

# Happiness Raised by Raising Awareness: Effect of Happiness Using the Happiness Indicator



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# HAPPINESS RAISED BY RAISING AWARENESS

## Effect of happiness self-monitoring using the Happiness Indicator

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### ABSTRACT

*The Happiness Indicator ([www.happinessindicator.nl](http://www.happinessindicator.nl)) is an online tool designed to make people more aware of their own happiness. Participants periodically record how happy they feel on the present day and how happy they have felt over the past month, using the Happiness Comparer. They also have the option of indicating in the Happiness Diary how happy they felt during the various activities of the previous day. Participants receive feedback in the form of a comparison with their earlier scores and with the average scores of similar participants. The theory behind the website is that a keener awareness of one's own happiness helps users find an optimal lifestyle and consequently promotes happiness among participants.*

*The website has been online since January 2011; 5,411 participants have participated at least twice, and 64% of them used the Happiness Diary one or more times. These numbers are now high enough to permit an initial analysis of the effect of the use of the Happiness Indicator on the participants' happiness.*

*We find that the use of the Happiness Comparer only marginally increases happiness. The effect of using the Happiness Diary turns out to be stronger. Using the Happiness Diary 10 times results in an average increase in happiness of 2%. This 2% increase in happiness can be compared to the effects of an increase of € 600 in annual income. In addition, we find that repeated use of the Happiness Diary had a particularly strong effect for those who felt less happy when they first used the Happiness Indicator.*

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# **1 INTRODUCTION**

## **1.1 In search of greater happiness**

It is in our nature to prefer feeling happy over feeling unhappy, and currently, we are more aware of our happiness than in the past. This is partly because we have more choices and because the chances of living a happy life have increased considerably in the Western world.

Being happy is not only more pleasant than being unhappy; it also has positive side effects. Happiness makes people more productive (Oswald & Proto, 2014), social, active, and engaged (Lyubomirsky, King & Diener 2005). Therefore, happy people are generally better citizens. Happiness also makes people less susceptible to disease, and as a result, happy people live considerably longer than unhappy people (Lyubomirsky et al., 2005; Veenhoven, 2008).

Especially in the light of findings that happy people are healthier and more productive and that there is more to people's well-being than economic growth, there is increasing support for the seeking greater happiness for a greater number of people (Layard, 2006; Veenhoven, 2010; Diener et al., 2012). Accordingly, happiness has become an increasingly important goal for governments and businesses alike.

## **1.2 Methods for becoming happier**

Happiness depends in part on genetic predisposition and on circumstances that are difficult to change. However, we can control a large part of happiness. Researchers estimate that approximately 40% of our happiness depends on how we arrange our lives (Sheldon & Lyubomirsky, 2007). Therefore, many people ask themselves what would be

the best way to do this.

That question led to the development of a growing range of products, such as self-help books, training courses and life-coaching, that claim they will increase happiness. These products use different techniques, such as increasing personal insight, reducing stress and promoting positive thinking (for example, encouraging people to see a glass as half full instead of half empty). The majority of these techniques originate from psychology; in recent years, they have drawn mainly from the field of positive psychology. Other methods that aim to increase happiness draw on esoteric inspiration, such as the mindfulness movement.

At present, little is known about the effectiveness of these interventions. Limited research has examined the effects of these methods, and the few studies that do exist typically show no significant effect<sup>6</sup>. This does not necessarily mean that there is no effect at all; most of these studies' samples were too small to reveal even minor effects or to divide users into subtypes for whom the intervention does or does not work.

### **1.3 Happiness Indicator**

In collaboration with the health insurance company VGZ, a new online method has been developed at the Erasmus University Rotterdam<sup>7</sup> that aims to provide people with greater insight into their own happiness: that is, how happy they generally feel and how happy they feel during specific daily activities. It is expected that a better awareness of one's

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<sup>6</sup> World Database of Happiness (Veenhoven 2014), Findings on [Happiness and Therapy](#), T2.2 Effects

<sup>7</sup>The first version of the Happiness Indicator was developed for a study of elderly people by Ruut Veenhoven in collaboration with Lyanda Vermeulen-Kerstens and Peter Hermus. Arnold Bakker, Pierter van Haaren and Wido Oerlemans were also involved in the development of the current version. Arnold Bakker and Wido Oerlemans also developed a version specific to work situations (Oerlemans & Bakker 2013).

own happiness helps individuals find a way of life that suits them well, which subsequently leads to increased happiness.

### *Underlying theory*

The expectation that a better awareness of one's happiness makes one happier is based on several psychological insights. First, our feelings have a signaling function, and a feeling of happiness basically indicates the extent to which our way of life matches our nature (Grinde 2007). Second, memories of how happy we felt in the past are often distorted for a number of reasons; for example, sharp memories of ups and downs limit our perception of the average experience (Wilson, Gilbert & Meyers 2003). Third, such distortions are part of the reason that we are bad at predicting how our choices will affect our happiness (Gilbert 2005) and, therefore, frequently make suboptimal choices (Frey & Stutzer, 2004). Giving periodical feedback on happiness - e.g., via the Happiness Indicator - may help people gain more insight into their happiness, as a result of which they will make better choices.

### *Concept of happiness*

The Happiness Indicator addresses the feeling of happiness – in other words, how pleasant or unpleasant mood is most of the time. In the academic literature on subjective well-being, this is referred to as the 'affective component' of happiness and is distinguished from the 'cognitive component', the more rational assessment of the extent to which life brings what one wants it to bring (Veenhoven 1984: Section 2.2). Research has shown that the affective component dominates how we experience life as a whole and that the effect of happiness on health mainly takes place via the affective component

(Veenhoven 2009).

### *Tools for working on one's happiness*

The Happiness Indicator is a combination of a self-help website and a large-scale follow-up study. The website is presented as 'A tool for working on your happiness' and is available free of charge on [www.happinessindicator.nl](http://www.happinessindicator.nl)<sup>8</sup>. Participants were recruited using various channels, including different types of customer communications from the health insurer VGZ, social media (Facebook, LinkedIn, Twitter) and Dutch magazines (including 'Libelle' and 'Psychologie Magazine').

Upon visiting the website for the first time, the participants create an account and complete a profile questionnaire. They receive an e-mail every month with a link to their personal page ('My Happiness') where they complete the 'Happiness Comparer' and, if desired, the 'Happiness Diary'. At the end of each calendar year, they also specify what has changed in their lives.

