

**Experimental Research in the Field of Subjective Well-being:
Challenges and Potential Solutions**

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Abstract

Over the past years, there has been a surge in research on subjective well-being. Most of this research relies on correlational methods. As correlational research has important limitations, the field of subjective well-being is in need for more experimental approaches. While longitudinal experimental studies provide maximum ecological validity, field and (especially) lab experiments provide more experimental control. However, investigating subjective well-being experimentally poses several challenges. First, the question arises whether happiness and satisfaction can be measured in brief experiments. Second, experiments may undermine people's basic need for autonomy. Third, the conclusions of experiments on subjective well-being may not always extend beyond the experimental context. We discuss potential solutions for these challenges, accompanied by a few examples of successful experiments that may inspire future experimental research in the field of subjective well-being.

Keywords: subjective well-being, happiness, life satisfaction, mood, experimental design, autonomy, ecological validity

Introduction

Most of us desire to be happy (Diener, 2000). Being happy does not only feel good, it is also associated with a wide variety of positive by-products at both the individual and societal level. Happy individuals are healthier, have more satisfying social lives, are more likely to get married, perform better at work, and behave more prosocially (for an overview, see Lyubomirsky, King, & Diener, 2005). While most research in the field of subjective well-being is correlational, there is growing evidence that happiness and satisfaction are not only the consequence of positive events and circumstances, but also the cause (Diener, 2012; Lyubomirsky, King, & Diener, 2005). As such, it is highly important to investigate the factors that are related to increased and decreased subjective well-being.

Veenhoven (2015) ‘guesstimated’ that in developed countries, 25 percent of one’s happiness level depends on the ‘livability of the environment’ (socio-economic position: 5 percent, social ties: 5 percent, life-events: 15 percent), and 55 percent on the so-called ‘life-ability of individuals’ (genetic factors: 30 percent, acquired skills: 15 percent, choices in life: 10 percent), with 20 percent unexplained variance. A different estimation was made by Lyubomirsky, Sheldon, and Schkade (2005), who stated that 10 percent of one’s happiness level depends on circumstances (e.g. education and income), 50 percent on genetic factors, and 40 percent on self-chosen activities. It may be noted that these are estimates across people, and not within individuals (i.e. the percentages may differ from person to person). Although estimates vary and are highly debated, most researchers seem to agree that self-chosen activities influence one’s subjective well-being substantially. While changing people’s circumstances is very difficult and changing genetic factors is virtually impossible, it is possible to influence people’s activities to some extent. From an intervention perspective, the latter observation is crucial.

Research in the field of subjective well-being

Researchers who aim to investigate which activities and thoughts are related to increased and decreased subjective well-being have various methods at their disposal. In cross-sectional research, people's subjective well-being is measured at a single point in time and correlated with people's (degree of) participation in one or more activities of interest. In experience sampling and diary studies, people's happiness/satisfaction and activities are tracked over a longer period of time and correlated with each other. In longitudinal experimental and intervention studies, an activity is manipulated over a longer period of time and potential changes in people's subjective well-being are measured (compared to a control condition). In lab and field experiments, an activity is manipulated for a relatively brief period of time and potential effects on people's happiness and/or satisfaction are measured (compared to a control condition). A simple Web of Science search showed that from 2013 till 2017, there were 640 cross-sectional studies on subjective well-being, 50 experience sampling and diary studies, 30 longitudinal experimental and intervention studies, and 5 lab or field experiments.^{1 2} As this Web of Science search suggests, research in the field of subjective well-being is mostly correlational.

Naturally, correlational research can reveal interesting relations between various activities and people's subjective well-being. However, there are some important limitations to correlational studies. First and most obvious, the causal direction between variables is

¹ We did a Topics search (title, abstract, keywords) in the Web of Science Core collection (English articles only). In order to search for cross-sectional studies, the following search terms were used: *Subjective well-being* AND (*cross-sectional* OR *survey*) NOT *diary* NOT *experience sampling* NOT *experiment* NOT *longitudinal* NOT *intervention* NOT *condition* NOT *assign*. In order to search for experience sampling and diary studies, the following search terms were used: *Subjective well-being* AND (*diary* OR *experience sampling*) NOT *experiment* NOT *intervention* NOT *condition* NOT *assign*. In order to search for longitudinal experimental and intervention studies, the following search terms were used: *Subjective well-being* AND *longitudinal* AND (*experiment* OR *intervention*) NOT *cross-sectional* NOT *survey*. In order to search for lab and field experiments, the following search terms were used: *Subjective well-being* AND (*lab experiment* OR *field experiment*) NOT *cross-sectional* NOT *survey* NOT *longitudinal* NOT *intervention*.

