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Making Minds Matter

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How Does More Attention to Subjective Well-Being Affect Subjective Well-Being?

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Abstract There is an ongoing debate as to whether pursuing happiness is beneficial for people's subjective well-being (SWB). To address this question, we tested whether attention to SWB – measured by participation in SWB surveys – is related to experienced SWB in two longitudinal studies. The initial study was conducted from November to December 2013 ($N = 129$), and the replication study, three years later from November to December 2016 ($N = 120$). The studies include two groups: one group (the control group) answered three SWB surveys over 4 weeks, and the other group (the experimental group) followed the same procedure but additionally tracked their SWB in detail using the experience sampling method four times a day and the day reconstruction method once a day using a smartphone application for two weeks to heighten their attention to their SWB. Both studies show higher SWB scores at later measurements compared to the first ones.

Keywords Attention · Subjective Well-Being (SWB) · Experience Sampling Method (ESM) · Day Reconstruction Method (DRM) · Mobile Application

Introduction

In the present paper, we investigate the relationship between subjective well-being (SWB) and attention to SWB. According to the OECD guidelines on measuring SWB, SWB is defined as "*Good mental states, including all of the various evaluations,*

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positive and negative, that people make of their lives and the affective reactions of people to their experiences." (OECD, 2013, page 10). In their paper, Diener et al. (2003) use happiness and subjective well-being (SWB) interchangeably, and in accordance such usage, Seligman and Csikszentmihalyi (2000) stated that the term SWB is only "a more scientific-sounding term for what people usually mean by happiness" (p. 9; also cp. Diener 2000, p. 24). In line with these authors we will use the term SWB and happiness interchangeably as well. According to Brown & Ryan (2003), the term attention describes a heightened sensitivity for experiences. In our study, the heightened sensitivity to SWB is inflicted by participation in SWB surveys.

Understanding how attention to SWB is related to actual SWB levels is important given the strong interest in the pursuit of happiness by media and the general public alike (e.g., marketing claims such as Coca Cola's "Open Happiness" and number one music hits such as "Happy" from Pharrell Williams). We define the pursuit of happiness as every action an individual takes with the intent to increase its SWB for example hiring a happiness coach or reading a book on how to become happier. This interest in the pursuit of happiness is reflected in an exponentially rising number of scientific publications on happiness as well, with more than 500 every year (Veenhoven 2015) since 2000. Hence, it seems crucial to understand the effect that efforts to pursue happiness have on people's SWB. This issue seems especially relevant, since research shows that individuals who are most concerned with their own SWB tend to have lower levels of SWB (Mauss et al. 2011). Presumably those who are concerned about their own SWB also pay attention to their SWB levels; however, whether attention on its own has a negative or positive effect remain unclear. Thus, an important research question that needs to be answered first before evaluating specific actions to pursue happiness concerns how higher attention to SWB affects SWB.

Findings Showing that Attention to Subjective Well-Being may be Detrimental

Studies on the "dark side of happiness" (Gruber et al. 2011) suggest that explicitly pursuing high SWB can paradoxically lead to lower levels of SWB. Most notably, Schooler et al. (2003) showed in an experimental study that people who were told to try to become "as happy as possible" by listening to hedonically ambiguous music [music that is novel to the listener and from which the listener does not have expectations of how the music should make them feel] rated themselves unhappier afterwards than a control group that merely listened to the same music. On a similar note, Schooler et al. (2003) asked participants before New Year's Eve what they expected from the evening, and participants who had high expectations for the evening rated their SWB and their evening lower the next day, while Mauss, Tamir, Anderson and Savino showed in 2011 that participants who valued SWB higher reported lower levels of SWB and had lower mental health when they had low life stress.

Findings Showing that Attention to Subjective Well-Being may be Beneficial

In combination with reflection, attention can result in more awareness, which is – in turn - associated with higher SWB (Brown and Ryan 2003).

In this regard, Wismeijer et al. (2009) showed that people who are more aware of their emotions and who are better able to label these emotions are better at regulating

their mood and report higher SWB. Similarly, Beaman's longitudinal research (2008) on retirees' SWB supports the mediating role of emotional awareness to SWB at least by facilitating positive emotions. Lyubomirsky and Layous (2013) outline evidence that happiness can be actively increased by focusing on activities (behaviours or thoughts) that can increase SWB. Higher attention to SWB can help to find out the right activities for the right person in the right situation to increase SWB. Bryant et al. (2005) showed that positive reminiscence can increase experienced happiness by paying more attention to a happy moment in the past. In a study by Bakker et al. (2016), people were invited by public commercials to share their happiness levels and to complete happiness diaries on a website using e-mail-reminders, with the goal of increasing the awareness of their SWB levels. The authors found a significant increase of 0.14 points on a 0–10 happiness scale for monthly happiness if participants completed at least 10 diaries.

In sum, attention influences awareness and higher awareness is associated to higher SWB levels.

Findings Showing that Surveying People Frequently may Increase Awareness

Two survey methods increase people's attention and may increase their awareness. The first method is the experience sampling method (ESM; Csikzentmihalyi and Hunter 2003; Csikszentmihalyi and Larson 2014), a method that signals participants in the moment and asks them to report how they feel right now and what, with whom and where they are doing such activities. The second method is the day reconstruction method (DRM; Kahneman et al. 2004; Diener and Tay 2014), a happiness diary method that asks participants to reconstruct their day in episodes and to report how they felt in these episodes.

Scollon et al. (2009) summarized ESM reactivity effects in their review of this method. They stated that being asked many times a day with this method can alert participants to their more inner thoughts and potentially change their behaviours. Likewise, Litt et al. (1998) showed that alcoholics reported that they were more aware of their addiction after an ESM study, while Thompson et al. (2011) investigated the relationship between attention to emotion and affect intensity in an ESM study, and found that participants who were prompted eight times a day for seven days showed both higher positive and negative affect because of the higher attention to their emotions.

Hence, some evidence suggests that ESM studies increase participants' attention and awareness, resulting in emotional changes. Such an increase is likely to be observed for not only ESM but also DRM studies, as seen in the study from Bakker et al. (2016). Indeed, as participants reconstruct their day, they may obtain a better sense of what was going on in their life in comparison with those who did not participate in such an activity. Accordingly, participation in the DRM could lead to higher attention and awareness.

Findings Showing that Surveying People Frequently may not Increase Awareness

Although it seems clear that ESM and DRM can increase attention, it is not clear whether the ESM and DRM increase participants' awareness. Thus, an individual that answers surveys about its SWB has to reflect on the questions, ratings and findings

instead of just paying attention to the questions, ratings and findings to become more aware of its SWB. Without reflection there is just attention to the SWB surveys but not awareness for the SWB. In line with this Conner-Christensen (2003) showed that not all individuals report their personal experience and reflect on it deeply to become more aware. Indeed, some participants merely report semantic knowledge or respond more behaviourally to the prompts. In line with this finding, Killingsworth and Gilbert (2010) showed in an ESM study that for 46.9% of the prompts, participants' minds were wandering, which indicates that they were not aware of the current situation.

