



**University of  
Zurich**<sup>UZH</sup>

**Zurich Open Repository and  
Archive**

University of Zurich  
University Library  
Strickhofstrasse 39  
CH-8057 Zurich  
[www.zora.uzh.ch](http://www.zora.uzh.ch)

---

Year: 2016

---

**Humor-based online positive psychology interventions: A randomized  
placebo-controlled long-term trial**

Wellenzohn, Sara ; Proyer, Rene T ; Ruch, Willibald

DOI: <https://doi.org/10.1080/17439760.2015.1137624>

Posted at the Zurich Open Repository and Archive, University of Zurich

ZORA URL: <https://doi.org/10.5167/uzh-121848>

Journal Article

Accepted Version

Originally published at:

Wellenzohn, Sara; Proyer, Rene T; Ruch, Willibald (2016). Humor-based online positive psychology interventions: A randomized placebo-controlled long-term trial. *Journal of Positive Psychology*, 11(6):584-594.

DOI: <https://doi.org/10.1080/17439760.2015.1137624>

Humor-based Online Positive Psychology Interventions:  
A Randomized Placebo-controlled Long-term Trial

Sara Wellenzohn

University of Zurich, Switzerland

René T. Proyer

Martin-Luther University Halle-Wittenberg, Germany

University of Zurich, Switzerland

Willibald Ruch

University of Zurich, Switzerland

Sara Wellenzohn is at the Department of Psychology, University of Zurich, Switzerland. René T. Proyer is at the Department of Psychology at the Martin-Luther University Halle-Wittenberg in Germany and the Department of Psychology at the University of Zurich, Switzerland. Willibald Ruch is at the Department of Psychology, University of Zurich, Switzerland

This research was supported in part by grants from the Swiss National Science Foundation (SNSF; 100014\_132512 and 100014\_149772) awarded to RTP and WR. The authors are grateful to Dr. Frank A. Rodden for proofreading the manuscript.

Correspondence concerning this article should be addressed to Sara Wellenzohn, Department of Psychology, University of Zurich, Binzmühlestrasse 14/7, 8050 Zurich, Switzerland; E-mail: s.wellenzohn@psychologie.uzh.ch

### Abstract

While correlational evidence exists that humor is positively associated with well-being, only few studies addressed causality. We tested the effects of five humor-based activities on happiness and depression in a placebo-controlled, self-administered online positive psychology intervention (PPI) study ( $N = 632$  adults). All of the five one-week interventions enhanced happiness, three for up to six months (i.e., three funny things, applying humor, and counting funny things), whereas there were only short-term effects on depression (all were effective directly after the intervention). Additionally, we tested the moderating role of indicators of a person  $\times$  intervention-fit and identified early changes in well-being and preference (liking of the intervention) as the most potent indicators for changes six months after the intervention. Overall, we were able to replicate existing work, but also extend knowledge in the field by testing newly developed interventions for the first time. Findings are discussed with respect to the current literature.

*Keywords.* happiness; humor; online intervention; person  $\times$  intervention fit; positive psychology intervention

## Humor-based Online Positive Psychology Interventions:

### A Randomized Placebo-controlled Long-term Trial

#### **Introduction**

Humor plays an important role in people's lives. Recent years have seen an increased interest in the study of humor with a particular interest in its contribution to well-being (see e.g., Ruch & McGhee, 2014; Ruch, Rodden, & Proyer, 2011). One might argue that positive psychology is a "natural home" for the study of humor. For example, humor is listed as a strength of character assigned to the virtue of transcendence in Peterson and Seligman's (2004) *Values-in-Action* (VIA) classification although recent evidence suggests the strongest alignment to be with humanity (Beermann & Ruch, 2009; Müller & Ruch, 2011; Ruch & Proyer 2015). One of positive psychology's main aims is to study ways to promote human flourishing (Seligman, 2011). Two recent meta-analyses (Bolier et al., 2013; Sin & Lyubomirsky, 2009) showed that positive psychology interventions (PPIs; "[...] treatment methods or intentional activities that aim to cultivate positive feelings, behaviors, or cognitions", Sin & Lyubomirsky, 2009; p. 468) could be effective tools to achieve this aim. Up to now, however, only few humor-based interventions have been published.

Although it has been shown that the study of the relationship between humor and (facets of subjective) well-being has several pitfalls (Heintz & Ruch, 2015; Ruch & Heintz, 2014), humor seems to have a potential to contribute to people's well-being. For example, correlational studies using (self- and peer-ratings of) character strengths consistently show robust positive relations in the upper range of the VIA strengths (e.g., Buschor, Proyer, & Ruch, 2013; Park, Peterson, & Seligman, 2004; Proyer, Ruch, and Buschor, 2013; Proyer, Gander, Wellenzohn, & Ruch, 2013). Furthermore, the strength of humor contributes to better recovery after a history of physical illness (Peterson, Park, & Seligman, 2006). Vaillant

(e.g., 2000) has argued that humor may contribute to healthy aging (as a mature *defense mechanism*). There are also humor-based programs in the elderly that are effective in ameliorating depression, anxiety, or pain (e.g., Ganz & Jacobs, 2014; Hirsch, Junglas, Konradt, & Jonitz, 2010; Konradt, Hirsch, Jonitz, & Junglas, 2013; Low et al., 2013; for an overview see Ruch & McGhee, 2014), or in enhancing positive affect in habitants of residential homes (Houston, McKee, Carroll, & Marsh, 1998). Humor is also potent in inducing the positive emotion of amusement (Ruch, 2001, 2009), which may be helpful in the building of resources for well-being (Fredrickson, 1998). Only few humor-based interventions exist, which have been tested in non-clinical settings (for an overview see Ruch & McGhee, 2014). In an effort to narrow this gap, we have tested the potential of humor-based PPIs in a randomized, placebo-controlled, self-administered web-based setting.

### **Humor-based interventions and well-being in non-clinical samples**

Most of the existing humor interventions are administered in group-settings (cf. Ruch & McGhee, 2014). For example, Lowis (1997) conducted a humor workshop consisting of five sessions aimed at learning how to use humor as a coping mechanism for life stress for people who recently went through stressful situations. Nevo, Aharonson, and Klingman (1998) conducted a 14-sessions program with a group of teachers, aimed at improving five different components of “sense of humor” and Ganz and Jacobs (2014) conducted a “humor therapy” workshop with elderly people without cognitive impairment attending senior centers. Moreover, McGhee developed a program to improve one’s sense of humor for usage in group settings—“*The 7 Humor Habits Program*” (see McGhee, 2010a). The habits are structured with increasing difficulty (from “surround yourself with humor” to “find your humor in the midst of stress”). Crawford and Caltabiano (2011) administered the program over eight weeks and found increases in self-efficacy, positive affect, optimism, and perceptions of control. As well as decreases in self-rated depression, anxiety and stress levels

in adults as compared with control groups (social activity and no-intervention group). These improvements lasted for up to three months after the training. McGhee (2010b) and Ruch and McGhee (2014) summarize further research conducted with the program.