² When searching for 'happiness' instead of 'subjective well-being', this led to similar results: 984 cross-sectional studies, 86 experience sampling and diary studies, 50 longitudinal experimental and intervention studies, and 22 lab or field experiments.

uncertain. For example, if one finds a positive relation between physical activity and happiness, it is unclear whether physical activity leads to happiness, whether happy people engage in more physical activity, or both. Second, there may be another variable (for example one's genetic make-up) that results in both physical activity and happiness. Third, correlational studies tend to have more confounds compared to experimental studies. For instance, physical activity may be related to happiness because physical activities are often also social activities. These limitations are problematic from both a theoretical and a practical point of view.

In view of the shortcomings of correlational research, the field of subjective well-being is in need for more experimental research (also see Diener, 2012). However, investigating happiness and satisfaction experimentally poses several challenges. Based on two examples of successful happiness experiments, we first discuss which types of subjective well-being research seem to work well in an experimental setting. Based on examples from our own lab³, we subsequently elaborate on three challenges one may encounter when carrying out experimental research on subjective well-being. Following this, we discuss potential solutions to these challenges. The present article is concerned with brief lab and field experiments. While longitudinal studies have the benefit of maximum ecological validity, field and (especially) lab experiments provide a greater degree of experimental control.⁴

What subjective well-being research works well in an experimental setting?

A search for successful experiments on subjective well-being suggests that two types of activity manipulations work well. First, manipulations that are directly aimed at enhancing positive affect seem to be suitable for an experimental setting. For example, practicing

³ It may be noted that we tried to find examples from other labs as well. However, no examples from other labs were found in the literature. This may partly be the case because null-findings and inconsistent results are less likely to get published.

⁴ The present article is focused on experimental research on the relation between activities/thoughts and subjective well-being. It is also possible to manipulate environmental factors (e.g. light exposure, income) in a lab or field experiment. Some of the challenges discussed in this article may be less applicable to the manipulation of environmental factors.

optimism has been related to subjective well-being in correlational research (Carver, Scheier, & Segerstrom, 2010; Scheier, Carver, & Bridges, 2001) as well as in experimental studies (Renner, Schwarz, Peters, & Huibers, 2014; Sheldon & Lyubomirsky, 2006). In the latter case, participants were asked to write about the best imaginable future (optimism condition) or about a normal day (control condition), and subsequently reported on their experienced emotions.

Second, some successful activity manipulations do not boost positive emotions directly, but seem to enhance subjective well-being by satisfying people's basic need for relatedness (Ryan & Deci, 2000). For example, spending money on others has been related to happiness in both cross-sectional and experimental studies (Dunn, Aknin, & Norton, 2014). Participants who were asked to buy something for another person over the course of a day felt happier compared to participants who were asked to buy something for themselves (Dunn, Aknin, & Norton, 2008). One can imagine that asking participants to spend money on others would have elicited enhanced happiness in a lab environment as well (e.g. instructing participants to buy a present for someone else on the internet).⁵

Why do these types of happiness experiments work well (i.e. converge with correlational findings)? It seems that the activity manipulations described above have two important features in common. First, activities such as practicing optimism and buying a present for someone else have a positive effect on both short- and long-term well-being. Second, it appears that these types of activities are conducive of subjective well-being for the majority of people. If these criteria are not met, carrying out experimental research on subjective well-being may be challenging.

Challenges in experimental research on subjective well-being

⁵ It was not our aim to provide an exhaustive overview of successful experiments on subjective well-being. Rather, we aimed to provide examples of types of subjective well-being research that seem to work well in an experimental setting.

Not all activities and thoughts have converging short- and long-term effects on people's subjective well-being (see sections 'Measuring subjective well-being in an experimental setting' and 'Mood as a proxy for subjective well-being'). Furthermore, certain activities are associated with subjective well-being in correlational studies, but may become less appealing when they are imposed (see section 'Experimental manipulation and people's need for autonomy'). It is also possible that activities have a different influence on subjective well-being for people who engage in these activities in their daily life, and for people who do not engage in these activities spontaneously (see section 'Ecological validity'). Such activities are more challenging to investigate in an experimental setting. Before addressing these issues, we first discuss a more general issue pertaining to the measurement of subjective well-being in lab and field experiments.