#### ***1.3.1 Happiness Comparer***

The participants' first task is to answer 2 questions: first, how happy they feel that day, and next, how happy they have felt over the past month. The answers are rated using a visual analog scale faces scale, ranging from 0 (very unhappy) to 10 (very happy); see Figure 1. By asking the participants first how they feel that day, we focus the participants' attention on the affective component of happiness and prevent their rating of their happiness over the past month from being unconsciously distorted by their current mood.

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<sup>8</sup> The version in Dutch: [www.gelukswijzer.nl](http://www.gelukswijzer.nl)

**Figure 1**

Questions about how happy the participant feels

The screenshot shows the 'happiness indicator beta' logo in the top left corner. In the top right corner, there are navigation links: 'Home', 'Research', 'News', and 'My Happiness'. The main content area is titled 'Your Comparative Happiness Indicator' and includes a paragraph explaining the tool. Below this, it says 'Answer the following questions on a scale from 0 to 10.' and presents a table with two rows of questions and a scale of 11 smiley face icons (0 to 10). The first row of the table is 'How happy do you feel today?' and the second row is 'How happy did you feel over the past month?'. Each row has a radio button next to each number from 0 to 10. A 'Next' button is located at the bottom right of the form.

	0	1	2	3	4	5	6	7	8	9	10
How happy do you feel today?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How happy did you feel over the past month?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Next

After answering these two questions, the participants receive instant feedback in the following two ways:

### *Comparison with others*

The program compares the answer to these two questions with the average score of all participants and with participants with the same profile (e.g., those in same age category, with same gender and with a similar level of education). A screenshot of this feedback is shown in Figure 2. This feedback provides the participants with insight about the



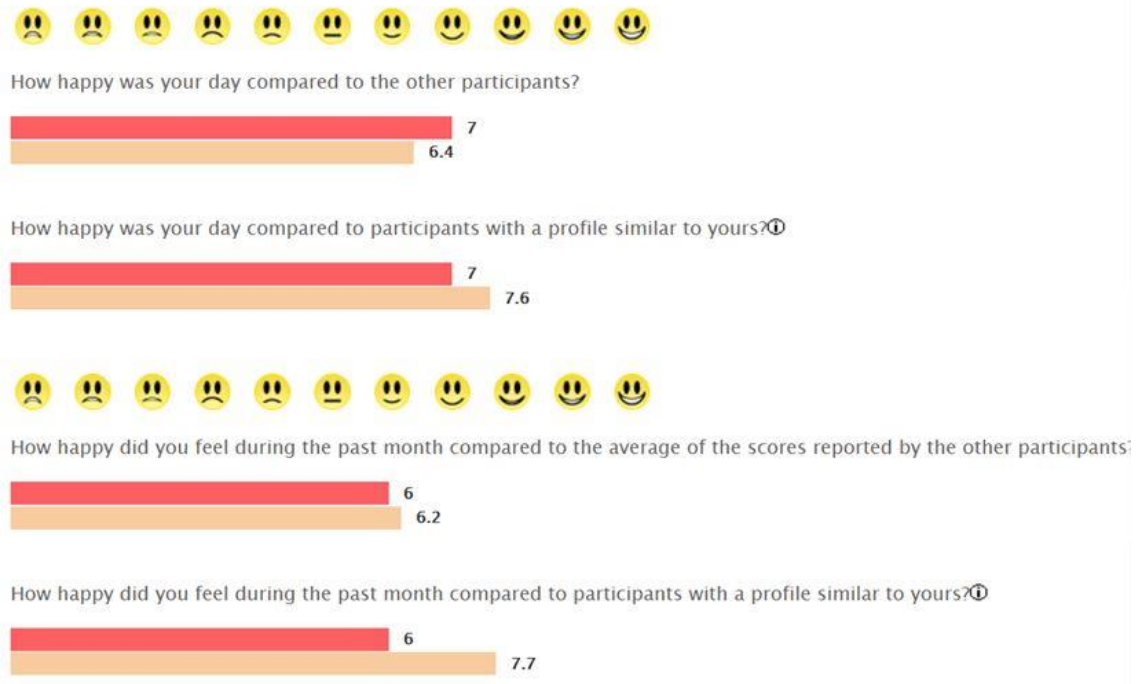
likelihood of becoming happier than they are at present.

### *Comparison over time*

If the participant has previously used the Happiness Comparer, the program generates a trend line (see Figure 3). This trend line shows participants whether they have made progress in their happiness and whether they have fared better or worse than similar participants.

**Figure 2**

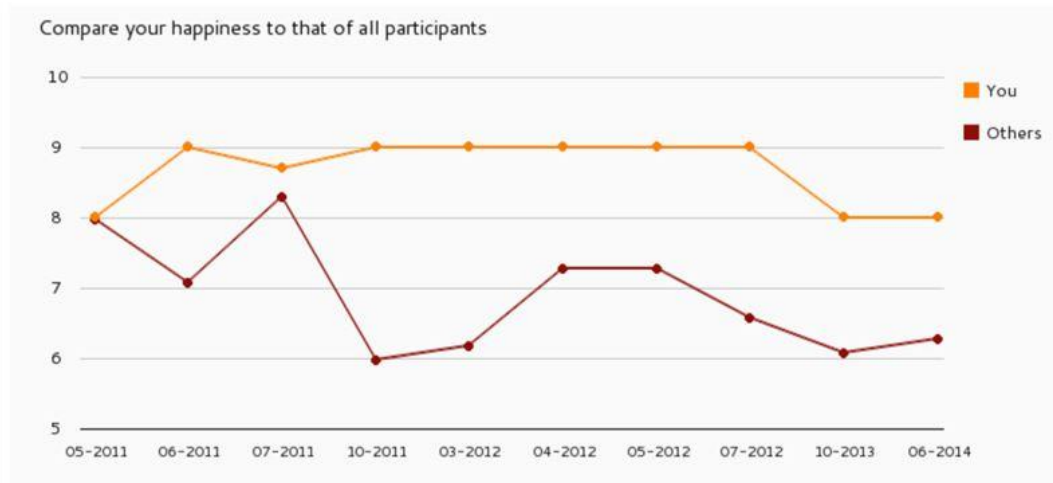
The participant's happiness compared with the happiness of other participants





**Figure 3**

Example of a comparison over time



### 1.3.2 Happiness Diary

The Happiness Diary (Figure 4) comprises an internet application of the Day Reconstruction Method (DRM) developed by Kahneman, Krueger, Schkade, Schwarz & Stone (2004).<sup>9</sup> Participants are first asked to make a list of everything they did the day before, such as eating, completing household tasks, working and resting. They also state how much time they spent on each activity, where the activity was carried out (e.g., at home or at work) and with whom (e.g., alone, with a partner, with family, or with colleagues). Happiness during the activities is indicated on a scale ranging from 0 (very unhappy) to 10 (very happy), similar to that shown in Figure 1. As Figure 5 shows, participants can use this scale to indicate how happy they felt during each activity.