Summary

On the one hand, evidence shows that explicitly pursuing higher levels of SWB and valuing SWB to a greater extent increases the chance that individuals are disappointed and thus have lower levels of SWB.

On the other hand, we expect that the ESM and DRM enhance attention and that greater attention in combination with reflection can help to increase awareness. Greater awareness is then associated with higher SWB, and hence, it should be beneficial to pay more attention to SWB.

Thus, given the literature so far (especially the study from Bakker et al. 2016), we do not expect a negative effect and even expect a potential increase in participants' SWB by paying more attention to their SWB when investigating a non-clinical sample.

A metaphor can help to understand this thought: A speedometer in a car should help drivers pay attention of the speed and thus minimize the risk of having an accident. If the driver has good driving skills and if the track is easy, he does not need to look at the speedometer too often because he has a good feeling of the speed and can focus on experiencing the track and focus on driving. Adapted to the old idea of a hedonimeter (Edgeworth 1881), this driver would be in the 'green' (Thriving) zone and identify the merit of experiencing higher awareness rather than the merit of meta-awareness (Schooler and Mauss 2010). Accordingly, more attention to SWB would not have a strong positive effect but also not a strong negative effect. If the driver has good driving skills but the track is difficult to traverse or vice versa, he or she needs to pay more attention to his or her speed and look at the speedometer more often to reach his or her goal. Such a driver would be in the 'yellow' (Struggeling) zone and need to pay a bit more attention to his or her happiness. Thus, he or she would need more meta-awareness and a bit less experience to find the right track or just realize that he or she is on the right track to be able to live in the green zone. Accordingly, more attention to SWB, would have a positive effect. If the driver has poor driving skills and if the track is difficult, it does not seem likely that looking at the speedometer all the time would be the right way to reach the goal. The driver would just focus on the speed, which is not his biggest problem, as he or she first needs to learn to drive (again). Such a driver would be in the 'red' (Suffering) zone and would, for example, suffer from depression. If he or she would focus on his or her (un)happiness every day instead of thinking about doing his or her clinical interventions right, he or she would not become happier. Accordingly, more attention to SWB would have a self-defeating effect. Thus, in a non-clinical sample without too many participants in the red zone we would expect a positive effect by paying more attention to SWB on participants' SWB.

This Study

If paying more attention to one's SWB has a clear negative impact on SWB, then people should not pursue happiness directly by hiring a happiness coach or reading books about happiness; instead, they should focus more on other aspects of their life to increase their SWB. If paying more attention to SWB is beneficial people should track their happiness in more detail to raise their awareness and understand better which activities, in which situations would increase their SWB. Thus, to investigate the role of more attention to SWB in how and whether we should pursue happiness seems to be very important and is investigated in this study.

Unfortunately, to our knowledge no other study investigated the effect of attention to SWB in an experimental study. Bakker et al. (2016) only had a quasi-experimental approach investigating the effect of the frequency and length of use of a website to track happiness on the happiness ratings. In order to investigate their finding in more detail we report a controlled longitudinal study that we ran in 2013 and a replication study that we ran in 2016 to investigate if paying more attention to SWB has a positive effect on a non-clinical sample.

Method

Initial study in 2013

Sample

Our sample for the initial study included psychology students of Heinrich-Heine University Düsseldorf who need to participate in experiments for course credits. All participants needed to be able to speak English or German. The participants in the experimental group needed to have an Android smartphone. The psychology students were recruited from presentations of the study in their classes. To control for participants' motivation to participate in the study, they were first asked whether they would participate in the group that would use the app. If they answered that they would like to participate but that they did not have an Android smartphone, they were informed about a different study in which they just needed to complete some online-questionnaires about their SWB (the control group). Hence, the sample was not truly randomly assigned; the difference between the two groups was not in their motivation, it was only the difference that participants in the experimental group owned an Android smartphone and that participants in the other group did not. As a reward, every participant who finished the entire study took part in a lottery for a 250 Euro Amazon voucher and got an individual SWB profile. Additionally, the psychology students in the experimental group got eight half participant hours (course credits), and the psychology students in the control group got four (they need to have 60 in total as part of their bachelor degree).

Overall, 188 people finished the first questionnaire (134 experimental group), 170 finished the second one (122 experimental group), and 156 finished the whole study (112 experimental group). Thus, the attrition rates were quite similar for both groups

(16.5% experimental group; 18.5% control group). In this paper, we will just look at participants who finished all three baseline questionnaires, did at least 50% of the DRM and ESM modules if they were in the experimental group (as a manipulation check) and did not have changes in their life satisfaction that were higher than two standard deviations between the different measurements because such changes could be due to other life events and not just study participation. Thus, the final sample comprises 129 participants (90 experimental group), with a mean age of 21.95 ($SD = 4.63$) and 108 women (74 experimental group) and 21 men (16 experimental group). The descriptive characteristics of the sample can be seen in Table 1:

Materials

The study used three different material modules: i) the self-developed smartphone app; ii) the online questionnaires measuring participants' SWB (SWB Questionnaire; see Appendix Table 7); and iii) some additional questionnaires (see Appendix Table 10).

Smartphone Application Regarding the increasing attention to SWB, we developed a smartphone application that combined two widespread and commonly used scientific techniques in happiness research (Diener and Tay 2014): i) ESM and ii) DRM. With both methods we try to increase the attention that participants pay to their SWB. Details about the app will be explained in the study procedure below.

SWB Questionnaire To measure the effect of increased attention for participant's SWB on their SWB, an online-questionnaire was programmed with the software EFS survey. This questionnaire was based on the OECD guidelines for measuring SWB (OECD 2013) and consists of the following components: i) Overall SWB Scores; ii) Affective SWB Scores; iii) Cognitive SWB Scores.

Overall SWB Measurements The first question was a *core measure of happiness* (HC) from the European Social Survey (Round 2013). Participants had to rate how happy they are on a Likert scale from 0 to 10. The test-retest reliability lies between .50 and .70 in prior research (Krueger and Schkade 2008).

The second question was a *core measure of life satisfaction* (LC) from the European Social Survey (Round 2013). Participants had to rate how satisfied they are with their life on a Likert scale from 0 to 10. The test-retest reliability after two weeks also lies between .50 and .70 in prior research (Krueger and Schkade 2008).

Affective SWB Measurements The *Affect Balance Scale* (ABS; Bradburn 1969) was integrated into our survey as a third measurement to assess positive and negative affect in more detail. Participants are asked to indicate whether they have felt a given emotion (5 positive and 5 negative ones) in the last two weeks (yes/no). If a negative emotion is rated with "yes," a -1 is coded, and if a positive emotion is rated with "yes," a $+1$ is coded. When these ratings are summed, the "Affect Balance" is calculated with a range between -5 and $+5$. Unfortunately, the only published test-retest study is still from Bradburn (1969), but it shows a test-retest reliability of .76 after three days, and the internal consistency is between .55 and .73 (Cronbach's α) for positive affect and .61 and .73 for negative affect in prior research.