Measuring subjective well-being in an experimental setting

A basic question concerns to what extent it makes sense to measure people's subjective well-being following brief experimental manipulations. Happiness and life satisfaction usually refer to people's long-term affective and cognitive evaluations of their life as a whole, and are moderately stable over time and circumstances (Diener, 1994; Diener, Lucas, & Oishi, 2002). In fact, Veenhoven (2015) stated that lab experiments are not suitable for studying happiness, as happiness measured in a lab setting is limited to transient mood.

As discussed later in this article (see section 'Mood as a proxy for subjective well-being'), we agree that lab experiments only allow the measurement of mood. However, we propose that experiments measuring mood do have added value when combining them with findings from correlational and longitudinal studies. Namely, although mood and subjective well-being are not the same, daily mood states are linked to both trait happiness and life satisfaction. Long-term affect seems to explain about half of the variance in life satisfaction (other variance among others comes from life circumstances such as relationship status and

work; Eid & Diener, 2004). Furthermore, meta-mood (thoughts and feelings about one's mood) is moderately correlated with trait happiness (Extremera, Salguero, & Fernández-Berrocal, 2011). While converging findings on mood in a controlled experiment lend causal support to correlational and longitudinal findings, diverging findings may be insightful (also see Kim-prieto, Diener, Tamir, Scollon, & Diener, 2005).

An example from our own lab may serve as an illustration of the measurement issues that may arise when experimentally investigating subjective well-being (Spronken, Holland, Wang, & Dijksterhuis, submitted). In one of our correlational studies, we found a positive relation between belief in free will and life satisfaction for people with high self-esteem, but a somewhat negative relation for people with low self-esteem.⁶ When manipulating participants' self-esteem in the lab (low self-esteem, high self-esteem, no manipulation), the relation between participants' belief in free will and their state or trait satisfaction did not differ between the three conditions. However, mood did drop more in the low self-esteem condition for participants who had stronger free will beliefs. These results suggest that mood measures may be more applicable in brief lab or field experiments.

Experimental manipulation and people's need for autonomy

Autonomy is believed to be highly relevant for intrinsic motivation and well-being (Self-Determination Theory; Ryan & Deci, 2000; Ryan & Deci, 2001; Ryff & Keyes, 1995). People experience autonomy if they have a sense of volition and choice with regard to their actions (Deci & Ryan, 2008). Both between and within participants, autonomy has been related to enhanced positive affect (Reis, Sheldon, Gable, Roscoe, & Ryan, 2000; Sheldon, Ryan, & Reis, 1996). As Csikszentmihalyi (1990) stated, the best moments tend to occur 'when a person's body or mind is stretched to its limits in a *voluntary* effort to accomplish something difficult or worthwhile' (p. 3).

⁶ It may be noted that we did not replicate the moderation by self-esteem in two other correlational studies.

Interestingly, the importance of autonomy for intrinsic motivation and well-being may conflict with the features of an experiment: manipulation and random assignment to conditions. In an experimental setting, participants are required to engage in activities that are instructed by an experimenter. People are deprived of volition and choice. Various studies in the educational and work literature suggest that experiencing limited autonomy may have negative consequences for people's interest in a task (Ryan & Deci, 2000; Ryan et al., 1989). For example, the presence of salient extrinsic reasons for performing school tasks was related to less interest in these tasks among elementary school children. Similarly, people may lose interest in work-related activities if they feel their behavior is imposed by an external source (Fisher, 1993). Presumably, salient extrinsic reasons for performing an activity lead people to focus on the compulsory nature of the activity rather than the activity itself. As such, manipulating an activity may inherently undermine intrinsic motivation and well-being, even if that same activity would be considered meaningful and enjoyable by participants when carried out voluntarily.

An example from our own lab can illustrate the potential clash between experimental manipulation and people's need for autonomy. In one of our studies, we investigated whether positive thought can boost people's happiness during a boring activity (Spronken, Holland, Figner, Wachner, & Dijksterhuis, submitted). Some participants were instructed to think of positive topics during a boring movie in the lab (positive thought condition), some were instructed to focus on the boring movie (task focus condition), and some were not given instructions regarding their thoughts (control condition). Happiness dropped somewhat less for participants in the positive thought condition compared to the other conditions. However, despite a successful manipulation, happiness still dropped in the positive thought condition. Even though this may partly be due to the presence of a boring task, it also seems likely that thinking about pleasant topics (presumably a positive and meaningful activity) is less

appealing in an experimental setting, when one is ‘forced’ to think about pleasant topics at a particular moment, for a pre-determined period of time.