<sup>9</sup> For a recent review of this method, see Diener and Tay (2014). Others studies that have applied DRM to the study of happiness include Kahneman et al. (2006), Oishi et al. (2009), Knabe et al. (2010), and Hendriks et al. (2014).

This diary also provides participants with instant feedback in the following ways:

*Feelings during each activity*

The program generates an at-a-glance overview that shows the activities during which the participant felt the least and most comfortable (see Figure 6). This overview can help participants allocate their time optimally.

*Comparison with other participants*

This part of the program also provides instant comparison with other participants with similar life situations (see Figure 6). This comparison can help when the participant is making choices, for example, when deciding whether to look for a new job. The fact that a person does not feel great at work is in itself not a reason to change jobs because most people feel one point less happy at work than at home. However, if the difference between work happiness and home happiness is greater than that of similar participants, it is most likely worthwhile to find a better job.

*Feelings throughout the total activity pattern.* The average happiness level of the day is calculated based on the time spent on each activity. This helps participants more accurately assess their own happiness level and provides information about the happiness return of their current way of life.

### ***1.3.3 Other tools to work on happiness***

The Happiness Indicator contains several more tools that aim to provide participants with more insight into their situation, such as a personality test and a diagnostic questionnaire addressing how they experience their jobs.

## **1.4 Long-term objective**

In the long run, the Happiness Indicator will also generate information on the effects of major life choices on happiness, such as the effect that starting a family or retiring early will have on happiness. Often, individuals do not know how these life choices will turn out; consequently, it is helpful to know how similar people who made a similar choice a long time ago have fared. Gathering this information requires that a large number of people continue to use the Happiness Indicator at least once a year. Of course, the willingness to do so depends on the effect of participation in the short run.

## **1.5 This report**

In this article, we give an account of the first study of the short-term effect of using the Happiness Indicator. The website has been operational since January 2011 and has attracted a sufficient number of participants to show the effect of repeated participation on monthly happiness. Is this effect positive, as we expect it to be? If so, what is the size of this effect, and does it differ across types of participants?

**Figure 4:**

Example of a completed diary

**Happiness Diary** from yesterday

*Describe what you did yesterday.*

	Time activity started	Time activity ended	Activity	Where	With whom	Subactivities
1.	7:00		Getting up	Home	My partner	
2.	7:00	7:30	Eating	Home	My partner	Breakfast   Lunch   Dinner   Snack   Other
3.	7:30	8:30	In transit	Elsewhere	Alone	By foot   By bicycle   By moped   By car   By public transport   Other
4.	8:30	12:00	Working	Work	Colleagues	Paid   Unpaid   Formal communication   Informal communication   Taking a break
5.	12:00	13:00	Eating	Work	Colleagues	Breakfast   Lunch   Dinner   Snack   Other
6.	13:00	17:00	Working	Work	Clients	Paid   Unpaid   Formal communication   Informal communication   Taking a break
7.	17:00	18:00	In transit	Elsewhere	Alone	By foot   By bicycle   By moped   By car   By public transport   Other
8.	18:00	19:00	Eating	Home	My family	Breakfast   Lunch   Dinner   Snack   Other
9.	19:00	21:00	Exercising	Elsewhere	Alone	Going for a walk   Cycling   Playing sports   Other
10.	21:00	23:00	Relaxing	Home	My partner	Hobby   Computer   Reading   Watching TV   Listening to music   Talking   Playing   Other

[Add an activity](#) [Delete last activity](#)

48.	23:00		Going to bed	Home	My partner	Showing affection   Having sex   Sleeping
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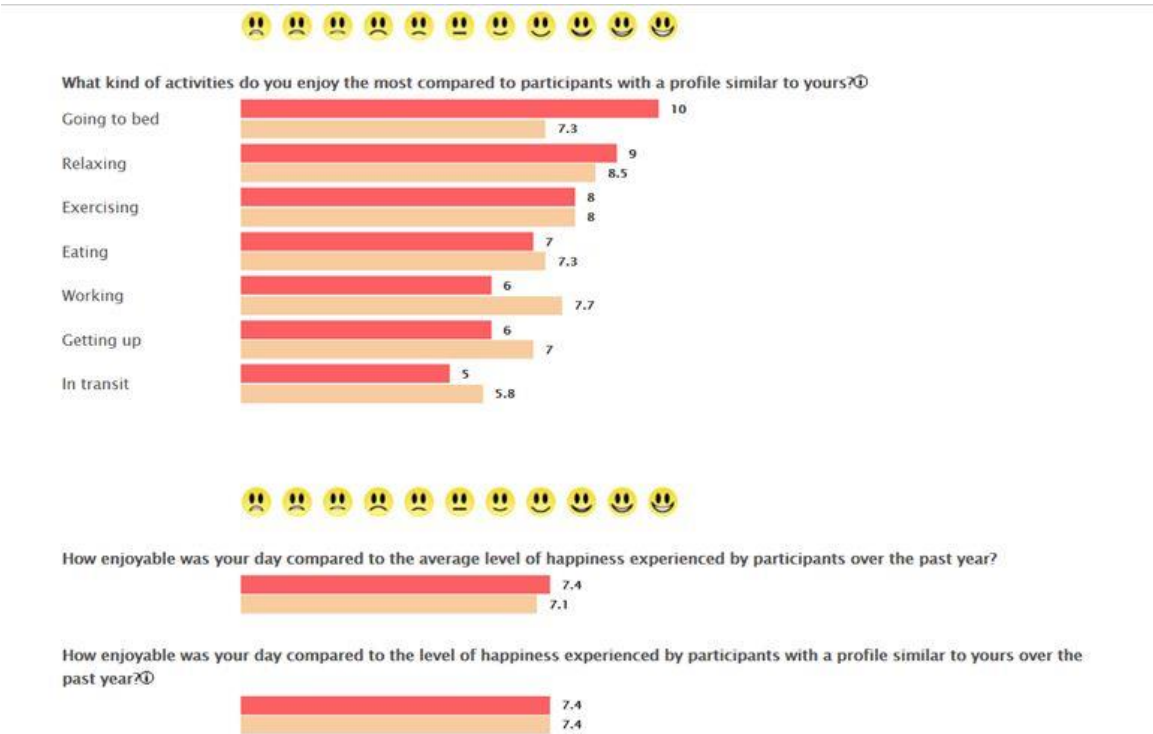
[Previous](#) [Next](#)

### Rating of how happy the participant felt during each activity

15

Figure 6

Example of a comparison of an individual's happiness profile with that of similar people





## 2 METHOD OF EFFECT STUDY

### 2.1 Participants

The Happiness Indicator has attracted 49,350 participants who completed a profile. Most of these individuals (89%) only participated once; therefore, we could not ascertain whether those users became happier as a result of using the Happiness Indicator. Consequently, we limited this study to examining the effect of Happiness Indicator use for people who participated two times or more. A total of 5,411 participants met this criterion. Those individuals used the Happiness Indicator for an average of 233 days.