Gander, Proyer, Ruch, and Wyss (2013) tested a variant of the *three good things* intervention (i.e., the *three funny things* intervention; writing down three *funny* things that happened during the day, every evening on seven consecutive days; see Table 1) in a self-administered, placebo-controlled online setting. They found increases in happiness at the one-month and three-months follow-up and an amelioration of depression at every follow-up time point (up to six-months) in comparison to the placebo control condition (writing about early memories). In a recent study Proyer, Gander, Wellenzohn, and Ruch (2014) replicated these findings in a sample of people aged 50 to 79 for depressive symptoms, but for happiness only for the six-months follow-up. Overall, the literature on humor-based PPIs is scarce, but findings are promising.

### **Developing self-administered humor-based interventions**

Different structural models of humor have been proposed involving a different number of facets or components (e.g., Craik, Lampert, & Nelson, 1996; Ruch, 2012). While McGhee (2010b) proposed six humor skills (i.e., enjoyment of humor, laughter, verbal humor, humor in everyday life, laughing at yourself, humor under stress), psychometric studies (Köhler & Ruch, 1996; Müller & Ruch, 2011; Ruch & Carrell, 1998) show that these components mostly mark a strong factor of humor that typically unites “[...] enjoying humorous stimuli, finding humour in everyday life and even in one’s own mishaps, enjoying cheerful interactions and telling jokes” (Ruch & Carrell, 1998; p. 555).

It was decided to “merge” classical PPIs with humor, but keep important distinctions (e.g., appreciation vs. production/reproduction of humor) intact and involve important facets that have health relevance (i.e., McGhee’s skill of finding humor under stress). We tested

new humor interventions that were based on the following well-established PPIs; (a) *gratitude visit*, (b) *counting kindnesses*, (c) *using signature strengths*, and (d) *one door closes and another door opens* (see Table 1 for the paraphrased instructions; full instructions are available from the authors).

The *gratitude visit* was found to be effective up to one month with respect to happiness and depressive symptoms (Seligman, Steen, Park, & Peterson, 2005), and up to three months in a replication study (Gander et al. 2013). In the humor-based variant of this intervention (*collecting funny things*) participants were instructed to write in detail about the funniest things they had ever experienced, to describe the emotions felt during this event, and to write down who was present (i.e., focusing on humor appreciation). Participants were further encouraged to share the funny experience with someone who was present when it happened (see Table 1). The *counting kindnesses* intervention by Otake and colleagues (2006) was effective in enhancing happiness at the post-test and also at a three months follow-up, but no effects on depressive symptoms were reported in Gander et al. (2013). Participants in our study had to count the *funny things* that happened to them during the day and noted the total number each evening. Furthermore, we adapted the *using signature strengths* intervention, which was found to be effective for up to six-months, for both happiness and depression (e.g., Gander et al., 2013; Mongrain & Anselmo-Mathews, 2012; Seligman et al., 2005). Participants were instructed to focus on humor in their life and to use it in new ways (*applying humor*; i.e., humor production). Finally, we adapted the *one door closes another door opens*-intervention (Rashid & Anjum, 2008) for which Gander et al. (2013) found effects at the one and three-months follow-ups for happiness (no effects on depressive symptoms though). Our variant was the *solving stressful situations in a humorous way*-intervention: Participants were asked to search for and write about stressful situations in their past that they had resolved in a humorous way.

-----  
Insert Table 1 about here  
-----

We excluded participants with elevated scores in depressive symptoms from this study (using the cut-off score in the CES-D at pre-test; Hautzinger, Bailer, Hofmeister, & Keller, 2012). All newly developed interventions require daily experiences with humor and those with elevated levels of depressive symptoms might find it difficult to embrace such experiences and to express them appropriately—at least in a self-administered setting with comparatively little interaction between the participants and the investigators. Other exclusion criteria were (a) being younger than 18, (b) currently seeing a therapist or taking psychotropic drugs, and (c) participating for professional reasons (e.g., being a journalist and wanting to report on the project). Of course, this leads to a reduction in the variance in one of the dependent variables, but as the measure we use has also been shown to be sensitive in lower levels of depression, we will still consider depression as a dependent variable in our study.

### **The role of the person $\times$ intervention-fit in humor-based interventions**

As this is the first study with a clear focus on online humor-based interventions, we were also interested in how people work with these kinds of interventions. There is robust evidence that moderators exist which contribute to the effectiveness of positive psychology interventions (e.g., Schueller, 2012; Schueller & Parks, 2012; Senf & Liao, 2013). We are especially interested in testing the impact of engagement and motivation on the effectiveness of the interventions (see Ruch & McGhee, 2014). Recently, Proyer, Wellenzohn, Gander, and Ruch (2015) examined indicators of a person  $\times$  intervention-fit 3.5 years after conducting an online PPI. The liking of the intervention, its subjective benefit (i.e., preference), continuation above the instructed time period, the *effort* invested in the activities, but also an

“early reactivity” predicted happiness (6%) and depressive symptoms (9%) after 3.5 years, while controlling for the respective baseline levels. We will evaluate the same indicators of the person  $\times$  intervention-fit in this study for testing their role in humor-based interventions.

This study allows for an initial evaluation of newly developed humor-based positive psychology interventions; follow-ups are directly after the interventions as well as after one, three, and six months. The aim of the present study is threefold, (1) replicating Gander et al.’s (2013) findings for the *three funny things* intervention, (2) testing whether four newly developed interventions lead to an increase in happiness and an amelioration of depressive symptoms, and (3) investigating indicators of a person  $\times$  intervention-fit on the long-term effectiveness of humor-based interventions. A power-analysis has shown that for detecting small effects with a power of  $\geq .80$ , sample sizes of  $\geq 100$  participants per condition will be needed.

## Method

### Participants

A total of  $N = 1,472$  (2,067 registered) participants completed the baseline measures (see Figure 1). Of these, 297 were excluded because they did not fulfill the inclusion criteria (three were younger than 18; 22 were currently seeing a psychotherapist or using psychotropic drugs; 250 were over the cut-off score in depression at baseline) and 60 did not fill-in the pre-test before the intervention. Overall, 632 (117 men, 515 women;  $M = 47.4$ ,  $SD = 11.6$ ; 18-80 years) completed all five-measurement points. They were rather well-educated with 41.5% holding a degree from a university and 19.1% from an applied university, 13.8% had a degree which allows them to attend university, 16.9% had vocational training, 5.2% had a degree which allows attending an applied university, and 3.5% had finished public school. We used the multiple imputations method (Allison, 2001) to estimate the missing data

points. Thus, our analyses include all participants that have indicated the completion of all assignments ( $N = 984$ ).