Studies in the physical exercise literature may serve as another example of the clash between experimental manipulation and people’s need for autonomy. Namely, participants tend to enjoy high-intensity physical exercise when they choose this high intensity themselves. However, when induced by an experimenter, high-intensity physical exercise tends to have a negative effect on participants’ enjoyment (Ekkekakis, Parfitt, & Petruzzello, 2011; Ekkekakis & Petruzzello, 1999; Parfitt, Rose, & Burgess, 2006). These findings suggest that high-intensity physical exercise has a positive influence on people’s affective states, provided that this exercise intensity is autonomously chosen.

Ecological validity

Some activities (or thoughts) may have different outcomes for people who engage in these activities naturally, and people who do not. Correlational studies reveal the relation between a certain activity and subjective well-being, taking for granted that only some people may carry out this activity. People who take part in the activity may systematically differ from people who do not. Experimental studies show how a certain activity would affect people’s subjective well-being if everyone would engage in this activity. If this assumption does not match reality (i.e. the activity is self-selected by only some people in real life), the researchers’ conclusions may only apply to the experimental context, resulting in low ecological validity (see Gaines & Kuklinski, 2011). It may be noted that this issue is distinct from the previous challenge. Regarding the autonomy issue, correlational and experimental results differ because people’s sense of autonomy is harmed in an experiment. If undermining people’s autonomy can be avoided, correlational and experimental findings could and should converge. Regarding the present issue on ecological validity, correlational and experimental findings differ because people who engage in a certain activity naturally may systematically

differ from people who do not. This issue is unrelated to people's experienced autonomy in an experimental setting.

Again, our own studies can serve as an example here. In order to investigate the relation between temporal focus (past versus future), temporal distance (near versus distant), and mind-wandering valence, we carried out an experience sampling study in daily life as well as a lab experiment (Spronken, Holland, Figner, & Dijksterhuis, 2016). In the experience sampling study, the frequency of negative thoughts was higher for the distant past and future compared to the near past and future. However, when manipulating temporal distance in the lab, the frequency of negative thoughts was somewhat lower (and the frequency of positive thoughts higher) for the distant past and future compared to the near past and future. We speculated that a manipulation inducing distant past or future thoughts may result in positive thoughts for most people. However, an average person may not often think about the distant past and future in daily life. Thoughts about the distant past and future reported in an experience sampling study may mostly come from people who are troubled by their distant past and/or future. As this example shows, some thoughts may have different outcomes for people who have these thoughts spontaneously and people who do not. From a theoretical and an intervention perspective, it is important to know the well-being outcomes of activities when they are self-selected, and when they are manipulated.

Potential solutions

Mood as a proxy for subjective well-being

There is no solution for the problem that measurements in the lab are limited to transient mood. However, we can discuss ways of dealing with this problem. Although it may not make sense to measure trait happiness, life satisfaction, and other well-being related variables following brief manipulations, experiments measuring mood can be valuable when combining them with findings from correlational and longitudinal experimental studies. As

pointed out before, converging findings in a controlled lab or field experiment lend causal support to correlational and longitudinal findings. Diverging findings in a controlled experiment may be insightful (also see Kim-prieto et al., 2005).

According to the time-sequential framework of subjective well-being (Kim-prieto et al., 2005), subjective well-being unfolds over time, from events and circumstances that evoke affective reactions, to memories of these affective reactions, to global judgments of subjective well-being. Every temporal stage correlates with the previous stage, but new factors come into play at each stage as well (e.g. life circumstances such as relationship status and income appear to affect global judgments of subjective well-being in addition to memories of affective reactions). As discussed before, empirical studies show moderate relations between long-term mood and measures of subjective well-being (Eid & Diener, 2004; Extremera et al., 2011). In view of the links between the different stages of subjective well-being, mood measured in the lab may serve as a proxy of happiness and life satisfaction in daily life. For instance, mindfulness has been related to subjective well-being in correlational studies, longitudinal intervention studies, and experimental lab studies (Baer & Lykins, 2011; Brown & Ryan, 2003; Killingsworth & Gilbert, 2010). Lab experiments manipulating mindfulness and measuring mood (or affect) lend causal support to correlational and longitudinal findings measuring trait subjective well-being.