Table 1 Descriptive characteristics of the sample

Variable	Experimental Group 90 Mean (*SD*) / %	Control Group 39 Mean (*SD*) / %	*F* value
Age	21.24 (4.07)	23.56 (5.68)	6.88* 6.88*
Gender (% male)	17.8%	12.8%	0.49
Education			1.54
High School	84.4%	76.9%	
Vocational Training	7.8%	7.7%	
Bachelor or Higher	7.8%	15.4%	
Personality			
Extraversion	1.29 (2.82)	0.95 (2.98)	0.38
Conscientiousness	3.06 (2.21)	3.10 (2.25)	0.01
Openness	2.38 (2.14)	2.56 (1.97)	0.22
Agreeableness	2.26 (1.97)	2.69 (2.08)	1.29
Emotional stability	4.53 (1.52)	4.44 (1.52)	0.11
Chronic condition (yes)	8.9%	5.1%	0.53
Immigrant	4.4%	2.6%	0.26
Height	170.42 (8.53)	172.62 (7.23)	1.96
Weight	63.18 (11.94)	64.31 (12.34)	0.24
Alcoholic	1.1%	0.0%	0.68
Smoker	5.6%	7.7%	0.97
Religion			0.28
Atheist	21.1%	15.4%	
Catholic	32.2%	41.0%	
Protestant	33.3%	23.1%	
Others	13.3%	20.5%	
Monthly Income			1.55
Below modal	80.0%	74.4%	
Modal (€2.500 net)	15.6%	12.8%	
Above modal	4.4%	12.8%	
Having a job (% yes)	37.8%	43.6%	0.38
Household situation			0.34
At parents' home	41.1%	25.6%	
Alone	23.3%	33.3%	
With partner	34.4%	12.8%	
Flat-sharing	1.1%	28.2%	

The table displays the exact descriptive characteristics of the full sample, experimental group and control group. As can be seen, the whole sample is comparably young, there are more women than men, and the participants are highly educated for their age, have low immigrant rates, are not overweight, live healthily according to alcohol and smoking habits, have a lower income and have a mixed household situation. Significant differences between the two groups are displayed with their *F*-values calculated by a MANOVA (* $p < .05$; ** $p < .01$). The questionnaire group is significantly older

Cognitive Happiness Measurements To measure participants' life satisfaction in more detail than in the core-question, the fourth measurement included is the *Satisfaction with Life Scale* (SWLS; Diener et al. 1985). The SWLS is a short 5-item instrument on a 7-point Likert scale designed to measure global cognitive judgments of satisfaction with one's life. The scale usually requires only one minute to answer, and it is often used in research studies all over the world. The test-retest reliability is above .80 (Diener et al. 2013) in most studies, and the internal consistency Cronbach's α is about .80 or higher in prior research (Diener et al. 2013; Eid and Diener 2004).

To measure the construct of eudaimonia, the *Flourishing Scale* (FS; Diener et al. 2010) was integrated into the survey as the fifth measurement. The Flourishing Scale is a brief 8-item summary measure of the respondent's self-perceived success in important areas such as relationships, self-esteem, purpose, and optimism. The scale provides a single psychological well-being score. Its test-retest reliability is about .80, and the internal consistency about .80 in prior research (Cronbach's α).

As a last measurement, we added the *Domain Evaluation Questionnaire* (DEQ; OECD 2013), which is a module suggested by the OECD (2013) to measure satisfaction in 10 different domains of life (e.g., health) on an 11-point Likert scale. Because it is a very new scale, no evidence of test-retest reliability is available. However, because of the OECD's recommendation and the provision of additional information, it was implemented in the survey.

Additional Questionnaires A demographic questionnaire collecting some personal information was integrated at the end of the first survey. To control for personality effects, the Big Five short scale (TIPI; Gosling et al. 2003) was used. For details, see Appendix Table 10.

Study Procedure

The whole study procedure lasted about six weeks. In the first week, the study was presented to evaluate different happiness measurements among psychology students at the Heinrich-Heine University Düsseldorf in their classes. First, participants who owned an Android phone signed up to a list with their email address in order to participate in the more intense measurement group (experimental group). Afterwards, participants without a smartphone signed up on a list with their email address in order to participate for the repeated measurement group (control group).

To ensure that as many of the participants who signed up to take part in the study were really going to participate, reminder emails for the start of the study were sent on Sunday November 3rd 2013, Wednesday November 6th 2013 and Thursday November 7th 2013 before the start of the study.

To control the effects of weekday (e.g., Helliwell and Wang 2014) and time of day, the first online questionnaire had to be filled in by both groups on Thursday, November 7th 2013 between six pm and three am. Before starting the questionnaire, participants had to create their own individual participant code. The first online questionnaire consisted of the SWB questionnaire, the personal information questionnaire and the Big Five questionnaire outlined above. The entire online questionnaire took the participants about 13 min to finish.

After finishing the same online questionnaire as the control group, the experimental group received an explanation about how to download the app on the next page of the survey. For participants who had problems downloading the app, there was a service hotline (3 people needed help). Ultimately, every participant succeeded in downloading the app.

To ensure an easy download and installation process for the participants, the app was published in the Google Play Store for the duration of the study. After downloading the app, the participant needed to sign up with an individual participant code created by the participant. By doing so, participants could ensure that their data were anonymous and that it could not be tracked, so social desirability biases should have been reduced. All tracking information (e.g., GPS information) were automatically deleted.

To ensure that participants understand how to use the app, a tutorial explaining all different functions and screens was provided. It was not possible to skip this tutorial; thus, every participant had the same understanding of the app. As part of the tutorial, the app sent examples of the two different notifications that popped-up, such as a short message.

The first one was a notification for the ESM: when the participant clicked on the notification, the app asked the participant to merely rate his or her SWB on a smiley scale between 0 and 10 (Veenhoven 2004). Next, the participant was asked to describe what he or she was doing in that moment using a series of multiple-choice questions. Sequent, the participant rated where he or she was in that moment and with whom. If an answer to a notification took the participant about 30 s after some experience, it was possible to give an answer for a notification in nearly every situation.

The other notification was for the DRM. In this regard, participants were asked to reconstruct their previous day by describing it in episodes (e.g., breakfast from 9 to 10, and so on). For the description of the activity, the same questions as in the experience sampling questionnaire were used. After finishing the reconstruction of the previous day in episodes, participants had to rate episodes on a smiley scale (Veenhoven 2004).

On the home screen, participants could see their ratings on different graphs to ensure high attention to SWB. Thus, participants were able to see how happy they were during different activities, with different people or in different locations, how they used their time and how happy they were on which day. All this information was based on the participant's answers in the ESM or DRM.