### **Procedure**

The study was advertised as an online positive psychology training via leaflets and in local newspapers. In the advertisement, we avoided hinting at potential effects on well-being. Prospective participants were guided to the website for instructions and registration. They had to create a personal account, secured with a username and a password. At this point, participants were randomly (by an automated algorithm, based on a Mersenne-Twister) assigned to one of the six conditions (see Table 1).

After registration, participants filled in baseline assessments and demographics. They then clicked through some (8-10) slides about humor (an overview on what psychology knows about humor; e.g., definitions) or about childhood memories. At the end of this presentation, they were directed to a downloadable pdf-file with a summary of the presentation and detailed instructions on the intervention-activity with the request to print this document. Participants were instructed to pursue the activity during the next seven days. They were informed to come back to the website the day after the last day of training to describe how the training was (i.e., filling in the posttests—pre- and post intervention, and after one month, three and six months) and also received a reminder via email. Participants were not paid, but given personalized feedback on happiness and depressive symptoms over the six-months follow-up.

### **Instruments**

The *Authentic Happiness Index* (AHI; Seligman et al., 2005; German version as used by Gander et al., 2013) assesses happiness with 24 statements arranged on five levels of agreement. A sample group of statements is from 1 = *I have sorrow in my life* to 5 = *My life*

*is filled with joy*. The AHI has already been frequently used in intervention studies and demonstrated a high internal consistency of  $\alpha = .93$  in this study.

The *Center of Epidemiologic Studies Depression Scale* (CES-D; Radloff 1977; German adaptation by Hautzinger, Bailer, Hofmeister, & Keller, 2012, 2012) was used to assess depressive symptoms. It consists of 20 items (e.g., “My sleep was restless”) utilizing a four-point scale from 0 = *rarely or none of the time (less than 1 day)* to 3 = *most or all of the time (5-7 days)* and showed an internal consistency of  $\alpha = .90$  in this study.

We followed Proyer et al.’s (2015) procedure for assessing the person  $\times$  intervention-fit in positive psychology interventions. For *preference*, we asked how much the participants liked the intervention (from 1 = *not at all* to 7 = *very much*), and whether they saw a personal benefit and if so how strong it was (from 1 = *no, not at all* to 5 = *yes, very high*). At every follow-up time point we asked if they continued practicing their intervention voluntarily (*continuation*; from 0 = *not continued over the one week* to 3 = *continued up to the 6-months follow-up*). *Effort* was assessed via participants’ invested time (from 1 = *less than 10 minutes* in 10 minutes steps to 20 = *more than 180 minutes*) and we asked whether they conducted the intervention as instructed (=2), or if they did less (=1), or more (=3). The changes in the AHI and in the CES-D from pre- to post-test (subtracting the pre-test score from the post-test score) were used as indicators of *early reactivity* in happiness and depressive symptoms.

## Results

### Preliminary Analyses

Of those who started their assigned activity, 54.4% completed all follow-ups. Participants who dropped out did not differ from the completers at baseline happiness ( $t[1160] = 1.83, p = .07$ ), nor in depressive symptoms,  $t(1160) = -1.27, p = .21$ . The dropouts were on average 3.5 years younger ( $t[1160] = 5.22, p < .001, d = 0.31$ ), but did not differ in terms of the gender ratio ( $\chi^2(1, N = 1162) = 9.81, p = .08$ ), or their educational level,  $\chi^2(1, N$

$= 1162) = 16.54, p = .90$ . The dropout rate across conditions was between 43.2% and 47.8% (Figure 1). There was no difference among the conditions,  $\chi^2(5, N = 1162) = 0.99, p = 0.96$ . Participants in the six conditions differed neither in their baseline levels of happiness ( $F[5, 978] = 1.00, p = .42$ ), nor in depressive symptoms,  $F(5, 978) = 1.02, p = .40$ .

### **Effectiveness of the interventions**

Table 2 gives all mean scores (and *SDs*) for all measurement time points for a first overview, using the pooled data set, resulting from the multiple imputations.

-----  
 Insert Table 2 about here  
 -----

In general, Table 2 shows that mean levels of happiness increased numerically over time in all conditions. The mean levels of depressive symptoms decreased directly after the intervention in all conditions, but in the follow-ups they tended to return to the baseline level again.

The effectiveness in enhancing happiness as well as in ameliorating depressive symptoms was analyzed by comparing each intervention with the placebo control condition, using the multiple imputation data sets<sup>1</sup>. ANCOVAs were conducted with the follow-ups in happiness or depressive symptoms as dependent variables and their baseline levels as the covariate (see Table 3).

---

<sup>1</sup> When analyzing completers only, we found a main effect of the condition (humor-based intervention vs. placebo condition) on happiness ( $F(1, 629) = 4.48, p < .05, \eta^2 = .01$ ), but not on depressive symptoms,  $F(1, 629) = 0.98, p = 0.35$ . Furthermore, we found the three funny things at the one and three months follow-up, and the counting funny things and the applying humor intervention at every follow-up to be effective in enhancing happiness, all three also showing overall effects. However, no overall effects for depressive symptoms were found, only applying humor was found to ameliorate depressive symptoms at post and one month follow-up and solving stressful situations in a humorous way showed trends at post and three months follow-up.

Insert Table 3 about here

-----

As shown in Table 3, all five humor-based interventions demonstrated positive overall effects for increases in happiness—a trend only for the *collecting funny things* intervention though. There were overall effects for all interventions on depression (trend only for *counting funny things*). Aside from pre-tests, this is the first study where these interventions were being fully tested. Therefore, we decided to test for effects at single time points despite having found single overall effects on the 10% level of significance only.

We conducted ANCOVAs for each follow-up time point separately, comparing the interventions with the placebo control condition. As shown in Table 3, the *three funny things* intervention, *counting funny things*, and *applying humor* were effective in enhancing happiness at all follow-up time points. The *collecting funny things*- and the *solving stressful situations in a humorous way* intervention were only effective directly after the intervention, with the latter showing a trend at the one and three months time point. Overall, all tested humor-based interventions were at least at one time point effective for increasing happiness (two out of the five tested at the post-test only though).

For depressive symptoms, all of the humor-based interventions were effective, directly after the intervention. The *collecting funny things* and the *applying humor* interventions were also effective at the one month follow-up. There were trends for the *counting funny things* and the *solving stressful situations in a humorous way* intervention one and three months after the intervention-week.