If experimental results do not replicate correlational findings, this may provide new insights. It is possible that there is in fact no causal effect of a certain activity on subjective well-being. However, it may also be the case that the effect of an activity differs for the short- and long-term. People's feeling states may change due to a particular activity at first, but return to their original levels on the long-term. For example, following a material purchase people may experience positive affect, but material purchases are unlikely to result in long-lasting happiness (Dunn, Gilbert, & Wilson, 2011). It is also possible that people's feeling

states initially do not change due to a particular activity (or change for the negative), but that this activity does have a positive influence on people's long-term subjective well-being. This is often the case for personal goals related to purpose in life and mastery (Csikszentmihalyi, 1990; Delle Fave, Massimini, & Bassi, 2011; Ryff, 1989). Serious leisure activities (e.g. language learning, drawing, marathon running; Stebbins, 2007) often lead to a sense of happiness and purpose on the long-term, but may be associated with frustration or boredom on the short-term (Delle Fave et al., 2011). While long-term effects show which activities promote happiness and life satisfaction sustainably, short-term effects may reveal why people do not always pursue activities that contribute to their subjective well-being on the long-term.

Providing a sense of autonomy in an experimental setting

As experimental manipulations may undermine people's sense of autonomy and consequently people's well-being, it seems worthwhile to develop (semi-)experimental paradigms that provide people with a sense of autonomy. A possibility may be to assign participants to conditions randomly, but also offer participants some choice within conditions (as opposed to assigning participants to one specific activity). This may shed more light on causal relations without undermining people's autonomy. Naturally, such a design goes at the expense of experimental control to some extent (the activities people can choose from within conditions probably differ on few more characteristics than only the characteristic of interest). However, this approach is likely to keep important psychological variables more constant between participants (e.g. activity liking, experienced autonomy).

In one of our research lines, we investigated the relation between physical and mental activity, happiness, and life satisfaction (Spronken, Holland, Figner, & Dijksterhuis, submitted). Regarding physical activity, a clean manipulation would be walking slow versus fast on a treadmill. Regarding mental activity, a clean manipulation would be an easy versus a difficult math or memory task. However, such activities would probably feel rather

meaningless and non-autonomous for participants, and may not necessarily shed light on the relation between physical activity, mental activity, and well-being in daily life. Therefore, we assigned people randomly to a physical activity, mental activity, passive activity, or control condition in a field study. In the experimental conditions, people could choose between various activities (e.g. walking, running, cycling, dancing, muscle exercises, ball game, and swimming in the physical activity condition). In line with our hypothesis and earlier correlational findings, people in the physical activity condition felt happier during the manipulated activities compared to participants in the control condition, and more satisfied following manipulated activities compared to participants in the other conditions. As such, our design seemed suitable for investigating the relation between physical activity and well-being (the results for mental activity were somewhat more complex).

Another method to introduce feelings of autonomy in an experimental setting may be to assign each participant to a task that has previously been identified to elicit the psychological state of interest for that specific participant. Namely, people may experience more autonomy during an activity if they have already engaged in this activity voluntarily (naturally, also this method goes at the expense of experimental control to some extent). For example, Rogatko (2009) asked participants to list eight to ten activities they carried out regularly, and asked participants to indicate to what extent they experienced a number of emotions (including flow) during these activities. Next, participants were randomly assigned to a flow or non-flow condition on the basis of the activities that had previously been identified to increase flow or not. In this study, flow activities were related to higher positive affect. This method is particularly suitable when one is interested in investigating a particular psychological state (e.g. flow). It may be noted that the paradigms discussed in this section are also beneficial for the ecological validity of experiments on subjective well-being.

Including a self-selection condition in the experimental design

As self-selection and manipulation of activities may result in different conclusions, we need paradigms that allow us to systematically investigate how a particular activity affects people's subjective well-being when this activity is self-selected, and when this activity is induced. In the field of political science, Gaines and Kuklinski (2011) proposed including a so-called 'self-selection condition' in experimental paradigms. Participants in the self-selection condition are given the opportunity to choose between the experimental conditions other participants are assigned to. For example, when studying how the temporal distance of thoughts influences thought valence (see section 'Ecological validity'), a self-selection condition could be included in which participants choose whether they want to engage in near or distant future thinking. This may reveal whether the relation between temporal distance and thought valence differs depending on whether people self-select a particular temporal distance (the possibility should be taken into account that people do not self-select into the condition they would engage in naturally in their daily life). It is important to identify which factors distinguish people who self-select into a particular condition. While a self-selection condition may provide valuable insights, it may be noted that this approach has several disadvantages, too (see Gaines & Kuklinski, 2011).