Although downloading the app and signing up with a participant code requires a data connection (wi-fi or cellular), the app itself worked both with and without an internet connection. If the participant completed the survey with no connection, the data were transferred to the server as soon as the user had an internet connection. Figure 1 displays the ESM and DRM of the self-developed smartphone application.

For two weeks, the experimental group used the smartphone application. The intensity of notifications was high to ensure that participants were really paying attention to their happiness and that enough data was collected to give them graphical feedback about their SWB. Accordingly, the participants got six ESM notifications per day and were asked to do the DRM every day. The effort was about 3–5 min for the ESM notifications and about 10–15 min for the DRM per day.

On Sunday, Wednesday and Thursday before the second questionnaire on Thursday, November 21st 2013, reminder mails were sent to the participants. The experimental group was told to ensure that their smartphones would be connected to the internet on Thursday to ensure that all the data could be transferred to the server. On Thursday afternoon at six pm, the app was deleted, so that it was not possible to use it anymore.

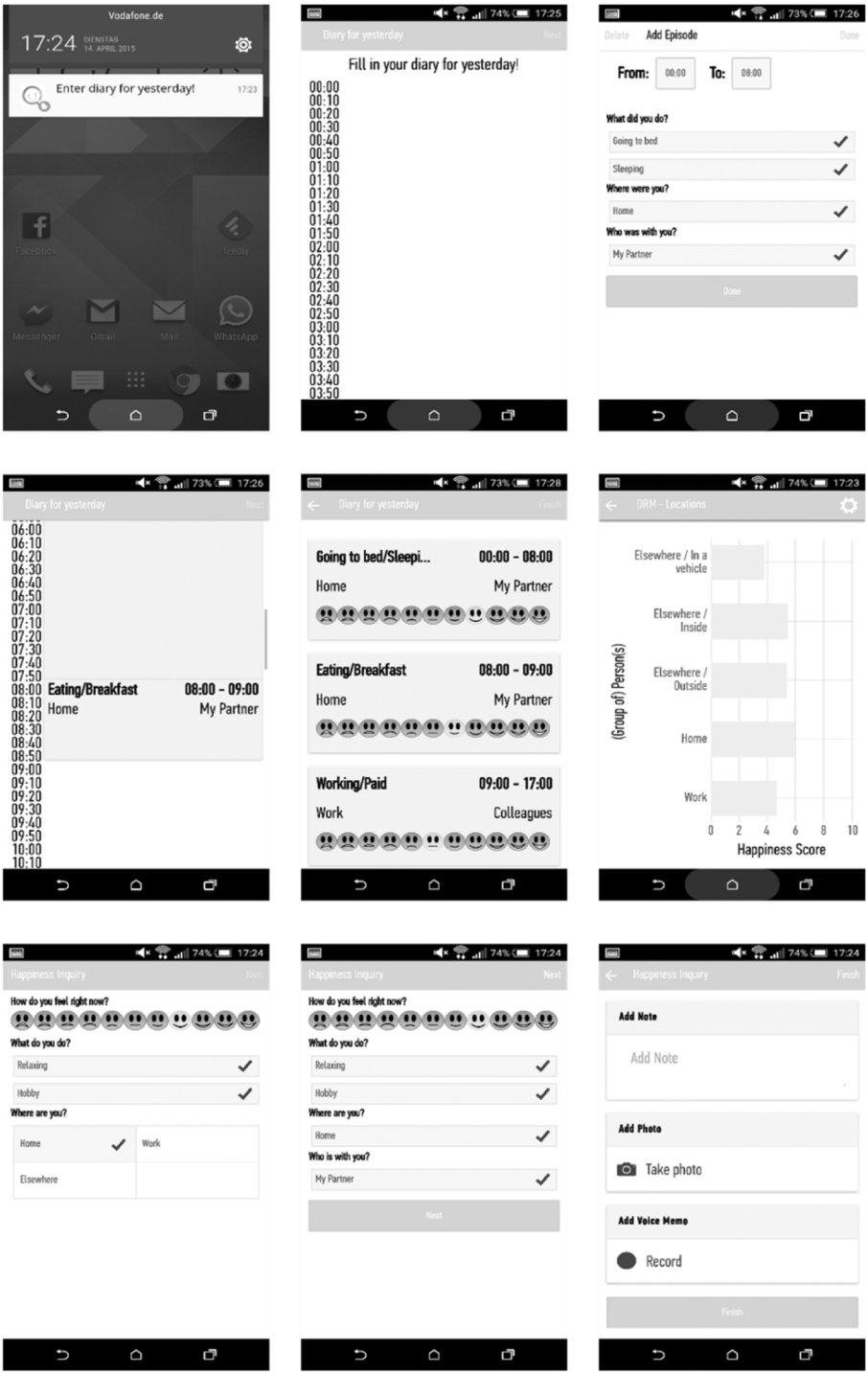


Fig. 1 The figure displays screenshots of the self-developed smartphone application

Subsequently, both groups were asked to complete just the SWB questionnaire a second time between six pm and three am. Hence, the online questionnaire took only about 6–8 min to complete. The participants again needed to sign in with their participant code for this purpose.

Two weeks later, both groups had to complete the SWB questionnaire a third time. Reminder mails were again sent on Sunday, Wednesday and Thursday, December 5th 2013, before the start of the third online questionnaire. This was the same for the second questionnaire for both groups.

When they finished the last SWB questionnaire, participants were asked to send an email to a previously unknown e-mail address (happinessprofile@web.de) to confirm that they finished the study. Only the participants that sent this mail were allowed to participate in the lottery to receive the 250 Euro Amazon voucher, to get a link to their individual SWB profile and to a get certificate to get their participant hours (course credits). In this way, it was possible for participants to remain anonymous, as they did not need to report their individual participant code.

After we exported their data, individual SWB profiles could be automatically generated. The participants who finished the study received a link to their profile in their "Thank You" mail. To ensure anonymity once again, participants had to sign up with their individual participant code again on this webpage to be able to access their individual happiness profile. This profile showed their data in the form of graphs, and the data were explained to them. In the "Thank You" e-mails, all participants in the app group were invited to attend a "mulled wine-evening" at Heinrich-Heine University. However, this event was organised not only to say thank you but also to evaluate the app and the study process among the participants. The lottery for the 250 Euro Amazon voucher also occurred on this evening. Additionally, in the "Thank You" e-mails, the psychology students were informed of the dates when they could get their signatures for their participant hours (course credits).