#### *Frequency of participation*

The participants in our sample completed the Happiness Comparer 2 to 35 times.<sup>10</sup> Each time, they had to indicate how happy they had felt over the past month (see Section 1.3.1). In addition, over 64% of the participants completed the Happiness Diary (see Section 1.3.2) at least once. The data are presented in Tables 1 and 2. It is possible that the participants also used other tools on the website, such as the personality test or the questionnaire about how they experienced their jobs; however, the use of these tools was not taken into account in this analysis. The participants were able to freely choose whether to use in the Happiness Indicator weekly, biweekly, monthly, bimonthly, quarterly, every six months, or yearly. Figure 7 shows the distribution of the participants by frequency of participation.

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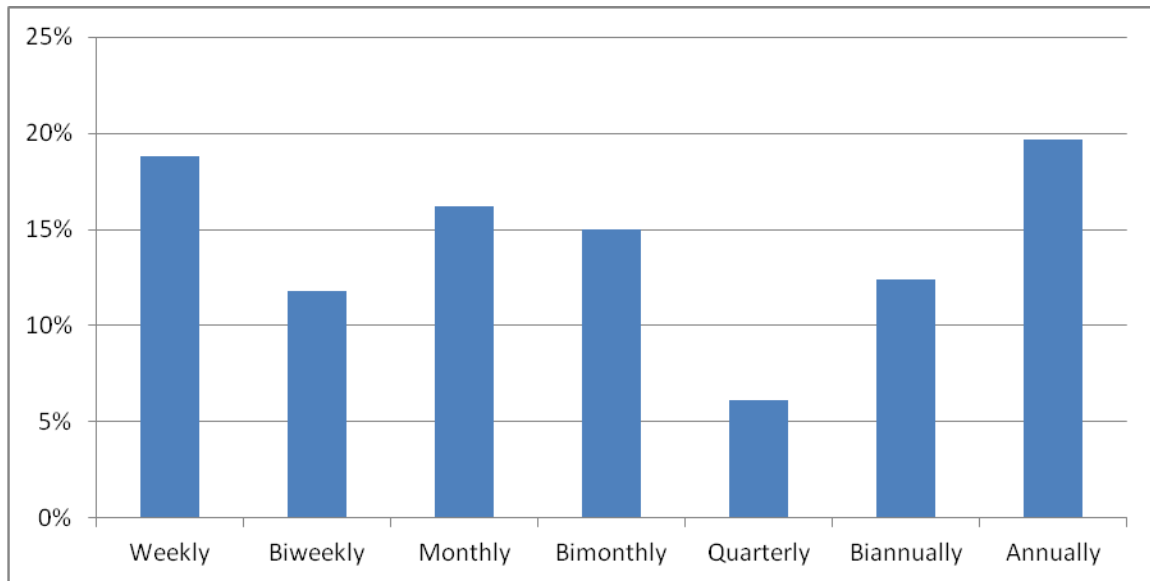
<sup>10</sup> Individuals falling within the top 1% for the number of times of participation (35 or more) were considered outliers and were excluded from our analysis.

### *Personal characteristics*

The average age of the participants was 45 years ( $SD = 14$ ), and 78% of the participants were women. Regarding employment, 68% of the participants had a job, and the participants worked an average of 4 days ( $SD = 1.26$ ) or 29 hours a week ( $SD = 11.86$ ). Over a quarter of the participants (28.9%) worked in health care institutions and welfare institutions, 13.8% worked in the business or financial sector, 13.4% worked in education, 9.5% worked for the government, 6.1% worked in retail, 4.9% worked in the cultural sector, 4.1% worked in the catering industry, 2.2% worked in the transportation sector, and 17.1% worked in other sectors. The participants' level of education varied: 34.1% of the participants had a higher vocational education (HBO), 23.0% had a university degree, 6.1% had a pre-university education (VWO), 19% had a senior secondary vocational education (MBO), 11.7% had a preparatory secondary vocational education (VMBO), 7.5% had senior general secondary education (HAVO), and 2.7% had only attended primary school. In terms of household income, 27.7% of the participants had a relatively low family income (€ 0-2499 per month), 34.8% had an average family income (€ 2500-4499 per month), and 37.5% had a relatively high family income on average (>€ 5000 per month). The participants' living situations also varied:

**Figure 7**

Frequency of Use of the Happiness Comparer



27.8% of the participants cohabited with their partner and no children, 21.3% cohabited with their partner and children, 21.9% were single with no children, 18.4% were single with children, and 10.6% had some other living situation (e.g., a communal group or student group housing).

## 2.2 Responses

### *Use of and Scores on the Happiness Comparer*

The average number of times the Happiness Comparer was used was 3.53 (SD = 3.62), with a range from 2 to 36 times. The average number of Happiness Diary entries was

2.13 (SD = 4.15). The participants reported an average monthly happiness of 6.37 (SD = 1.57) and an average daily happiness of 6.70 (SD = 1.36).

#### *Outcome variable for this effect study*

In this study, we focused on the feeling of happiness in the past month, as measured with the second question shown in Figure 1. The research question was whether happiness in the past month increases with the repeated use of the Happiness Comparer and the Happiness Diary.