Are these challenges specific to research on subjective well-being?

The question may arise whether the challenges discussed in this article are specific to research on subjective well-being, or whether these challenges also apply to other fields of research. The measurement issues discussed in this article may also play a role in other research areas studying global constructs that develop over time in daily life. For instance, in relationship research, constructs like commitment and relationship satisfaction may not be affected by brief manipulations. As has been alluded to before, the clash between manipulation and people's need for autonomy may apply to research on intrinsic motivation and personal growth, too. For example, experimentally investigating the effect of various

learning strategies on performance may be difficult if students are not interested in studying a particular topic. Importantly, the autonomy issue probably plays less of a role for researchers investigating depression (aimed at diminishing negative affect) than for researchers studying happiness (aimed at increasing positive affect). If people's sense of autonomy is undermined in an experiment, one manipulation may still lead to less negative affect compared to another. However, if people's need for autonomy is not satisfied, it may be very challenging to boost people's subjective well-being. Finally, the issue on the ecological validity of experimental findings is not very specific to research on happiness and satisfaction (Bless & Burger, 2016), but nevertheless highly important when carrying out experimental research on subjective well-being.

Alternative explanations

While the challenges identified in this article seem valid issues in relation to experimental research on subjective well-being, unexpected (or absent) findings in our studies may also be explained by other factors than the challenges discussed. For example, regarding our research on temporal distance and thought valence (see section 'Ecological validity'), as well as our research on belief in free will and life satisfaction (see section 'Measuring subjective well-being in an experimental setting'), it is unclear whether our correlational findings can be replicated. If our findings are not replicable, this would also explain why our lab experiments showed different or no results. Regarding our research on boredom, happiness dropped for participants who were asked to think about positive things during a boring movie. We suggested that people may suffer from a limited sense of autonomy when being 'forced' to think about positive topics (see section 'Experimental manipulation and people's need for autonomy'). Other (or supplementary) explanations may be that people simply had difficulty thinking about positive topics, or that the accompanying boring task lowered people's happiness. However, whether or not the challenges described in the present

article were the reason for our findings, the challenges described here seem worth considering when carrying out experimental research on subjective well-being.

Conclusion

In the present article, we identified three challenges related to investigating subjective well-being experimentally, and provided potential solutions for these challenges. First of all, subjective well-being measurements following brief manipulations are limited to momentary mood. However, we proposed that converging findings on mood in a controlled experiment nevertheless lend causal support to correlational findings on happiness and life satisfaction. If experimental findings on mood diverge from correlational findings, this may be insightful. Second, experimental manipulation of activities may conflict with people's basic need for autonomy. We suggested that providing participants with some choice in an experimental context may allow us to obtain more insight in causal relations, while diminishing people's sense of autonomy to a lesser extent. Third, activities may have a different influence on subjective well-being for people who engage in these activities in their daily life, and for people who do not engage in these activities spontaneously. Including self-selection in the experimental design may provide insight in the ecological validity of experimental findings. The present article may inspire future experimental research in the field of subjective well-being.

References

- Baer, R. A., & Lykins, E. L. M. (2011). Mindfulness and positive psychological functioning. In K. M. Sheldon, T. B. Kashdan, & M. F. Steger (Eds.), *Designing positive psychology: Taking stock and moving forward* (pp. 335–348). New York: Oxford University Press.
- Bless, H., & Burger, A. M. (2016). A closer look at social psychologists' silver bullet: Inevitable and evitable side effects of the experimental approach. *Perspectives on Psychological Science, 11*(2), 296–308. <https://doi.org/10.1177/1745691615621278>
- Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology, 84*(4), 822–848. <https://doi.org/10.1037/0022-3514.84.4.822>
- Carver, C. S., Scheier, M. F., & Segerstrom, S. C. (2010). Optimism. *Clinical Psychology Review, 30*, 879–889. <https://doi.org/10.1016/j.cpr.2010.01.006>
- Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: Harper & Row.
- Deci, E. L., & Ryan, R. M. (2008). Hedonia, eudaimonia, and well-being: An introduction. *Journal of Happiness Studies, 9*, 1–11. <https://doi.org/10.1007/s10902-006-9018-1>
- Delle Fave, A., Massimini, F., & Bassi, M. (2011). *Psychological Selection and Optimal Experience Across Cultures* (Vol. 2). Dordrecht: Springer. <https://doi.org/10.1007/978-90-481-9876-4>
- Diener, E. (1994). Assessing subjective well-being: Progress and opportunities. *Social Indicators Research, 31*, 103–157. <https://doi.org/10.1007/BF01207052>
- Diener, E. (2000). Subjective Well-Being. *American Psychologist, 55*(1), 34–43. <https://doi.org/10.1037//0003-066X.55.1.34>
- Diener, E. (2012). New findings and future directions for subjective well-being research. *American Psychologist, 37*, 590–597. <https://doi.org/10.1037/a0029541>