The whole study process took about eight weeks: two weeks to recruit participants, four weeks to conduct the study itself and two weeks to finish the study by sending the profiles, the "Thank You" e-mails, the non-responder questionnaires, the "mulled wine evening" and the signatures for the participant hours (course credits). Figure 2 summarizes the study procedure:

Study design

For the study, a one-factorial repeated between-subjects design with two intensities was implemented. The single factor is an increase in attention for SWB, which should be higher for the experimental group and lower for the control group. To measure the

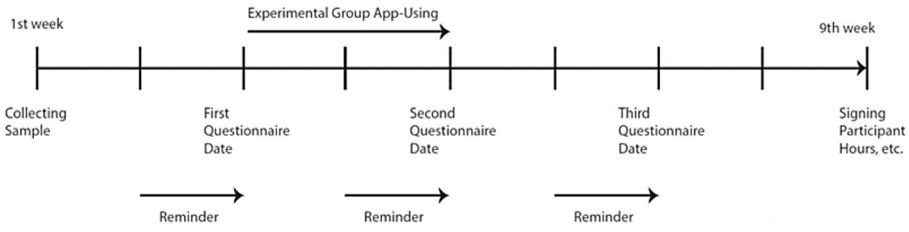


Fig. 2 The figure displays the study procedure. Further details are explained in the text above

SWB levels in both groups, six dependent variables were measured three times in four weeks in both groups: the happiness core question score (HC), the life satisfaction core question score (LC), the domain evaluation questionnaire score (DEQ), the flourishing scale score (FS), satisfaction with life scale score (SWLS) and the affect balance scale (ABS) score.

Replication study in 2016

Sample

The sample and sampling process was nearly the same as in 2013. The main difference was that we wanted to run the whole study on smartphones and that we wanted to have a fully randomized sampling process. Thus, the app was available for Android smartphones and iPhones this time, and we merely allowed psychology students to participate in the study if they owned either an Android smartphone or an iPhone. As the app could now also display the SWB questionnaires, participants signed up in class without knowing the group for which they would be selected. By waiting three years for the replication study, we ensured that none of the participants participated in the initial study.

In sum, 197 people finished the first questionnaire (105 in the experimental group), 152 finished the second one (79 in the experimental group), and 135 finished the whole study (72 in the experimental group). The attrition rates are the same in both groups but are higher than in the first study because participants had to download an update for the app in the middle of the study (31.5% experimental group; 31.5% control group). Similar to the initial study sample, we merely assess participants who finished all three baseline questionnaires, did at least 50% of the DRM and ESM modules if they were in the experimental group and did not have changes in their life satisfaction that were more than two standard deviations between the different measurements because this could be due to other life events and not just from their study participation. Thus, the final sample comprises 120 participants (63 experimental group), with a mean age of 21.71 ($SD = 5.10$) and 101 women (52 experimental group) and 19 men (11 experimental group). The descriptive characteristics of the sample are summarized in Table 2:

Materials

Most materials remained the same for the replication study. The main differences are that now all questionnaires were displayed in the app and that there are no external online questionnaires to realize a fully randomized sampling process.

As we doubted that the ABS would be sensitive enough because it merely asks participants to give “yes” or “no” answers, we replaced it with the Scale of Positive and Negative Experience (SPANE; Diener et al. 2010; for details see Appendix Table 8), which asks respondents about the strength of 12 different emotions in the last weeks on a 7-point Likert scale.

Additionally, we added the mindful attention awareness scale (MAAS; Brown and Ryan 2003; for details, see Appendix Table 9) to determine whether people merely pay more attention to their SWB in the experimental group or whether they really have a higher general awareness.

Table 2 Descriptive characteristics of the sample

Variable	Experimental Group 63 Mean (*SD*) / %	Control Group 57 Mean (*SD*) / %	*F* value
Age	21.43 (4.26)	22.02 (5.90)	0.40
Gender (% male)	17.5%	14.0%	0.26
Education			1.11
High School	88.9%	84.2%	
Vocational Training	3.2%	0.0%	
Bachelor or Higher	7.9%	15.8%	
Personality			
Extraversion	1.44 (2.84)	0.96 (2.48)	0.96
Conscientiousness	3.14 (2.15)	3.23 (2.20)	0.05
Openness	2.52 (2.35)	2.40 (2.25)	0.08
Agreeableness	2.48 (1.93)	2.12 (2.04)	0.95
Emotional stability	4.56 (1.57)	4.79 (1.57)	0.66
Chronic condition (yes)	9.5%	8.8%	0.02
Immigrant	4.8%	5.3%	0.02
Height	171.16 (6.96)	169.49 (8.17)	1.46
Weight	63.09 (12.17)	60.70 (9.74)	1.39
Alcoholic	1.6%	0.0%	0.43
Smoker	6.3%	1.8%	2.93
Religion			0.24
Atheist	23.8%	29.8%	
Catholic	41.3%	36.8%	
Protestant	25.4%	24.6%	
Others	9.5%	8.8%	
Monthly Income			2.49
Below modal	85.7%	73.7%	
Modal (€2.500 net)	7.9%	14.0%	
Above modal	6.3%	12.3%	
Having a job (% yes)	61.9%	45.6%	3.23
Household situation			8.91**
At parents' home	28.6%	42.1%	
Alone	36.5%	10.5%	
With partner	12.7%	15.8%	
Flat-sharing	22.2%	31.6%	

The table displays the exact descriptive characteristics of the full sample, the experimental group and the control group. As can be seen, the whole sample is comparably young, there are more women than men, participants are highly educated for their age, they have low immigrant rates, they are not overweight, they live healthily according to alcohol and smoking habits, they have a lower income, and they a mixed household situation. Significant differences between the two groups are displayed with their *F*-values calculated by a MANOVA (* $p < .05$; ** $p < .01$). The household situation differs significantly

Study Procedure

The general procedure was almost similar to that of the initial study in 2013. To ensure that the effects were not due to the context of Christmas becoming closer, we decided to start the study one week later than we did in 2013. In the first week (November 7th to November 13th 2016), we collected our sample by presenting the study in psychology classes. On Sunday, Wednesday and Thursday, we reminded participants about the start of the study by e-mail. On Thursday November 17th 2016, participants were able to download the app in the Google Play Store or the Apple App Store at six pm.

By downloading the app, participants were randomly assigned to the experimental or the control group. Subsequently, participants filled in the first questionnaire and were informed about the further study process afterwards. Participants in the experimental group did the tutorial afterwards and did the ESM and DRM modules for the next two weeks. Because participants gave feedback in 2013 that six ESM modules per day required too much effort, we decided to reduce the number to four ESM modules for this study.

On the Sunday, Wednesday and Thursday before the second questionnaire on Thursday December 1st between 6 pm and 3 am, the app reminded the participants to participate in the study additionally to the reminder e-mails. For the third questionnaire on Thursday, December 15th between 6 pm and 3 am, the same procedure was used. Participants were able to see their final profiles, including all questionnaire results right after they finished the third questionnaire.

The lottery voucher was sent to one participant on Friday December 16th through the app. In the last study week, the app reminded the participants of the dates when they could get their participant hours signed and when the mulled-wine evening was going to happen. Thus, we were able to shorten this process from two weeks to one week to be able to finish the study before the Christmas Holiday.