### **Moderators of the effectiveness of the humor-based positive psychology interventions**

For testing potential moderators of the effectiveness of the humor-based interventions, we conducted separate hierarchical regression analyses for each of the seven fit indicators

(Step 2) predicting happiness and depressive symptoms at the six-months follow-up, while controlling for the baseline levels in Step 1 (see Table 4).

-----  
Insert Table 4 about here  
-----

Table 4 shows that every indicator of the person  $\times$  intervention-fit pointed in the expected direction. *Early reactivity* in happiness (8% incremental variance predicted) was the best predictor for happiness, but also early reactivity in depression as well as *liking* and *benefit* (i.e., indicators of preference), *continuation*, and early reactivity in depression contributed to the prediction (about 1%). As expected, the contribution for the prediction of depression was lower, but *early reactivity* (both happiness and depression), and *continuation* invested contributed (about 1 - 4% each) contributed to the prediction.

We also conducted a joint analysis using all person  $\times$  intervention-fit indicators for the prediction of happiness and depression, respectively. For this, we computed hierarchical regression analyses, in which the pre-test scores were entered in a first step, and all person  $\times$  intervention-fit indicators in a second step. The results are not shown in detail, but are available in the supplementary material online (Table A). Together, all the person  $\times$  intervention-fit indicators explained 8 - 9% of the variance in happiness at the six-months follow-up, and 5 - 6% of the variance in depressive symptoms after controlling for the pre-test scores; best predictors were *early reactivity in happiness* ( $t[809] = 9.81, p < .001$ ) and *early reactivity in depression* ( $t[809] = 5.09, p < .001$ ) for happiness and depressive symptoms, respectively. Additionally, *continuing* the intervention also predicted enhanced happiness and ameliorated depressive symptoms.

## Discussion

The present study contributes to the as of yet limited literature on humor-based positive psychology interventions (PPIs), especially, in self-administered online settings. It replicates and extends prior findings (Gander et al., 2013) by testing new humor-based interventions. Earlier studies (for an overview see Ruch & McGhee, 2014) have already pointed out that there is a potential in these types of interventions for people's well-being. This is the first study to test a broader range of self-administered humor-based PPIs in a randomized placebo-controlled online trial.

The results of this study show that, aside from the already tested *three funny things*-intervention, the four newly developed interventions (*collecting funny things*, *counting funny things*, *applying humor*, and *solving stressful situations in a humorous way*) were effective in enhancing happiness— *three funny things*, *collecting funny things* and *applying humor* were the most potent by showing effects at all follow-up time points. All of the humor-based interventions were also effective in ameliorating depressive symptoms; however, only directly after the intervention and generally with smaller effects.

The *applying humor* intervention is based on the *using signature strengths in a new way* intervention (Seligman et al., 2005). A major difference is that in the signature strengths intervention, participants need to focus on their *highest* strengths, but in this variant, they need to focus on humor *irrespective* of their own humorousness. The findings support the notion that applying humor in a new way in everyday life seems beneficial for those high *or* low in humor. One might argue that simply acting like being a humorous person might already contribute to one's well-being (cf. Fordyce, 1977). This is in line with research published by Fleeson, Malanos, and Achille (2002) who found that *acting* extravert (irrespective of ones expression in extraversion) is associated with experiencing more positive affect. Similarly, Proyer, Gander, Wellenzohn, and Ruch (2015) found that not only a *signature strengths*, but also a *lesser strengths* intervention (i.e., participants were

instructed to apply their lowest strengths—assessed with the Values in Action Inventory of Strengths—in their daily life) was effective in enhancing happiness and ameliorating depressive symptoms in a placebo controlled online study. Unfortunately, we are not able to control for baseline levels of humor in the present study, but the finding may suggest that the intervention could be equally effective for those low or high in humor. In fact, Wellenzohn, Proyer, and Ruch (2015) found no moderating role of the sense of humor (assessed via McGhee’s Sense of Humor scale, 2010a) for humor-based PPIs. However, there it was shown that the *three funny things* intervention was more effective for extraverts. Thus, basic personality traits might also moderate the effects and this warrants attention in future studies.

The findings for the *counting funny things* intervention are comparable with findings for the *counting kindnesses* intervention (Otake et al., 2006). In fact, the humor-based variant demonstrated more sustainable effects for happiness. Keeping the spillover effects in mind, that Otake et al. (2006) found for the *counting kindnesses* intervention (on gratitude and performing acts of kindness), one might expect similar effects on traits related to *counting funny things* such as performing more humorous acts (e.g., telling jokes, making others laugh). The consequences of shared humor (e.g., spending more time with others, strengthening social bonds) might also support the long-term effects. All interventions were well-received; the drop-out rate (46% after six months) was smaller than in comparative studies (e.g., up to 69% at post-test and up to 79% at six months intervals in Mitchell et al., 2010).

As mentioned, there were short-term effects on depression only—contrary to the expectation also for the *three funny things* intervention. When comparing sample characteristics across the three studies where this intervention has been used (i.e., the present study; Gander et al., 2013; Proyer et al., 2014), the baseline levels of depression seem to differ. Obviously levels of depression were lowest in this study, because we excluded those

participants above a (sensitive) threshold for depression. However, one might argue that depressive symptoms may have a moderating role in the effectiveness of the interventions and that the restriction in the variance in the dependent variable had an impact on the findings. Nevertheless, we found short-term effects for depression in this study. This is in line with findings for humor-based programs that were also effective in depressed patients (e.g., Falkenberg, Buchkremer, Bartels, & Wild, 2011; Konradt et al., 2013). Overall, results for the replication of the findings for the *three funny things*-intervention were mixed, as we could replicate the ameliorating effects on depressive symptoms only in the short-term (findings for happiness were replicated though).

### **Core characteristics of the effective interventions**

The common core of the most effective interventions (i.e., *counting funny things*, *applying humor*, and *three funny things*) is that they require the participants to focus on humor experienced on the *present* day of the intervention – a *positive focus on the presence*. For example, one needs to notice funny things during one's day to be able to count them. This idea resembles studies on the *positive information-processing bias* (see Sanchez & Vazquez, 2014) and its relation to positive mood (see Sanchez, Vazquez, Gomez, & Joormann, 2014) or the *attentional preference* (Peters, Vieler, & Lautenbacher, 2015). Hence, favoring positive over negative information seems a contributing factor. Wadlinger and Isaacowitz (2011) describe attentional deployment as a modifiable strategy of emotion regulation, which could be used in trainings to enhance the experience of positive emotions. The interventions might be useful to shift the attentional focus; in the same line as suggested for positive psychotherapy by Seligman, Rashid and Parks (2006).

One might also argue for a *savoring* component while experiencing the positive emotions again that have happened during the remembered events. This is very much in the sense of a positive rumination about the funny things experienced during the day (Quoidbach,

Berry, Hansenne, & Mikolajczak, 2010). Of course, this also relates to what has been described in the Fredrickson's (1998) broaden and build theory of positive emotions.