### **2.3 Analysis**

To test the effect of the Happiness Comparer and Happiness Diary, a simple reduced-form happiness model was estimated (see also Di Tella, MacCulloch & Oswald 2003; Arampatzi, Burger & Veenhoven 2015):

$$H_{it} = \alpha_0 + \alpha_1 H_{i(t-1)} + \alpha_2 P_{i(t-1)} + \alpha_3 X_{i(t)} + \mu_i + \varphi_t + \varepsilon_{it},$$

where  $H$  is the self-reported happiness over the past month at participation time  $t$ ;  $P$  is a set of variables capturing the number of times the participant has used the Happiness Comparer and the Happiness Diary<sup>11</sup>;  $X$  is a set of control variables capturing happiness that day, the number of days the participant has already used the Happiness Indicator, and the number of days since the last use;  $\mu_i$  is a vector of participant fixed effects to control for time-invariant participant characteristics, such as gender, marital status, income, and

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<sup>11</sup> Please note that our Happiness Diary variable is Winsorized at the 1% level.

level of education; and  $\varphi_t$  is a vector of month and year dummies to capture time-related circumstances, such as the weather and the economic situation. The lagged dependent variable  $H_{i(t-1)}$  is included to allow for adjustment dynamics and to tackle serial correlation and potential omitted variable bias.

We acknowledge that there is interdependence between the Happiness Comparer use and Happiness Diary use variables. To measure how large these influences might be, three versions of the model were estimated: version (i) only includes the use of the Happiness Comparer variable; version (ii) only includes the use of the Happiness Diary variable; and version (iii) includes both variables. We prefer the third specification because it allows us to capture the “direct” impacts of the Happiness Diary and Happiness Diary use variables on happiness.

### **3 EMPIRICAL RESULTS**

#### **3.1 Happiness is changeable**

First, we examined whether individual happiness fluctuates over time. This did indeed turn out to be the case. Approximately 36% of the differences in monthly happiness can be attributed to within-individual variation. The other 64% of differences in monthly happiness can be explained by differences between individuals. These results are at odds with the ‘set-point’ theory of happiness (Cummins 2010), which holds that happiness is a rather stable property that is not easily changed.

#### **3.2 Happiness increases following repeated use of the Happiness Indicator**

Subsequently, we considered whether individuals experienced an increase in monthly happiness following the use of the Happiness Indicator. All models were estimated using fixed-effects estimators and cluster robust standard errors. The results of our regressions are shown in Table 1. Of the control variables included in the model (Table 1, Column 1), only happiness that day was statistically significant ( $b = 0.314$ ,  $SE = 0.016$ ,  $p < 0.01$ ). Surprisingly, we did not find an effect of happiness in the previous time period on happiness that day. However, it should be noted that this effect might be confounded by the individual fixed effects and the Nickell bias induced by fixed-effects estimation. This is further explored below.

### *3.2.1 Marginal effect of the Happiness Comparer*

First, we examined whether there was an increase in monthly happiness over time as a result of repeated use of the Happiness Comparer. We observed a marginal positive effect that did not reach statistical significance ( $b = 0.008$ ,  $SE = 0.005$ ,  $p = 0.113$ ; Table 1, Column 2).

### *3.2.2 Significant effect of the Happiness Diary*

We did find a significant effect of use of the Happiness Diary ( $b = 0.013$ ,  $SE = 0.005$ ,  $p < 0.01$ ; Table 1, Column 3), even when controlling for use of the Happiness Comparer ( $b = 0.014$ ,  $SE = 0.007$ ,  $p < 0.05$ ; Table 1, Column 4).

How strong is this effect? Using the Happiness Diary ten times increased monthly happiness by approximately 0.14 points on a 0 to 10 scale when all other factors were held constant. However, less than 4% of the respondents completed the diary 10 times or more, and the average use was only 2.4 times.

The Happiness Comparer and Happiness Diary cannot be considered substitutes for one another in terms of their contribution to well-being. The participants who only used the Happiness Comparer and not the Happiness Diary did not profit more from the Happiness Comparer than the participants who used both tools (Table 1, Column 5).

**Table 1:** Determinants of Happiness Last Month – Fixed Effects Estimation

	(1) Only Control Variables	(2) + Happiness Indicator	(3) + Happiness Diary	(4) Full Specifi- cation	(5) Indicator Effect for People with No Diary Use
Times Happiness Comparer Used <sub>t-1</sub>		0.008 (0.005)		-0.001 (0.007)	0.001 (0.008)
Times Happiness Comparer Used <sub>t-1</sub> x No Diary Used					-0.010 (0.012)
Times Happiness Diary Used <sub>t-1</sub>			0.013*** (0.005)	0.014** (0.007)	0.012* (0.007)
Happiness Last Month <sub>t-1</sub>	0.024 (0.020)	0.023 (0.020)	0.022 (0.019)	0.022 (0.020)	0.022 (0.020)
Days Using Happiness Indicator (x100)	0.156 (0.146)	0.126 (0.149)	0.119 (0.148)	0.121 (0.150)	0.123 (0.149)
Days Since Last Use (x100)	-0.020 (0.014)	-0.012 (0.015)	-0.012 (0.015)	-0.013 (0.015)	-0.014 (0.015)
Happiness Today	0.314*** (0.016)	0.314*** (0.016)	0.314*** (0.016)	0.314*** (0.016)	0.314*** (0.016)
Respondent FE	Yes	Yes	Yes	Yes	Yes
Month-Year FE	Yes	Yes	Yes	Yes	Yes
Observations	13320	13320	13320	13320	13320
Number of Respondents	5411	5411	5411	5411	5411
Within R-Square	0.15	0.15	0.15	0.15	0.15
Between R-Square	0.26	0.29	0.30	0.29	0.29
Overall R-Square	0.27	0.29	0.30	0.29	0.29

Cluster-robust standard errors in parentheses \*\*\*p<0.01, \*\* p<0.05, \* p<0.10.

At the same time, we found decreasing marginal benefits of using the Happiness Comparer and Happiness Diary. In other words, the effect of repeated participation on monthly happiness decreases slightly with increasing use of the Happiness Comparer and the Happiness Diary. These so-called interaction effects are shown in Table 2. When participants first begin to use the Happiness Indicator, 1 additional use of the Happiness Comparer increases happiness last month by 0.025; however, after using the Happiness Comparer 20 times, the marginal benefits of use become negligible (Table 2, Column 1).



Given that most of the participants only used the Happiness Comparer a few times, it can be tentatively concluded that happiness increases for participants who repeatedly use the Happiness Comparer, but typically by less than 1%. A similar observation can be made regarding the Happiness Diary (Table 2, Column 2), although the squared term becomes insignificant when the squared terms of both the Happiness Comparer and Happiness Diary variables are entered into our model (Table 2, Column 3).