- Diener, E., Lucas, R. E., & Oishi, S. (2002). Subjective well-being: The science of happiness and life satisfaction. In C. R. Snyder & S. J. Lopez (Eds.), *Handbook of positive psychology* (pp. 63–73). New York: Oxford University Press.
- Dunn, E. W., Aknin, L. B., & Norton, M. I. (2008). Spending money on others promotes happiness. *Science*, *319*(5870), 1687–1688. <https://doi.org/10.1126/science.1150952>
- Dunn, E. W., Aknin, L. B., & Norton, M. I. (2014). Prosocial spending and happiness: Using money to benefit others pays off. *Current Directions in Psychological Science*, *23*(1), 41–47. <https://doi.org/10.1177/0963721413512503>
- Dunn, E. W., Gilbert, D. T., & Wilson, T. D. (2011). If money doesn't make you happy, then you probably aren't spending it right. *Journal of Consumer Psychology*, *21*(2), 115–125. <https://doi.org/https://doi.org/10.1016/j.jcps.2011.02.002>
- Eid, M., & Diener, E. (2004). Global judgments of subjective well-being: Situational variability and long-term stability. *Social Indicators Research*, *65*, 245–277. <https://doi.org/10.1023/B:SOCI.00000003801.89195.bc>
- Ekkekakis, P., Parfitt, G., & Petruzzello, S. J. (2011). The pleasure and displeasure people feel when they exercise at different intensities: Decennial update and progress towards a tripartite rationale for exercise intensity prescription. *Sports Medicine*, *41*(8), 641–671. <https://doi.org/10.2165/11590680-000000000-00000>
- Ekkekakis, P., & Petruzzello, S. J. (1999). Acute Aerobic Exercise and Affect. *Sports Medicine*, *28*(5), 337–374. <https://doi.org/10.2165/00007256-199928050-00005>
- Extremera, N., Salguero, J. M., & Fernández-Berrocal, P. (2011). Trait meta-mood and subjective happiness: A 7-week prospective study. *Journal of Happiness Studies*, *12*, 509–517. <https://doi.org/10.1007/s10902-010-9233-7>
- Fisher, C. D. (1993). Boredom at work: A neglected concept. *Human Relations*, *46*(3), 395–417. <https://doi.org/10.1177/001872679304600305>

- Gaines, B. J., & Kuklinski, J. H. (2011). Experimental estimation of heterogeneous treatment effects related to self-selection. *American Journal of Political Science*, *55*(3), 724–736. <https://doi.org/10.1111/j.1540-5907.2011.00518.x>
- Killingsworth, M. A., & Gilbert, D. T. (2010). A wandering mind is an unhappy mind. *Science*, *330*(6006), 932–932. <https://doi.org/10.1126/science.1192439>
- Kim-prieto, C., Diener, E., Tamir, M., Scollon, C., & Diener, M. (2005). Integrating the diverse definitions of happiness: A time-sequential framework of subjective well-being. *Journal of Happiness Studies*, *6*(3), 261–300. <https://doi.org/10.1007/s10902-005-7226-8>
- Lyubomirsky, S., King, L., & Diener, E. (2005). The benefits of frequent positive affect: Does happiness lead to success? *Psychological Bulletin*, *131*(6), 803–855. <https://doi.org/10.1037/0033-2909.131.6.803>
- Lyubomirsky, S., Sheldon, K. M., & Schkade, D. (2005). Pursuing happiness: The architecture of sustainable change. *Review of General Psychology*, *9*(2), 111–131. <https://doi.org/10.1037/1089-2680.9.2.111>
- Parfitt, G., Rose, E. A., & Burgess, W. M. (2006). The psychological and physiological responses of sedentary individuals to prescribed and preferred intensity exercise. *British Journal of Health Psychology*, *11*(1), 39–53. <https://doi.org/10.1348/135910705X43606>
- Reis, H. T., Sheldon, K. M., Gable, S. L., Roscoe, J., & Ryan, R. M. (2000). Daily well-being: The role of autonomy, competence, and relatedness. *Personality and Social Psychology Bulletin*, *26*(4), 419–435. <https://doi.org/10.1177/0146167200266002>
- Renner, F., Schwarz, P., Peters, M. L., & Huibers, M. J. H. (2014). Effects of a best-possible-self mental imagery exercise on mood and dysfunctional attitudes. *Psychiatry Research*, *215*(1), 105–110. <https://doi.org/10.1016/j.psychres.2013.10.033>
- Rogatko, T. P. (2009). The influence of flow on positive affect in college. *Journal of Happiness Studies*, *10*, 133–148. <https://doi.org/10.1007/s10902-007-9069-y>