Overall, we argue in favor of these two mechanisms (the positive focus on the presence and the savoring component) as being core to the intervention's effectiveness. The *savoring* component might also play a role in the *collecting funny things*-intervention, but it seems more focused on the past than on the present. In contrast, the intervention to *solve stressful situations in a humorous way* requires a focus on the *presence*, but *not* on *positive* things (rather on stressful situations). To complete the instructed activity, one needs to focus on stressful situations during the day to be then able to solve them in a humorous way. Consequently, this focus on stressful situations might dampen the effect on well-being. Even if humor has been shown to facilitate amusement (Ruch, 2001), participants may have selected an event, which was not fully resolved with the usage of humor. Therefore, the instruction of the intervention may be improved by a stronger focus on solving situations in a humorous way, or just slightly stressful situations, which might be easier to solve.

### **How do participants work with the humor-based positive psychology interventions?**

We identified person  $\times$  intervention-fit indicators, which have contributed to the interventions' effectiveness. Early changes in happiness and depressive symptoms were the most potent predictors of the effectiveness of humor-based interventions at the six months follow-up, when controlled for the baseline scores. This fits well to what we have found in an earlier study using a 3.5 years interval (Proyer et al., 2015). These were followed in importance by indicators of *preference* and *continuing* the exercises longer than the intervention-week. In more adaptive settings, such information could be used to predict a participants' gain from an intervention s/he has started and may lead to a re-assignment to an intervention, which has a better fit for the person.

### **Limitations and Future Directions**

Although, the present study is based on comparatively large sample sizes the sample consisted of people interested in working on positive interventions on a self-selected basis. Hence, the generalizability of the results is limited. However, we tested the interventions in a randomized placebo-controlled design, so the participants in the placebo control condition had the same expectations and interests. A further advantage of the present study is the online administration. Crawford and Caltabiano (2011) formulated concerns about the effects a group setting might have in humor-based PPIs (e.g., the personality of the person guiding the program, or other interactions among the participants than those intended). Overall, effect sizes were rather low and should not be over-interpreted.

Current research on humor also considers its possible detrimental sides (e.g., using humor to laugh at someone or extensive levels of fearing to be laughed at; e.g., Ruch, Hofmann, Platt, & Proyer, 2014). We do not know what kind of funny things the participants count, do, or think of, when they are conducting the exercises. Thus, one needs to be cautious when disseminating humor-based PPIs. We already considered this, when formulating the instructions, having in mind that different kinds of people appreciate different kinds of humor (Ruch, 2012). For example, people may have different perceptions of what they find funny—we did not instruct participants to favor one specific type of humor over another. In future studies, one might consider asking the participants to hand in their assignments to get more insights on how they actually work with the different interventions. It might also be advisable to focus on a specific kind of humor, for which positive relationships with well-being have been established. Finally, we developed our interventions parallel to existing ones. Other strategies for the development of humor-based interventions, however, might be even more effective.

A further question is whether happiness and depressive symptoms are the best and most self-evident outcome variables in studies such as this one. One could also think of more

proximate outcomes of humor-based PPIs which aim at increasing the participants' senses of humor (McGhee, 2010b) or other traits which might also contribute to well-being (e.g., serenity, or cheerfulness; e.g., Ruch, Köhler, & Van Thriel, 1997).

The present study outlines and extends the knowledge about humor-based PPIs and shows their potential. Research in this area is, however, still at the very beginning, nonetheless findings reported in literature and in the study described here are promising and encourage further work in this line of research.

### References

- Allison, P. D. (2001). *Missing data: Series: Quantitative applications in the social sciences*. Thousand Oaks, CA: SAGE.
- Beermann, U., & Ruch, W. (2009). How virtuous is humor? What we can learn from current instruments. *The Journal of Positive Psychology, 4*, 528–539.  
doi:10.1080/17439760903262859
- 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. doi:10.1186/1471-2458-13-119
- Buschor, C., Proyer, R. T., & Ruch, W. (2013). Self- and peer-rated character strengths: How do they relate to satisfaction with life and orientations to happiness? *The Journal of Positive Psychology, 8*, 116–127. doi:10.1080/17439760.2012.758305
- Craik, K. H., Lampert, M. D., & Nelson, A. J. (1996). Sense of humor and styles of everyday humorous conduct. *Humor: International Journal of Humor Research, 9*, 273–302.
- Crawford, S. A., & Caltabiano, N. J. (2011). Promoting emotional well-being through the use of humour. *The Journal of Positive Psychology, 6*, 237–252.  
doi:10.1080/17439760.2011.57708
- Falkenberg, I., Buchkremer, G., Bartels, M., & Wild, B. (2011). Implementation of a manual-based training of humor abilities in patients with depression: A pilot study. *Psychiatry Research, 186*(2–3), 454–457. doi:10.1016/j.psychres.2010.10.009
- Fleeson, W., Malanos, A. B., & Achille, N. M. (2002). An intraindividual process approach to the relationship between extraversion and positive affect: Is acting extraverted as “good” as being extraverted? *Journal of Personality and Social Psychology, 83*(6), 1409–1422. doi:10.1037//0022-3514.83.6.1409

- Fordyce, M. W. (1977). Development of a program to increase personal happiness. *Journal of Counseling Psychology, 24*, 511–521.
- Fredrickson, B. L. (1998). What good are positive emotions? *Review of General Psychology, 2*, 300–319. doi:10.1037/1089-2680.2.3.300
- Gander, F., Proyer, R. T., Ruch, W., & Wyss, T. (2013). Strength-based positive interventions: Further evidence for their potential in enhancing well-being and alleviating depression. *Journal of Happiness Studies, 14*, 1241–1259. doi:10.1007/s10902-012-9380-0
- Ganz, F. D., & Jacobs, J. M. (2014). The effect of humor on elder mental and physical health. *Geriatric Nursing, 35*(3), 205–211. doi:10.1016/j.gerinurse.2014.01.005
- Hautzinger, M., Bailer, M., Hofmeister, D. & Keller, F. (2012). *Allgemeine Depressionsskala (ADS)* [General Depression Scale] (2nd ed.) Göttingen, Germany: Hogrefe.
- Heintz, S., & Ruch, W. (2015). An examination of the convergence between the conceptualization and the measurement of humor styles: A study of the construct validity of the Humor Styles Questionnaire. *Humor: International Journal of Humor Research, 28*, 611-633. doi:10.1515/humor-2015-0095
- Hirsch, R. D., Junglas, K., Konradt, B., & Jonitz, M. F. (2010). Humorthherapie bei alten Menschen mit einer Depression: Ergebnisse einer empirischen Untersuchung. [Humor therapy in the depressed elderly. Results of an empirical study]. *Zeitschrift für Gerontologie und Geriatrie, 43*, 42–52. doi:10.1007/s00391-009-0086-9
- Houston, D., McKee, K., Carroll, L., & Marsh, H. (1998). Using humour to promote psychological wellbeing in residential homes for older people. *Aging & Mental Health, 2*, 328–332. doi:10.1080/13607869856588
- Konradt, B., Hirsch, R. D., Jonitz, M. F., & Junglas, K. (2013). Evaluation of a standardized humor group in a clinical setting: a feasibility study for older patients with depression:

- Humor therapy for older patients with depression. *International Journal of Geriatric Psychiatry*, 28, 850–857. doi:10.1002/gps.3893
- Köhler, G., & Ruch, W. (1996). Sources of variance in current sense of humor inventories: How much substance, how much method variance? *HUMOR*, 9, 363–398. doi:10.1515/humr.1996.9.3-4.363
- Low, L.-F., Brodaty, H., Goodenough, B., Spitzer, P., Bell, J.-P., Fleming, R., ... Chenoweth, L. (2013). The Sydney multisite intervention of laughterbosses and elderclowns (SMILE) study: cluster randomised trial of humour therapy in nursing homes. *BMJ Open*, 3(1), e002072. doi:10.1136/bmjopen-2012-002072
- Lewis, M. J. (1997). A humor workshop program to aid coping with life stress. *Mankind Quarterly*, 38(1/2), 25.
- McGhee, P. E. (2010a). *Humor as survival training for a stressed-out world: The 7 humor habits program*. Bloomington, IN: Author House.
- McGhee, P. E. (2010b). *Humor: The lighter path to resilience and health*. Bloomington, IN: Author House.
- Mitchell, J., Vella-Brodrick, D., & Klein, B. (2010). Positive psychology and the internet: A mental health opportunity. *Electronic Journal of Applied Psychology*, 6(2), 30–41. doi:10.7790/ejap.v6i2.230
- Mongrain, M., & Anselmo-Matthews, T. (2012). Do positive psychology exercises work? A replication of Seligman et al. (2005). *Journal of Clinical Psychology*, 68, 382–389. doi:10.1002/jclp.21839
- Müller, L., & Ruch, W. (2011). Humor and strengths of character. *The Journal of Positive Psychology*, 6, 368–376. doi:10.1080/17439760.2011.592508
- Nevo, O., Aharonson, H., & Klingman, A. (1998). The development and evaluation of a systematic program for improving sense of humor. In W. Ruch (Ed.), *The sense of*

- humor: Exploration of a personality characteristic* (pp. 385-404). New York, NY: Mouton de Gruyter.
- Otake, K., Shimai, S., Tanaka-Matsumi, J., Otsui, K., & Fredrickson, B. L. (2006). Happy people become happier through kindness: A counting kindnesses intervention. *Journal of Happiness Studies, 7*, 361–375. doi:10.1007/s10902-005-3650-z
- Park, N., Peterson, C., & Seligman, M. E. (2004). Strengths of character and well-being: A closer look at hope and modesty. *Journal of Social and Clinical Psychology, 23*, 628–634. doi:10.1521/jscp.23.5.628.50749
- Peters, M. L., Vieler, J. S. E., & Lautenbacher, S. (2015). Dispositional and induced optimism lead to attentional preference for faces displaying positive emotions: An eye-tracker study. *The Journal of Positive Psychology*. doi:10.1080/17439760.2015.1048816
- Peterson, C., Park, N., & Seligman, M. E. P. (2006). Greater strengths of character and recovery from illness. *The Journal of Positive Psychology, 1*, 17–26. doi:10.1080/17439760500372739
- Peterson, C., & Seligman, M. (2004). *Character strengths and virtues: A handbook and classification*. Washington, DC: New York: American Psychological Association / Oxford University Press.
- Proyer, R. T., Gander, F., Wellenzohn, S., & Ruch, W. (2013). What good are character strengths beyond subjective well-being? The contribution of the good character on self-reported health-oriented behavior, physical fitness, and the subjective health status. *The Journal of Positive Psychology, 8*, 222–232. doi:10.1080/17439760.2013.777767
- Proyer, R. T., Gander, F., Wellenzohn, S., & Ruch, W. (2014). Positive psychology interventions in people aged 50–79 years: long-term effects of placebo-controlled

- online interventions on well-being and depression. *Aging & Mental Health*, *18*, 997-1005. doi:10.1080/13607863.2014.899978
- Proyer, R. T., Gander, F., Wellenzohn, S., & Ruch, W. (2015). Strengths-based positive psychology interventions: A randomized placebo-controlled online trial on long-term effects for a signature strengths- vs. a lesser strengths-intervention. *Frontiers in Psychology*, *6*, 456. doi:10.3389/fpsyg.2015.00456
- Proyer, R. T., Ruch, W., & Buschor, C. (2013). Testing strengths-based interventions: A preliminary study on the effectiveness of a program targeting curiosity, gratitude, hope, humor, and zest for enhancing life satisfaction. *Journal of Happiness Studies*, *14*, 275–292. doi:10.1007/s10902-012-9331-9
- Proyer, R. T., Wellenzohn, S., Gander, F., & Ruch, W. (2015). Toward a better understanding of what makes positive psychology interventions work: Predicting happiness and depression from the person  $\times$  intervention fit in a follow-up after 3.5 years. *Applied Psychology: Health and Well-Being*, *7*, 108–128. doi:10.1111/aphw.12039
- Quoidbach, J., Berry, E. V., Hansenne, M., & Mikolajczak, M. (2010). Positive emotion regulation and well-being: Comparing the impact of eight savoring and dampening strategies. *Personality and Individual Differences*, *49*, 368–373. doi:10.1016/j.paid.2010.03.048
- Radloff, L. S. (1977). The CES-D scale. A self-report depression scale for research in the general population. *Applied Psychological Measurement*, *1*, 385–401. doi:10.1177/014662167700100306
- Rashid, T., & Anjum, A. (2008). Positive psychotherapy for young adults and children. In J. R. Z. Abela & B. L. Hankin (Eds.), *Handbook of depression in children and adolescents* (pp. 250–287). New York, NY: Guilford.