**Table 2:** Determinants of Happiness Last Month – Fixed Effects Estimation – Squared Terms

	(1) Squared Term Happiness Comparer	(2) Squared Term Happiness Diary	(3) Full Specification
Times Happiness Comparer Used <sub>t-1</sub>	0.026** (0.012)	0.000 (0.007)	0.021* (0.013)
Times Happiness Comparer Used <sub>t-1</sub> Squared	-0.001*** (0.000)		-0.001*** (0.000)
Times Happiness Diary Used <sub>t-1</sub>	0.011* (0.006)	0.033*** (0.011)	0.020 (0.013)
Times Happiness Diary Used <sub>t-1</sub> Squared		-0.001** (0.000)	-0.000 (0.000)
Happiness Last Month <sub>t-1</sub>	0.019 (0.019)	0.020 (0.019)	0.019 (0.019)
Days Using Happiness Indicator (x100)	0.101 (0.149)	0.108 (0.149)	0.100 (0.149)
Days Since Last Use (x100)	-0.009 (0.015)	-0.010 (0.015)	-0.008 (0.015)
Happiness Today	0.313*** (0.016)	0.314*** (0.016)	0.313*** (0.016)
Respondent FE	Yes	Yes	Yes
Month-Year FE	Yes	Yes	Yes
Observations	13320	13320	13320
Number of Respondents	5411	5411	5411
AR-2 (p-value)	0.15	0.15	0.15
Sargan test (p-value)	0.31	0.30	0.31
Difference-in-Sargan (p-value)	0.30	0.30	0.30

Cluster-robust standard errors in parentheses \*\*\*p<0.01, \*\* p<0.05, \* p<0.10.

### 3.2.3 *Nickell bias and reverse causality*

One potential problem with the fixed-effects estimation presented above is that the presence of a lagged endogenous variable in the model induces autocorrelation. Nickell (1981) has indicated that in this context, fixed-effects estimates tend to be downward biased, and the use of this technique typically results in an underestimation of the coefficient of the lagged dependent variable. If the other independent variables in the model are correlated with the lagged dependent variable, their coefficients may also be biased. The so-called Nickell bias is particularly pertinent when the time dimension of the panel is short and the number of individuals is large. Given that our sample is generally characterized by a large  $N$  (many individuals), a small  $T$  (limited number of time points), and a very small coefficient for our lagged dependent variable, the results described in the previous section might be biased. The system generalized method of moments (GMM) developed by Arellano and Bover (1995) and Blundell and Bond (1998) addresses the issue by instrumenting the variables in the regressions with their lagged levels and lagged first differences.<sup>12</sup>

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<sup>12</sup> Another solution would be the estimation of the model using the first-differenced generalized method of moments (difference GMM), a technique developed by Arellano and Bond (1991). However, Bond et al. (2001) note that in many empirical applications, the performance of difference GMM is disappointing, and the estimates of difference GMM are often implausible because the lagged levels are often poor instruments for first differences. Hence, this technique was not used in this study.

**Table 3:** Determinants of Happiness Last Month – System GMM Estimation

	(1) Baseline Specification	(2) Squared Term Happiness Comparer	(3) Squared Term Happiness Diary	(4) Full Specification
Times Happiness Comparer Used $t_{-1}$	0.002 (0.006)	0.001 (0.006)	0.004 (0.005)	0.003 (0.005)
Times Happiness Comparer Used $t_{-1}$ Squared		-0.000 (0.000)		-0.000 (0.000)
Times Happiness Diary Used $t_{-1}$	0.015** (0.007)	0.015** (0.007)	0.017*** (0.006)	0.015** (0.006)
Times Happiness Diary Used $t_{-1}$ Squared			-0.001* (0.000)	-0.000 (0.000)
Happiness Last Month $t_{-1}$	0.140*** (0.024)	0.138*** (0.024)	0.142*** (0.024)	0.142*** (0.024)
Days Using Happiness Indicator (x100)	0.029 (0.022)	0.024 (0.023)	0.005 (0.023)	0.009 (0.023)
Days Since Last Use (x100)	-0.023 (0.020)	-0.017 (0.021)	-0.019 (0.020)	-0.016 (0.021)
Happiness Today	0.454*** (0.048)	0.444*** (0.048)	0.440*** (0.046)	0.437*** (0.047)
Respondent FE	Yes	Yes	Yes	Yes
Month-Year FE	Yes	Yes	Yes	Yes
Observations	13320	13320	13320	13320
Number of Respondents	5411	5411	5411	5411
AR(2) test (p-value)	0.07	0.07	0.06	0.06
Sargan test (p-value)	0.54	0.52	0.88	0.87
Difference-in-Sargan test (p-value)	1.00	1.00	1.00	1.00

Cluster-robust standard errors in parentheses \*\*\*p<0.01, \*\* p<0.05, \* p<0.10.

In addition, system GMM estimation has two additional advantages. First, by using the lagged levels and lagged first differences of the variables as internally generated instruments, system GMM addresses the issue of reverse causality, in which happy individuals might be more or less likely to use the Happiness Indicator. Second, the time-invariant individual characteristics in the fixed-effects estimation can be correlated with the other independent variables. GMM models address this problem by using a first-difference estimation.

Table 4 shows the results of our system GMM estimation<sup>13</sup> for the baseline specifications in Table 1 and 2. System GMM use did not lead to any different conclusions regarding the effect of repeated Happiness Comparer and Happiness Diary use on happiness.<sup>14</sup> At the same time, two differences regarding our fixed-effects estimations stand out. First, our fixed-effects estimation was indeed subject to Nickell bias in that the coefficient of the lagged endogenous variable became positive and significant. Second, the size of the main effect for Happiness Comparer use became much smaller, and we did not find evidence of decreasing marginal returns for the use of the Happiness Comparer. Hence, we concluded that only the Happiness Diary adds substantially to happiness

Finally, we examined the issue of reverse causality using propensity score matching methods (Rosenbaum and Rubin, 1983; Caliendo and Kopeinig, 2008). This method also addresses the problem of not knowing what would have happened to the monthly happiness of frequent users if they had not decided to use the Happiness Comparer and/or Happiness Diary more frequently. Propensity score matching provides a way to reduce this selection bias by comparing the change in happiness between the first and last use of the Happiness Indicator of frequent Happiness Indicator users and infrequent users who are as similar as possible in all other respects (Becker and Ichino, 2002). After we applied propensity score matching using the kernel method and matching on several personal characteristics<sup>15</sup> within our data, our main conclusions did not

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<sup>13</sup> In this estimation, we also allowed the independent variables to be endogenous.