- Ryan, R. M., Connell, J. P., Grolnick, W., Lynch, J., Frederick, C., Mellor-, C., ... Deci, E. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains, *Journal of Personality and Social Psychology*, 57(1972), 749–761. <https://dx.doi.org/10.1037/0022-3514.57.5.749>
- Ryan, R. M., & Deci, E. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *The American Psychologist*, 55(1), 68–78. <https://doi.org/10.1037/0003-066X.55.1.68>
- Ryan, R. M., & Deci, E. L. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology*, 52(1), 141–166. <https://doi.org/10.1146/annurev.psych.52.1.141>
- Ryff, C. D. (1989). Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *Journal of Personality and Social Psychology*, 57(6), 1069–1081. <https://doi.org/10.1037/0022-3514.57.6.1069>
- Ryff, C. D., & Keyes, C. L. M. (1995). The structure of psychological well-being revisited. *Journal of Personality and Social Psychology*, 69(4), 719–727.
- Scheier, M. F., Carver, C. S., & Bridges, M. W. (2001). Optimism, pessimism, and psychological well-being. In E. C. H. Chang (Ed.), *Optimism & pessimism: Implications for theory, research, and practice* (pp. 189–216). Washington, DC: American Psychological Association.
- Sheldon, K. M., & Lyubomirsky, S. (2006). How to increase and sustain positive emotion: The effects of expressing gratitude and visualizing best possible selves. *The Journal of Positive Psychology*, 1(2), 73–82. <https://doi.org/10.1080/17439760500510676>
- Sheldon, K. M., Ryan, R., & Reis, H. T. (1996). What makes for a good day? Competence and autonomy in the day and in the person. *Personality and Social Psychology Bulletin*, 22(12), 1270–1279. <https://doi.org/10.1177/01461672962212007>

- Spronken, M., Holland, R. W., Figner, B., & Dijksterhuis, A. (2016). Temporal focus, temporal distance, and mind-wandering valence: Results from an experience sampling and an experimental study. *Consciousness and Cognition, 44*, 104-118.
<https://doi.org/10.1016/j.concog.2016.02.004>
- Spronken, M., Holland, R. W., Figner, B., & Dijksterhuis, A. (submitted). Physical and mental activity, happiness, and satisfaction: An experience sampling study and a field experiment.
- Spronken, M., Holland, R. W., Figner, B., Wachner, J., & Dijksterhuis, A. (submitted). When ‘Now’ is boring: Can positive thought boost our happiness during boring activities?
- Spronken, M., Holland, R. W., Wang, Z., & Dijksterhuis, A. (submitted). Is belief in free will always related to higher life satisfaction? The role of salience and self-esteem.
- Stebbins, R. A. (2007). *Serious leisure: A perspective for our time*. London: Transaction Publishers.
- Vazou-Ekkekakis, S., & Ekkekakis, P. (2009). Affective consequences of imposing the intensity of physical activity: Does the loss of perceived autonomy matter? *Hellenic Journal of Psychology, 6*(2), 125–144.
- Veenhoven, R. (2015). Informed pursuit of happiness: What we should know, do know and can get to know. *Journal of Happiness Studies, 16*(4), 1035–1071.
<https://doi.org/10.1007/s10902-014-9560-1>