- Ruch, W. (2001). The perception of humor. In A. W. Kaszniak (Ed.), *Emotion, Qualia, and Consciousness* (pp. 410–425). Tokyo, Japan: Word Scientific Publisher.
- Ruch, W. (2009). Amusement. In D. Sander, & K. Scherer (Eds.). *The Oxford Companion to the Affective Sciences* (pp. 27-28). New York, NY: Oxford University Press.
- Ruch, W. (2012). Towards a new structural model of the sense of humor: Preliminary findings. In *AAI Symposium on Artificial Intelligence of Humor Proceedings* (pp. 2–4). Retrieved from <http://www.aaai.org/ocs/index.php/FSS/FSS12/paper/viewFile/5652/5809>
- Ruch, W., & Carrell, A. (1998). Trait cheerfulness and the sense of humour. *Personality and Individual Differences, 24*, 551–558. doi:10.1016/S0191-8869(97)00221-3
- Ruch, W., & Heintz, S. (2014). Humour styles, personality, and psychological well-being: What's humour got to do with it? *European Journal of Humour Research, 1*(4), 1–24. Retrieved from <http://europeanjournalofhumour.org/index.php/ejhr/article/view/35>
- Ruch, W., Hofmann, J., Platt, T., & Proyer, R. (2014). The state-of-the art in gelotophobia research: A review and some theoretical extensions. *Humor: International Journal of Humor Research, 27*, 23–45. doi:10.1515/humor-2013-0046
- Ruch, W., Köhler, G., & Van Thriel, C. (1997). To be in good or bad humour: Construction of the state form of the State-Trait-Cheerfulness-Inventory—STCI. *Personality and Individual Differences, 22*, 477–491. doi:10.1016/S0191-8869(96)00231-0
- Ruch, W., & McGhee, P. E. (2014). Humor intervention programs. In A. C. Parks & S. Schueller (Eds.), *The Wiley Blackwell Handbook of positive psychological interventions* (1. ed., pp. 179–193). West Sussex, UK: John Wiley & Sons.
- Ruch, W., & Proyer, R. T. (2015). Mapping strengths into virtues: the relation of the 24 VIA-strengths to six ubiquitous virtues. *Frontiers in Psychology, 6*. doi:10.3389/fpsyg.2015.00460

- Ruch, W., Rodden, F. A., & Proyer, R. T. (2011). Humor and other positive interventions in medical and therapeutic settings. In Kirkcaldy, Bruce D. (Ed.), *The art and science of health care: Psychology and human factors for practitioners*. Göttingen, Germany: Hogrefe.
- Sanchez, A., & Vazquez, C. (2014). Looking at the eyes of happiness: Positive emotions mediate the influence of life satisfaction on attention to happy faces. *The Journal of Positive Psychology, 9*, 435–448. doi:10.1080/17439760.2014.910827
- Sanchez, A., Vazquez, C., Gomez, D., & Joormann, J. (2014). Gaze-fixation to happy faces predicts mood repair after a negative mood induction. *Emotion, 14*, 85–94. doi:10.1037/a0034500
- Schueller, S. M. (2012). Personality fit and positive interventions: Extraverted and introverted individuals benefit from different happiness increasing strategies. *Psychology, 03*, 1166–1173. doi:10.4236/psych.2012.312A172
- Schueller, S. M., & Parks, A. C. (2012). Disseminating self-help: Positive psychology exercises in an online trial. *Journal of Medical Internet Research, 14*(3), e63. doi:10.2196/jmir.1850
- Seligman, M. (2011). *Flourish*. New York, NY: Free Press.
- Seligman, M. E. P., Rashid, T., & Parks, A. C. (2006). Positive psychotherapy. *American Psychologist, 61*, 772–788. doi:10.1037/0003-066X.61.8.772
- Seligman, M. E. P., Steen, T. A., Park, N., & Peterson, C. (2005). Positive psychology progress: Empirical validation of interventions. *American Psychologist, 60*, 410–421. doi:10.1037/0003-066X.60.5.410
- Senf, K., & Liau, A. K. (2013). The effects of positive interventions on happiness and depressive symptoms, with an examination of personality as a moderator. *Journal of Happiness Studies, 14*, 591–612. doi:10.1007/s10902-012-9344-4

- 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*, 467–487. doi:10.1002/jclp.20593
- Vaillant, G. E. (2000). Adaptive mental mechanisms: Their role in a positive psychology. *American Psychologist, 55*, 89–98. doi:10.1037/0003-066X.55.1.89
- Wadlinger, H. A., & Isaacowitz, D. M. (2011). Fixing Our Focus: Training Attention to Regulate Emotion. *Personality and Social Psychology Review, 15*(1), 75–102. doi:10.1177/1088868310365565
- Wellenzohn, S., Proyer, R. T., & Ruch, W. (2015). *Who benefits from humor-based positive psychology interventions? The moderating effects of personality traits and the sense of humor*. Manuscript submitted for publication

Table 1

*Description of the Humor-based Interventions and the Placebo Control Condition.*

Intervention	Instruction	Source/adapted from
Three funny things	Every evening participants had to write down the three funniest things they had experienced during the day and to describe the feelings during each of the experiences.	Three good things (Seligman et al., 2005): Writing down three good things that happened during the day. Adapted to the Three funny things by Gander et al., 2013.
Collecting funny things	Participants were instructed to remember one of the funniest things they have experienced in the past and to write it down in the most possible detail (every evening).	Gratitude visit (Seligman et al., 2005): Thank someone, who was especially kind in the past, by writing a letter in which one's gratitude is expressed, and deliver it to the person
Counting funny things	During the day participants counted all the funny things that happened during the day and to note the total number every evening.	Counting kindnesses (Otake et al., 2006): Keep track of daily-performed acts of kindness, counting them and summing them up each evening.
Applying humor	Participants were instructed to notice the humor experienced during the day and add new humorous activities like reading comics, jokes, watching funny movies etc.	Using signature strengths (Seligman et al., 2005): Taking the Values in Action Inventory of Strengths to assess the personal top strengths and then to apply these in new ways in one's daily life
Solving stressful situations in a humorous way	Participants had to think about a stressful experience during the day and about how it was (or could have been) solved in a humorous way.	One door closes and another door opens (Rashid and Anjum, 2008): Think about situations in the past, that went wrong but that nonetheless had positive outcomes, or situations in which the positive outcomes could not have even happened without the negative situation
Placebo control condition: Early memories	"Participants were asked to write about their early memories every night for one week."	Seligman et al. (2005; p. 416)

Table 2

*Means and Standard Deviations for the Humor-based Interventions and the Placebo Control Condition at the Five Time Periods for Happiness and Depressive Symptoms Based on the Multiple Imputation Data Set.*