<sup>14</sup> Please note that system GMM assumes that the internally generated instruments are exogenous (tested with the Sargan test) and that the error term was not serially correlated (tested with the AR2 test). In addition, there should be no correlation between the unobserved individual fixed effects and the instruments, a factor that can be tested with the difference-in-Sargan test. The test statistics, provided in Table 3, show that there were no problems.

<sup>15</sup> These characteristics included gender, age, marital status, financial situation, job security, education level, having a chronic disease, happiness at first use, and timing between uses. The models were estimated

change: more frequent users of the Happiness Diary showed a larger increase in happiness compared with infrequent users, whereas frequent use of the Happiness Comparer did not affect the participants' well-being.

### **3.3 Effect is larger among those who initially were the least happy**

Further analysis of the use of the Happiness Diary indicates that the effect was larger for the participants who were less happy at the first use of the Happiness Indicator. This analysis is shown in Table 4. The participants who were initially the happiest profited less from participation compared with the participants who were initially the least happy. Using the Happiness Comparer or the Happiness Diary 10 times resulted in a 0.3-point increase the happiness of the people who scored 4 on their first use, whereas on average, no effect was found for people who were relatively happy (7 or higher) at the start. Nevertheless, the coefficient of the interaction effect between the number of times the Happiness Diary was used and happiness at first use became insignificant when both interaction effects were entered into our model. Here, it should be noted that the zero-order correlations between happiness at the start and the number of times that the Happiness Comparer and Happiness Diary were used were very low (0.02). These results were confirmed when the models were re-estimated using system GMM.

### **3.3 No differences in effect across participant types**

In the last step, we examined whether the increase in monthly happiness with repeated participation differed according to participant background (with respect to differences in

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using the `psmatch2` command in Stata (Leuven and Sianesi, 2003). For the sake of brevity, these results are not presented here, but are available upon request from the authors.

age, gender, income level, and education level). However, we found no evidence of heterogeneity in the effect of the Happiness Comparer or Happiness Diary across groups.

**Table 4:** Determinants of Happiness Last Month – Fixed Effects and System GMM Estimation - Effect for Unhappy vs. Happy People at Start. Fixed

	Fixed Effects			System GMM		
	(1)	(2)	(3)	(1)	(2)	(3)
	Interaction Term Happiness Comparer	Interaction Term Happiness Diary	Full Specification	Interaction Term Happiness Comparer	Interaction Term Happiness Diary	Full Specification
Times Happiness Comparer Used $t_{-1}$	0.099*** (0.022)	0.000 (0.007)	0.090*** (0.031)	0.068*** (0.010)	0.004 (0.004)	0.081*** (0.020)
Times Happiness Comparer Used $t_{-1}$ * Happiness Last Month at Start	-0.016*** (0.003)		-0.014*** (0.005)	-0.010*** (0.001)		-0.013*** (0.002)
Times Happiness Diary Used $t_{-1}$	0.016** (0.007)	0.096*** (0.019)	0.028 (0.028)	0.013** (0.005)	0.063*** (0.011)	0.001 (0.028)
Times Happiness Diary Used $t_{-1}$ * Happiness Last Month at Start		-0.013*** (0.003)	-0.002 (0.004)		-0.009*** (0.002)	-0.002 (0.003)
Happiness Last Month $t_{-1}$	0.001 (0.019)	0.008 (0.019)	0.001 (0.019)	0.180*** (0.022)	0.209*** (0.022)	0.190 (0.022)
Days Using Happiness Ind.(x100)	0.141 (0.150)	0.135 (0.151)	0.142 (0.150)	0.003 (0.021)	0.007 (0.020)	0.004 (0.020)
Days Since Last Use (x100)	-0.013 (0.014)	-0.014 (0.014)	-0.013 (0.014)	-0.009 (0.020)	-0.006 (0.020)	-0.012 (0.020)
Happiness Today	0.310*** (0.016)	0.311*** (0.016)	0.310*** (0.016)	0.712*** (0.048)	0.692*** (0.044)	0.675*** (0.046)
Respondent FE	Yes	Yes	Yes	Yes	Yes	Yes
Month-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13320	13320	13320	13320	13320	13320
Number of Respondents	5411	5411	5411	5411	5411	5411
Within R-Square	0.16	0.15	0.16			
Between R-Square	0.19	0.23	0.19			
Overall R-Square	0.18	0.22	0.18			
AR(2) test (p-value)				0.12	0.06	0.08
Sargan test (p-value)				0.24	0.05	0.09
Difference Sargan test (p-value)				1.00	1.00	1.00

Cluster-robust standard errors in parentheses \*\*\*p<0.01, \*\* p<0.05, \* p<0.10.

## 4 DISCUSSION

This first exploration confirmed our expectation that increased awareness of one's own happiness contributes to the likelihood of finding a more satisfying way of life. The findings give rise to the following questions:

### 4.1 Causal effect?

Happiness Indicator participants are probably occupied with their own happiness to an above-average degree, and this may even apply more to the most frequent users. Would these people have become happier without using the Happiness Indicator? We are, after all, familiar with the 'waiting room effect' described in psychotherapy<sup>16</sup>.

It is possible that this population would have experienced increased happiness regardless of their use of the Happiness Indicator; however, it is not probable. It was with good reason that these people made the effort to complete the diary several times. They were probably having difficulty finding a more satisfying lifestyle on their own; furthermore, psychotherapy indicates that there are greater 'waiting room effects' at stake than mere reorientation. This reverse causality and selection problem was addressed in this paper using system GMM and propensity score matching (cf. section 3.2.3). The most conventional solution in survey research would be to instrument the Happiness Indicator use, but unfortunately finding credible instruments is hard.<sup>17</sup> Future research can have a more experimental setup, where participants are randomly assigned to a

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<sup>16</sup> Waiting for treatment often appears to be conducive to spontaneous healing.

<sup>17</sup> For this reason, some scholars might argue that the results should be interpreted as conditional associations, rather than causal relationships.

condition, where some will use the Happiness Indicator frequently and others infrequently. At the same time, further research is needed to examine the effect of motivation to use the Happiness Indicator and the Happiness Diary in particular. It would be an interesting experiment to pay people who are not very concerned about their way of life to participate for a year.