Study Design

The study design remained the same as that for the replication study. The only differences were that the SPANE replaced the ABS as a dependent variable and that we added the MAAS as a dependent variable.

Results

Initial Study 2013

Between Group Results

To examine whether there is a significant difference in the change of the scores of the dependent variables between the control and experimental groups, a repeated-measures MANCOVA between them was conducted for all dependent variables controlling for all covariates. There was no significant effect between the two groups (Pillai's Trace: $F = 0.752$; $p = .697$; $\eta^2 = .009$).

Within Group Results

To investigate in general whether paying more attention to one's SWB affects one's SWB, the differences in the questionnaire scores in all three assessments (t1, t2, t3) were tested by repeated-measures MANCOVAs for every dependent variable for the control group and for the experimental group. Tables 3 and 4 display the results. The results for the experimental group show increased ratings for all scores (t1 vs. t3) except the ABS and significantly higher ones for DEQ (Pillai's Trace: $F = 5.165$; $p = .008$; $\eta^2 = .129$), FS (Pillai's Trace: $F = 3.493$; $p = .036$; $\eta^2 = .091$) and SWLS (Pillai's Trace: $F = 6.097$; $p = .004$; $\eta^2 = .148$). The control group also shows higher ratings for all scores except HC and ABS, but none of the changes are significant. The results do not differ significantly if we do not control for all covariates.

Replication Study 2016

Between Group Results

To investigate whether we find similar effects to the initial study in 2013, we ran the same calculations for the dataset of the replication study in 2016. The repeated measures MANCOVA did not show significant differences in the results between the two groups (Pillai's Trace: $F = 0.660$; $p = .785$; $\eta^2 = .008$).

Within Group Results

To investigate whether we find similar effects to the initial study in 2013, we ran the same calculations for the dataset of the replication study in 2016. The results are displayed in Tables 5 and 6. The experimental group shows increased ratings in all scores (t1 vs. t3) and significantly higher ones in the DEQ (Pillai's Trace: $F = 4.681$; $p = .014$; $\eta^2 = .179$). In the SPANE, we see significant variance (Pillai's Trace: $F = 6.834$; $p = .003$; $\eta^2 = .241$). First, there is a significant drop indicating

Table 3 Results ANOVAs: Within results for the different questionnaires in the experimental group ($N = 90$)

Measure	Score t 1	Score t 2	Score t 3	*Cohen's D (t2 – t1)*	*Cohen's D (t3 – t2)*	*Cohen's D (t3 – t1)*	*F* value	*p* value	η^2
HC	6.76	7.13	7.04	.240	−.055	.189	2.617	.080	.070
LC	6.81	6.91	7.00	.059	.056	.109	0.894	.414	.025
DEQ	6.75	6.98	7.00	.164	.011	.177	5.165**	.008	.129
FS	5.41	5.53	5.48	.146	−.068	.077	3.493*	.036	.091
SWLS	5.04	5.20	5.17	.147	−.028	.123	6.097**	.004	.148
ABS	0.77	0.82	0.73	.029	−.046	−.018	0.140	.870	.004

HC = Happiness Core; LC = Life Satisfaction Core; DEQ = Domain Evaluation Questionnaire; FS = Flourishing Scale; SWLS = Satisfaction with Life Scale; ABS = Affect Balance Scale. Significance Levels of $p < .05$ and $p < .01$ are displayed by * and **

Table 4 Results ANOVAS within for the different questionnaires in the control group ($N = 39$)

Measure	Score t 1	Score t 2	Score t 3	*Cohen's* D (t2 – t1)	*Cohen's* D (t3 – t2)	*Cohen's* D (t3 – t1)	*F* Value	*p* value	η^2
HC	6.67	6.41	6.59	−.137	.100	−.047	0.371	.695	.038
LC	6.64	6.69	6.92	.025	.122	.140	0.910	.420	.087
DEQ	6.70	6.75	6.80	.029	.026	.055	0.404	.673	.041
FS	5.15	5.29	5.20	.151	−.097	.057	2.156	.143	.185
SWLS	4.74	4.83	4.91	.076	.061	.135	0.980	.393	.094
ABS	0.67	0.72	0.64	.027	−.041	−.014	0.102	.904	.011

HC = Happiness Core; LC = Life Satisfaction Core; DEQ = Domain Evaluation Questionnaire; FS = Flourishing Scale; SWLS = Satisfaction with Life Scale; ABS = Affect Balance Scale. Significance Levels of $p < .05$ and $p < .01$ are displayed by * and **

lower ratings on positive emotions and then an increase indicating more positive emotions. The control group shows higher ratings in all scores (t1 vs. t3), except SPANE, and significantly higher ones for the DEQ (Pillai's Trace: $F = 7.803$; $p = .001$; $\eta^2 = .297$).

Awareness Effects

As stated in the method part, we added the MAAS for the replication study to investigate whether people merely pay more attention to their SWB or whether their also awareness increases. To investigate this effect, we ran a repeated measures MANCOVA within the two groups and a repeated measures MANCOVA while controlling for all covariates displayed in Table 2 between the two groups. We find that awareness significantly increases in the experimental group (Pillai's Trace: $F = 5.916$; $p = .005$; $\eta^2 = .216$) but not in the control group (Pillai's Trace: $F = 0.318$; $p = .730$; $\eta^2 = .017$). The differences between the two groups are not significant (Pillai's Trace: $F = 2.835$; $p = .064$; $\eta^2 = .054$).

Table 5 Results ANOVAs: Within differences for questionnaires in the experimental group ($N = 63$)

Measure	Score t 1	Score t 2	Score t 3	*Cohen's D (t2 – t1)*	*Cohen' D (t3 – t2)*	*Cohen' D (t3 – t1)*	*F* value	*p* value	η^2
HC	7.37	7.57	7.62	.143	.039	.180	1.476	.240	.064
LC	7.38	7.51	7.68	.088	.113	.209	1.660	.202	.072
DEQ	6.98	7.24	7.31	.226	.064	.295	4.681*	.014	.179
FS	5.63	5.68	5.67	.074	−.016	.053	0.332	.719	.015
SWLS	5.11	5.22	5.29	.120	.063	.181	2.639	.083	.109
SPANE	−0.04	−0.34	0.01	−.408	.459	.050	6.834**	.003	.241

HC = Happiness Core; LC = Life Satisfaction Core; DEQ = Domain Evaluation Questionnaire; FS = Flourishing Scale; SWLS = Satisfaction with Life Scale; SPANE = Scale of Positive and Negative Effect. Significance Levels of $p < .05$ and $p < .01$ are displayed by * and **

Table 6 Results ANOVAs: Within difference for questionnaires in the control group ($N = 57$)

