wellbeing. *Nature Human Behaviour, 1*–22. <https://doi.org/10.1038/s41562-021-01093-w>.
- van Agteren, J., Iasiello, M., Lo, L., Bartholomaeus, J., Kopsaftis, Z., Carey, M., & Kyrios, M. (2021b). A systematic review and meta-analysis of psychological interventions to improve mental wellbeing. *Nature Human Behaviour. https://doi.org/10.1038/s41562-021-01093-w*
- Van Boven, L., & Ashworth, L. (2007). Looking forward, looking back: Anticipation is more evocative than retrospection. *Journal of Experimental Psychology: General, 136*(2), 289. <https://doi.org/10.1037/0096-3445.136.2.289>
- Van der Gucht, K., Dejonckheere, E., Erbas, Y., Takano, K., Vandemoortele, M., Maex, E., Raes, F., & Kuppens, P. (2019). An experience sampling study examining the potential impact of a mindfulness-based intervention on emotion differentiation. *Emotion, 19*(1), 123. <https://doi.org/10.1037/emo0000406>
- Verduyn, P., Delvaux, E., Van Coillie, H., Tuerlinckx, F., & Van Mechelen, I. (2009). Predicting the duration of emotional experience: Two experience sampling studies. *Emotion, 9*(1), 83. <https://doi.org/10.1037/a0014610>
- Watkins, P. C., Woodward, K., Stone, T., & Kolts, R. L. (2003). Gratitude and happiness: Development of a measure of gratitude, and relationships with subjective well-being. *Social Behavior and Personality: An International Journal, 31*(5), 431–451.
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54*(6), 1063. <https://doi.org/10.1037//0022-3514.54.6.1063>
- Watson, D., Wiese, D., Vaidya, J., & Tellegen, A. (1999). The two general activation systems of affect: Structural findings, evolutionary considerations, and psychobiological evidence. *Journal of Personality and Social Psychology, 76*(5), 820. 0022-.1514/99/S3.00.
- Wichers, M. C., Myin-Germeyns, I., Jacobs, N., Peeters, F., Kenis, G., Derom, C., Vlietinck, R., Delespaul, P., & Van Os, J. (2007). Evidence that moment-to-moment variation in positive emotions

- buffer genetic risk for depression: A momentary assessment twin study. *Acta Psychiatrica Scandinavica*, 115(6), 451–457. <https://doi.org/10.1111/j.1600-0447.2006.00924.x>
- Wood, A. M., & Joseph, S. (2010). The absence of positive psychological (eudemonic) well-being as a risk factor for depression: A ten year cohort study. *Journal of Affective Disorders*, 122(3), 213–217. <https://doi.org/10.1016/j.jad.2009.06.032>
- Zautra, A. J., Johnson, L. M., & Davis, M. C. (2005). Positive affect as a source of resilience for women in chronic pain. *Journal of Consulting and Clinical Psychology*, 73(2), 212. <https://doi.org/10.1037/0022-006X.73.2.212>
- Zeng, X., Chiu, C. P., Wang, R., Oei, T. P., & Leung, F. Y. (2015). The effect of loving-kindness meditation on positive emotions: A meta-analytic review. *Frontiers in Psychology*, 6, 1693. <https://doi.org/10.3389/fpsyg.2015.01693>
- Zeng, X., Wang, R., Oei, T. P., & Leung, F. Y. (2019). Heart of joy: A randomized controlled trial evaluating the effect of an appreciative joy meditation training on subjective well-being and attitudes. *Mindfulness*, 10(3), 506–515. <https://doi.org/10.1007/s12671-018-0992-2>
- Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta Psychiatrica Scandinavica*, 67(6), 361–370. <https://doi.org/10.1111/j.1600-0447.1983.tb09716.x>

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