	<i>N</i>	Pre		Post		1 M		3 M		6 M	
		<i>M</i>	<i>SD</i>								
<i>Happiness</i>											
Three funny things	151	76.66	11.06	78.00	11.63	78.26	13.02	78.92	12.91	80.16	13.10
Collecting funny things	164	75.72	11.11	76.71	11.64	76.32	12.57	76.13	13.34	77.47	13.26
Counting funny things	176	75.07	12.51	76.97	12.77	77.54	13.96	78.29	13.73	75.07	14.08
Applying humor	165	74.04	11.32	76.70	12.09	77.61	12.61	77.13	13.21	77.43	13.67
Solving stressful situations in a humorous way	162	75.75	11.19	76.90	12.25	76.75	12.58	77.73	11.93	77.25	13.04
PCC	166	74.67	12.47	74.17	13.35	74.24	14.30	74.89	14.26	75.76	13.85
<i>Depressive Symptoms</i>											
Three funny things	151	9.75	5.72	8.77	6.23	10.40	8.25	10.36	8.26	9.37	8.57
Collecting funny things	164	11.00	6.02	9.75	7.10	10.28	8.07	11.32	8.75	11.17	9.09
Counting funny things	176	10.51	5.89	9.69	6.61	10.64	8.16	10.60	8.86	10.86	8.46
Applying humor	165	10.61	5.92	9.52	6.57	9.32	6.66	11.22	7.95	11.21	8.85
Solving stressful situations in a humorous way	162	10.02	5.76	9.38	6.99	10.29	8.34	9.80	7.37	10.32	8.37
PCC	166	10.72	5.30	11.02	7.35	12.16	8.68	12.01	9.13	10.85	8.48

*Note.* Happiness = Authentic Happiness Inventory, Depressive Symptoms = Center for Epidemiologic Studies Depression Scale; PCC = Early memories. 1 M = one month after the intervention, 3 M = three months after the intervention, 6 M = six months after the intervention.

Table 3

*ANCOVAs with the Intervention Condition (Humor-based Intervention × Placebo Control Condition) and Time (Happiness or Depressive Symptoms) Controlled for the Respective Baseline-Scores Based on the Multiple Imputation Data Set.*

	<i>N</i>	ANCOVA			ANCOVAs for each time point			
		<i>df</i>	<i>t</i>	<i>R</i> <sup>2</sup>	Post <i>t</i>	1 M <i>t</i>	3 M <i>t</i>	6 M <i>t</i>
<i>Happiness</i>								
Three funny things	151	2, 314	3.05**	.09	2.71**	2.01*	2.18*	2.26*
Collecting funny things	164	2, 327	1.31†	.04	2.09*	1.16	-0.29	0.79
Counting funny things	176	2, 339	3.59***	.11	3.30***	2.78**	2.84**	2.02*
Applying humor	165	2, 328	3.91***	.12	4.05***	3.73***	2.45**	2.16*
Solving stressful situations in a humorous way	162	2, 325	1.90*	.06	2.30*	1.56†	1.68†	0.53
<i>Depressive Symptoms</i>								
Three funny things	151	2, 314	1.90*	.09	-2.45**	-1.14	-0.90	-0.81
Collecting funny things	164	2, 327	1.87*	.08	-2.13*	-2.37**	-0.82	0.14
Counting funny things	176	2, 339	1.60†	.07	-1.83*	-1.60†	-1.36†	0.13
Applying humor	165	2, 328	1.89*	.09	-2.22**	-3.35***	-0.67	0.47
Solving stressful situations in a humorous way	162	2, 325	1.94*	.09	-1.70*	-1.46†	-1.65†	-0.10

*Note.* Happiness = Authentic Happiness Inventory, Depressive Symptoms = Center for Epidemiologic Studies Depression Scale; 1 M = one month after the intervention, 3 M = three months after the intervention, 6 M = six months after the intervention; Placebo Control Condition *n* = 166.

†*p* < .10; \**p* < .05; \*\**p* < .01; \*\*\**p* < .001 (one-tailed).

Table 4

*Hierarchical Regression Analyses of Happiness and Depressive Symptoms at the Six-Months Follow-Up on Indicators of a Person  $\times$  Intervention-Fit (Separately) for Humor-based Positive Psychology Interventions, Controlled for Baseline Scores in Step 1, Based on the Multiple Imputation Data Set.*

Indicators	Regression (Step 2)				
	df	Happiness after 6 months		Depressive Symptoms after 6 months	
		t	$\Delta R^2$	t	$\Delta R^2$
<i>Preference</i>					
Liking	2,815	3.69***	.01	1.22	.00
Benefit	2,815	3.81***	.01	2.39**	.01
<i>Continuation</i>					
	2,815	2.62**	.01	2.07*	.01
<i>Effort</i>					
Instruction	2,815	0.53	.00	0.74	.00
Time	2,815	1.79*	.00	1.57†	.00
<i>Early reactivity</i>					
Reactivity AHI	2,815	12.00***	.08	2.35**	.01
Reactivity CES-D	2,815	5.00***	.01	6.37*	.04

*Note.*  $N = 817$ . Liking: How much participants liked the exercise (1 = not at all, 7 = very much); Benefit: How much participants subjectively benefitted from the exercise (1 = not at all, 7 = very much); Continuation = Continued practicing up to one, three, or six months; Instruction: Did less than instructed (=0) or did as much or more than instructed (=1); Time: Total amount of time spent with the exercise during the intervention week; Reactivity AHI / CES-D: Differences between the posttest and the pretest in the Authentic Happiness Inventory and the Center for Epidemiological Studies Depression Scale, respectively.

† $p < .10$ ; \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$  (one-tailed)

## Supplemental online material

Table A

*Hierarchical Regression Analyses of Happiness and Depressive Symptoms at the Six-Months Follow-Up on Indicators of a Person × Intervention-Fit (Enter-Method), Controlled for Baseline Scores Based on the Multiple Imputation Data Set.*

Predictors	Hierarchical Regression				
	df	Happiness		Depressive Symptoms	
		after 6 months		after 6 months	
		$\Delta R^2$	<i>t</i>	$\Delta R^2$	<i>t</i>
Step 1:	1, 816	.50 - .53		.12 - .17	
Pretest			27.69***		7.91***
Step 2: Predictors	7, 809	.08 - .09		.05 - .06	
Preference-Liking			0.79		0.35
Preference-Benefit			0.39		-1.19
Continuation			1.95†		-1.56†
Effort-Instruction			-0.65		0.43
Effort-Time			1.09		-0.92
Reactivity AHI			9.81***		-0.21
Reactivity CES-D			0.00		5.09***

*Notes.*  $N = 816$ . Liking: How much participants liked the exercise (1 = not at all, 7 = very much); Preference-Benefit: How much participants subjectively benefitted from the exercise (1 = not at all, 7 = very much); Continuation = Continued practicing up to one, three, or six months; Effort-Instruction: Did less than instructed (=0) or did as much or more than instructed (=1); Effort-Time: Total amount of time spent with the exercise during the intervention week; Reactivity AHI / CES-D: Differences between the posttest and the pretest in the Authentic Happiness Inventory and the Center for Epidemiological Studies Depression Scale, respectively.

† $p < .10$ ; \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$  (one-tailed)