Measure	Score t 1	Score t 2	Score t 3	*Cohen's D (t2 – t1)*	*Cohen's D (t3 – t2)*	*Cohen's D (t3 – t1)*	F value	p value	η^2
HC	7.16	7.42	7.37	.166	−.030	.129	1.149	.328	.058
LC	7.39	7.58	7.60	.124	.012	.120	0.976	.386	.050
DEQ	7.02	7.19	7.50	.128	.229	.374	7.803**	.001	.297
FS	5.62	5.60	5.65	−.032	.064	.038	0.591	.559	.031
SWLS	5.15	5.30	5.30	.139	.004	.136	2.400	.105	.115
SPANE	0.09	−0.10	0.01	−.217	.123	−.091	0.605	.551	.032

HC = Happiness Core; LC = Life Satisfaction Core; DEQ = Domain Evaluation Questionnaire; FS = Flourishing Scale; SWLS = Satisfaction with Life Scale; SPANE = Scale of Positive and Negative Effect. Significance Levels of $p < .05$ and $p < .01$ are displayed by * and **

Discussion

Summary

This study aimed to answer the question "*How does more attention to SWB affect SWB?*". Our hypothesis was that paying more attention to SWB would have a positive effect on SWB in a non-clinical sample. We investigated our research question in two longitudinal studies mixing two different approaches (ESM and DRM). Two groups completed three SWB questionnaires within four weeks, and one of these groups (the experimental group) additionally completed four ESM modules per day and one DRM module per day for two weeks to increase their attention for their SWB.

Both studies show that more attention to one's SWB has no negative effect on one's SWB and that within the experimental group, there are significant positive effects in both studies. These differences do not significantly differ from the control group.

Methodological discussion

The representativity of this study for the general population is of course limited, as the sample merely comprises psychology students in Düsseldorf, Germany. Psychology students may be challenging subjects for this kind of study because they probably already reflect their life quite a lot and thus it is harder to increase their attention to SWB and their awareness.

Additionally, the statistical power is limited owing to the sample size. A bigger sample was unfortunately not available for the two studies mainly because of a lack of funding which would have been mandatory to increase the representative sample size for this intense study.

After the initial study, we were not confident whether some of the effects and differences between the two groups might have arisen because we did not have a random sampling between the two groups. As the results seem in general quite similar in both studies, it seems that the ownership of a (Android) smartphone in 2013 was not an important moderator.

In the initial study in the experimental group, only the ABS showed little variance over time. To increase the sensitivity, as the ABS merely gives the option to answer

with "yes" and "no" for experiencing certain emotions, we decided to use the SPANE for the replication study, as it uses a 7-point Likert scale. Unfortunately, the ABS and SPANE scores are not comparable for the two studies.

To be able to explain the effects better, we added the MAAS. Unfortunately, we did not think of this in 2013; thus, we do not have comparable results.

Another limitation is that the follow-up was too short to capture a possible sleeper effect. Deferred effects are likely to exist if heightened awareness of how well one feels affects the level of subjective wellbeing though major life choices, such as the awareness that one feels not well in the presence of one's spouse leading to the decision to divorce. Such decisions take time, and they may be taken years after one has realized how one feels.

The graphical information that participants received in the app might play a role in the increased awareness of the experimental group. Thus, higher attention and awareness could be not just due to the DRM and ESM; rather, it could be due to the graphical feedback. Further, experimental studies controlling for whether participants get graphical feedback should be conducted in the future.

The greatest problem in interpreting the results is that the control group itself also shows increases over time in both studies. Thus, none of the differences between the experimental and control group are statistically significant, likely because of the effect of just filling in three SWB questionnaires. To rule out context effects, we chose a time where the psychology students do not write any exams in the period they participated in the study, and we controlled for bigger changes in the LC score and controlled whether it has an effect that Christmas is closer by starting the replication study a week later. In a follow-up study, there should be three additional randomly assigned groups that merely complete one questionnaire at one of the different questionnaire dates to completely rule out possible context effects. Unfortunately, our sample sizes were too small to split the sample in more groups.

Results discussion

Even when we consider all the methodological issues stated above, it can be concluded that there is not a negative effect owing to more attention to SWB in both studies. In both studies, none of the dependent variables show a significant negative effect between t1 and t3, and the DEQ and SWLS scores show significant increases in the experimental group for both studies additionally to descriptive increases in all other SWB indicators except the ABS in the initial study.

Given that only the participants in the experimental group report significantly increased awareness in the MAAS, it seems that using the DRM and ESM over two weeks can have a specific effect. This increased awareness seems to result in more emotional variance given the significant negative changes in the SPANE, indicating lower ratings for positive emotions between t1 and t2, and significant positive changes between t2 and t3, indicating higher ratings for positive emotions. Thus, it seems that higher general awareness makes participants more aware of their emotions and induces them to rate their SWB in scales that ask them about their overall happiness (HC), overall life satisfaction (LC, SWLS) or their general satisfaction with certain domains (DEQ) but not on a scale that indicates changes in the perception of a meaning in life (FS). From our point of view, participants understand better how satisfied they are with their life when they pay more attention to their SWB because of their increased general awareness.

That similar changes occur in the control group, indicating the same descriptive patterns as in the experimental group (except of the HC scores in the initial study), is not surprising. In the second study, the control group's well-being increased even more in the DEQ, although this should not be overinterpreted as DEQ is not a very common measure, its test-retest-reliability is unknown and it might be more context dependent than the other measures. Participating in a SWB study for four weeks to fill in three longer SWB questionnaires should also increase participants' attention to their SWB. Further, without using DRM and ESM for two weeks, participants should not have higher general awareness but should have a better perception of how satisfied they are with their life.

In comparison to the effect of the study by Bakker et al. (2016), the app group's effect seems comparably high. They find a long-term effect on participant's happiness doing 10 DRM modules of 0.14 on a 0–10 point happiness scale. In this study, we find an effect of about 0.25 points, which is higher than the effect found by Bakker et al. (2016). This result might be due to the following differences: i) participants paid higher attention to SWB because of the mix of ESM and DRM and because the results were always on their phone; ii) the effect might be higher in the first weeks and decreases afterwards; and iii) there might be a context factor that multiplied the effect. In general, it needs to be stated that both studies find a positive effect owing to more attention for SWB.

General Discussion

We see that paying more attention to SWB seems to increase awareness, which results in higher SWB ratings in a non-clinical sample.

Unfortunately, we do not have enough participants that have a very low SWB to compare the effects on participants with a very low SWB to participants with a medium SWB and to participants with a very high SWB in order to test the speedometer metaphor explained in the introduction. Further research should investigate this in more detail.

Thus, our results are limited in the way that we only have findings that support the hypothesis that paying attention to SWB is not having a negative effect on a non-clinical sample but cannot securely state that it has a positive effect on a non-clinical sample nor on a clinical sample.

Final conclusions

In conclusion, the findings show that paying more attention to one's SWB does not have a negative effect on one's SWB in general and might even have a positive effect. Even if it is not yet clear for whom and to what extent more attention to SWB has a positive effect, the results show that it is not generally negative to pay more attention to one's SWB and to give a positive signal for the high media attention for the pursuit of happiness and to tracking happiness in more detail to understand better which activities in which situations can increase SWB.