It is also conceivable that repeated participation led the participants to score themselves higher on the happiness scale even though their happiness remained unchanged. In the literature, this is known as a ‘response shift’. However, no response shift seems to have occurred here. Previous follow-up research into happiness showed a reverse pattern, and happiness was estimated to be lower at the second measurement, apparently because respondents had formed a clearer picture of it (Van Landingham 2012).

## **4.2 Causal path**

As noted in Section 1.3, we assume that a clearer view of their own happiness helps individuals find a more suitable lifestyle, which subsequently results in increased happiness. Previous diary research, for example, shows that the momentary experience of happiness during activities benefits daily vitality and recovery (Oerlemans et al., 2014). In this analysis, we cannot show that the observed effect did indeed follow the path of daily lifestyle adjustment. Further analysis of shifts in time allocation can provide more insight into this effect.

It is possible that other causal mechanisms are involved, such as greater acceptance of the current way of life by participants who see that they are better off than people in similar situations.



### **4.3 Variation in effect**

In section 3.3, we reported that the effect of participation does not differ greatly according to socio-demographic background. However, this does not mean that the effect is the same for everyone. It is possible that the effect differs according to psychological characteristics, such as personality. For example, previous diary research shows that (a) extraverted participants become (even) happier on a daily basis when they spend time on social and rewarding activities (Oerlemans & Bakker, 2014); (b) participants who score high on burnout become happier daily as a result of social activities and relaxation (Oerlemans, Bakker & Demerouti 2014), and (c) participants who score high on work addiction become more vital daily and recover better when they exercise (Bakker, Demerouti, Oerlemans & Sonnentag 2014).

In this context, consideration should also be given to possible variation in the effects of repeated participation on the increase in monthly happiness, depending on personality. First analyses show that relatively unhappy participants (participants with an average score below 7) benefit more from repeated participation in the Happiness Indicator compared with participants with a relatively high score for monthly happiness (participants that a 7 or higher). This finding requires further research.

### **4.4 Effect size**

The observed increase in happiness that resulted from using the Diary ranged between 0.1 and 0.3 points on a scale of 0-10, i.e., approximately 1,5%. Is this a lot or a little?

One way to answer this question is to calculate how much additional income is

required to achieve the same happiness benefit. The use of a new method developed by Fujiwara, Kundra & Dolan (2014) indicates that a 1% increase in happiness equals an increase in annual income of € 297<sup>18</sup>, so the 2% gain in happiness due to repeated use of the Happiness Diary is equivalent to an annual income increase of about € 600.

Further comparisons with effects of real-life changes on happiness are presented in Figure 8. Although the effect of using the Happiness Diary can be considered modest compared with these real-life changes, it is a relatively easy road to take in the pursuit of happiness.

## Figure 8

Effects of the Happiness Indicator and specific life events on happiness, measured using a 0-10 scale

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+ 0.5	getting married <sup>19</sup>
+ 0.4	having first child <sup>20</sup>
+ 0.14	<b>frequent use of the Happiness Diary<sup>21</sup></b>
+ 0.05	winning the lottery <sup>22</sup> , <b>occasional use of the Happiness Diary<sup>23</sup></b>
- 0.2	injured in a traffic accident <sup>24</sup>

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<sup>18</sup>The effect of extra income on happiness was assessed on the basis of a study of lottery winners in the UK, where a comparison was made between the increase in happiness of winners of small and medium-sized prizes. This calculation assumed the average income in the Netherlands.

<sup>19</sup> One year before vs. one year after. Stutzer & Frey (2006)

<sup>20</sup> One year before vs. one year after. Stutzer & Frey (2006)

<sup>21</sup> This study.

<sup>22</sup> Winning vs. non-winning players. Kuhn, Kooreman & Soetevent (2011)

<sup>23</sup> This study

<sup>24</sup> Victim in last 2 years vs. the average population. Brorsson, Hays & Ifver. (1993)

- 0.8		becoming unemployed <sup>25</sup>
- 1.23		becoming widowed <sup>26</sup>

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#### 4.5 Effect on health?

As mentioned in Section 1.1, happiness makes people less susceptible to disease, and consequently, happy people live considerably longer (Veenhoven, 2008). Therefore, health may benefit from gains in happiness, which is one reason why the health insurer VGZ supports this project. Now that we have found that use of the Happiness Indicator does indeed make participants happier, the question arises regarding to how this can be translated into health benefits.

It is not possible to answer this question using the data of this study because information on the participants' health is limited and because the health effects of happiness only become visible in the long run. However, we can make an educated guess on the basis of earlier research into the relationship between happiness and health.

A 12-year follow-up study of married couples in the USA (Hawkins & Booth 2005) showed a more profound effect of happiness at an earlier age on health at a later age ( $r = +0.37$ ) than of health at an earlier age on happiness at a later age ( $r = +0.13$ ). From this, we may conclude that the independent effect of happiness on health was approximately  $+0.24$ . This suggests that approximately one-quarter of the increase in

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<sup>25</sup> Lost full-time job in last 10 years vs. continuously fully employed. Gerlach & Stephan (1996)

<sup>26</sup> Lost spouse in the last 5 year vs. continuously married. Nock (1981)

happiness translates into health benefit. The 2% minimum increase in happiness thus produces a health benefit of 0.5%, and the 10% maximum increase in happiness produces a health benefit of 2.5%. On the surface, this health benefit may seem small, but it is substantial when one compares it with the yields of current health promotion activities, such as encouraging people to drink less and exercise more.

Further research will reveal whether this provisional estimate holds. Such conclusions can only be drawn by analyzing large-scale panel studies that track both happiness and health, such as the German Social Economics Panel and the British Household Panel Survey.

#### **4.6 Implications for further application of the Happiness Indicator**

The Happiness Indicator encompasses two main tools: The Happiness Comparer and the Happiness Diary (cf. Section 1.3). The analysis has shown that the use of the Happiness Comparer has little or no effect on happiness, but the use of the Happiness Diary does increase happiness. Should we therefore omit the Happiness Comparer? It is possible that doing so would not harm the short-term aim of the project (namely, increasing the participants' happiness). However, eliminating the Happiness Comparer would interfere with the project's long-term aim of monitoring the effects of major life choices on happiness. Although it may not substantially contribute to the participants' happiness, the Happiness Comparer is still a useful tool for follow-up. It may also function as a stepping stone to the use of the Happiness Diary.

## **5 CONCLUSION**

This first study into the effect of Happiness Indicator participation confirms the expectation that participation has a positive effect on happiness. Repeated participation leads to a steady increase in happiness, especially when the Happiness Diary is used repeatedly. The effect of this intervention is positive but modest.

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