Compliance with Ethical Standards

Conflict of Interest On behalf of all authors, the corresponding author states that there is no conflict of interest. Additionally, we declare that this research was conducted in line with the Declaration of Helsinki which explains all main rules for human research ethics.

Appendix

Table 7 Dependent SWB Variables Initial Study

Measure	Items	Scale Range
Happiness Core (HC)	Taking all things together, how happy would you say you are?	0: Extremely unhappy 10: Extremely happy
Life Satisfaction Core (LC)	All things considered, how satisfied are you with your life as a whole nowadays?	0: Extremely dissatisfied 10: Extremely satisfied
Affect Balance Scale (ABS)	During the past few weeks, did you ever feel? (yes/no): 1: Excited / Interested 2: Restless 3: Proud 4: Lonely 5: Pleased 6: Bored 7: On top of the world 8: Depressed 9: Things were going your way 10: Upset	−5: All negative emotions experienced, but no positive ones +5: All positive emotions experienced, but not negative ones
Satisfaction With Life Scale (SWLS)	Indicate your agreement which each item: 1: In most ways, my life is close to my ideal 2: The conditions of my life are excellent 3: I am satisfied with my life 4: So far, I have gotten the important things I want in life 5: If I could live my life over, I would change almost nothing.	1: Strongly disagree 7: Strongly agree
Flourishing Scale (FS)	Indicate your agreement with each item: 1: I lead a purposeful and meaningful life 2: My social relationships are supportive and rewarding 3: I am engaged and interested in my daily activities 4: I actively contribute to the happiness and well-being of others 5: I am competent and capable in the activities that are important to me 6: I am a good person and live a good life 7: I am optimistic about my future 8: People respect me	1: Strongly disagree 7: Strongly agree
Domain Evaluation Questionnaire (DEQ)	The following questions ask you how satisfied you feel about specific aspects in your life: 1: Standard of Living 2: Health 3: Productivity 4: Personal relationships 5: Safety 6: Community 7: Personal Security 8: Free time 9: Environment (10: Job)	0: Not at all satisfied 10: Completely satisfied

Table 8 Dependent SWB Variables Replication Study

Measure	Items	Scale Range
Happiness Core (HC)	Taking all things together, how happy would you say you are?	0: Extremely unhappy 10: Extremely happy
Life Satisfaction Core (LC)	All things considered, how satisfied are you with your life as a whole nowadays?	0: Extremely dissatisfied 10: Extremely satisfied
Scale of Positive and Negative Experience (SPANE)	How often did the interviewed person experience the following emotions in the last two weeks: 1: Negative 2: Unpleasant 3: Good 4: Bad 5: Happy 6: Afraid 7: Pleasant 8: Contended 9: Sad 10: Angry 11: Joyful 12: Positive	0: never 7: always
Satisfaction With Life Scale (SWLS)	Indicate your agreement which each item: 1: In most ways, my life is close to my ideal 2: The conditions of my life are excellent 3: I am satisfied with my life 4: So far, I have gotten the important things I want in life 5: If I could live my life over, I would change almost nothing.	1: Strongly disagree 7: Strongly agree
Flourishing Scale (FS)	Indicate your agreement with each item: 1: I lead a purposeful and meaningful life 2: My social relationships are supportive and rewarding 3: I am engaged and interested in my daily activities 4: I actively contribute to the happiness and well-being of others	1: Strongly disagree 7: Strongly agree

Table 8 (continued)

Measure	Items	Scale Range
	5: I am competent and capable in the activities that are important to me 6: I am a good person and live a good life 7: I am optimistic about my future 8: People respect me	
Domain Evaluation Questionnaire (DEQ)	The following questions ask you how satisfied you feel about specific aspects in your life: 1: Standard of Living 2: Health 3: Productivity 4: Personal relationships 5: Safety 6: Community 7: Personal Security 8: Free time 9: Environment (10: Job)	0: Not at all satisfied 10: Completely satisfied

Table 9 MAAS Items

Measure	Items	Scale Range
Mindful Attention Awareness Scale (MAAS)	Below is a collection of statements about your everyday experience. Using the 1–6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what really reflects your experience rather than what you think your experience should be. Please treat each item separately from every other item. 1: I could be experiencing some emotion and not be conscious of it until sometime later. 2: I break or spill things because of carelessness, not paying attention, or thinking of something else. 3: I find it difficult to stay focused on what's happening in the present. 4: I tend to walk quickly to get where I'm going without paying attention to what I experience along the way. 5: I tend not to notice feelings of physical tension or discomfort until they really grab my attention. 6: I forget a person's name almost as soon as I've been told it for the first time. 7: It seems I am "running on automatic," without much awareness of what I'm doing. 8: I rush through activities without being really attentive to them. 9: I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there. 10: I do jobs or tasks automatically, without being aware of what I'm doing. 11: I find myself listening to someone with one ear, doing something else at the same time. 12: I drive places on 'automatic pilot' and then wonder why I went there. 13: I find myself preoccupied with the future or the past. 14: I find myself doing things without paying attention. 15: I snack without being aware that I'm eating.	1: Almost always 6: Almost never

Table 10 Independent Variables (both studies the same)

Measure	Items	Scale Range
Big Five Personality	10-Item TIPI scale: I see myself as: Extraversion: Extraverted, enthusiastic Reserved, quiet Agreeableness: Sympathetic, warm Critical, quarrelsome Conscientiousness: Dependable, Self-disciplined Disorganised, careless Emotional Stability: Calm, emotionally stable Openness: Open to new experiences, complex Conventional, uncreative	1: Disagree strongly 7: Agree strongly
Age	How old are you?	Open answer
Gender	Are you male or female?	a: male b: female
Income	What is your approximate household income (net; after tax)? An average household monthly income is approximately €2500.	a: lower than average b: average / modal c: Above average
Chronic Condition	Do you have a chronic condition?	a: yes b: no
Chronic Condition Details	If yes, which?	Open Answer
Religion	What is your religion?	a: Atheist b: Catholic c: Protestant d: Others
Household Situation	What is your household situation?	a: Alone b: Partner c: Flat-Sharing d: Parents
Education	Highest level of education completed?	a: High-School b: Vocational Training c: Bachelor or higher
Job	Are you gainfully employed?	a: yes b: no
Immigration Status	Which country were you born in?	a: Germany b: Other
Height	How tall are you?	Open answer
Weight	How much do you weigh?	Open answer
Alcohol	How many days a week do you drink two or more glasses of alcohol?	a: rarely or never b: 1–2 days a week c: 3–4 days a week d: 5 days a week or more
Smoking	How many days a week do you smoke?	a: rarely or never b: 1–2 days a week c: 3–4 days a week d: 5 days a week or more

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