Emotion

A New Micro-Intervention to Increase the Enjoyment and Continued Practice of Meditation

Patty Van Cappellen, Lahnna I. Catalino, and Barbara L. Fredrickson

Online First Publication, October 14, 2019. http://dx.doi.org/10.1037/emo0000684

CITATION

Van Cappellen, P., Catalino, L. I., & Fredrickson, B. L. (2019, October 14). A New Micro-Intervention to Increase the Enjoyment and Continued Practice of Meditation. *Emotion*. Advance online publication. http://dx.doi.org/10.1037/emo0000684

American Psychological Association

Emotion

© 2019 American Psychological Association
ISSN: 1528-3542

http://dx.doi.org/10.1037/emo0000684

A New Micro-Intervention to Increase the Enjoyment and Continued Practice of Meditation

Patty Van Cappellen
Duke University

Lahnna I. Catalino
Scripps College

Barbara L. Fredrickson
University of North Carolina at Chapel Hill

New health behaviors are difficult to maintain and meditation is no different. We tested two key pathways of the upward spiral theory of lifestyle change (Fredrickson, 2013), which identifies positive emotions as critical ingredients for the maintenance of new health behaviors. The present experiment combined a laboratory session that introduced novices to meditation with a 3-week follow-up period to assess the extent to which study participants maintained this new health behavior. In a 2 × 2 experimental design, midlife adults (N = 240) were randomized to (a) learn about judicious ways to prioritize positivity (labeled "prioritizing positivity plus") or about a control topic that also featured the science of positive emotions and (b) follow a guided meditation based on either loving-kindness, which provided an opportunity to self-generate positive emotions, or mindfulness, which did not. All participants rated their emotions following the initial guided meditation and reported, week by week, whether they meditated during the ensuing 21 days. Analyses revealed that being exposed to the prioritizing positivity plus microintervention, relative to a control passage, amplified the effect of engaging in loving-kindness (vs. mindfulness) meditation on positive emotions. Additionally, the degree to which participants experienced positive emotions during first exposure to either meditation type predicted the frequency and duration at which they practiced meditation over the next 21 days. These findings show that the enjoyment of meditation can be experimentally amplified and that initial enjoyment predicts continued practice. Discussion spotlights the importance of differentiating effective and ineffective ways to pursue happiness.

Keywords: health behavior, prioritizing positivity, positive psychology, positive affect

Supplemental materials: http://dx.doi.org/10.1037/emo0000684.supp

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

A 2014 survey of more than 35,000 Americans found that 40% reported that they meditated at least once a week (Masci & Hackett, 2018). Although religious people were more likely to say they meditated, 26% of Americans who were not religiously affiliated also reported meditating regularly (Masci & Hackett, 2018). Indeed, one of the most common reasons that people reported practicing meditation was to maintain their general health and well-being (Burke, Lam, Stussman, & Yang, 2017), a goal that is validated by research on the positive health consequences of meditation (Fredrickson et al., 2017; Galante, Galante, Bekkers, & Gallacher, 2014). Meditation can thus be considered a positive health behavior, akin to maintaining regular physical activity.

Yet sustaining positive health behaviors long-term can be difficult. A follow-up study of adults who initiated a meditation practice for the first time, found that 65% failed to maintain this practice 15 months later (Cohn & Fredrickson, 2010). Studies of adults who initiated a physical activity regimen have shown fall off in comparable numbers: 6 months later, 64–80% were not phys-

Patty Van Cappellen, Social Science Research Institute, Duke University; Lahnna I. Catalino, Department of Psychology, Scripps College; Barbara L. Fredrickson, Department of Psychology and Neuroscience, University of North Carolina at Chapel Hill.

Patty Van Cappellen and Lahnna I. Catalino contributed equally to this work and should be considered joint first authors. The study reported herein was supported by a research grant awarded to Barbara L. Fredrickson by the National Center for Complementary and Integrative Health of the U.S. National Institutes of Health (R01AT007884). The funding agency played no role in study design, data collection, data analysis, decision to publish, or preparation of the article. We thank Kristen Layous, Khoa Le Nguyen, Michael Prinzing, Kelly Tan, and Jieni Zhou for helpful comments on a draft of this article. The data presented are freely accessible through the Open Science Framework: https://osf.io/vtbk4/.

Correspondence concerning this article should be addressed to Lahnna I. Catalino, Department of Psychology, Scripps College, Steele 110, 1030 Columbia Avenue, Claremont, CA 91711 or Patty Van Cappellen, Social Science Research Institute, Duke University, Bay B, Room 226, 2024 West Main Street, Erwin Mill, Durham, NC 27005 or Barbara L. Fredrickson, Department of Psychology and Neuroscience, University of North Carolina at Chapel Hill, Davie Hall, Campus Box 3270, Chapel Hill, NC 27599-3270. E-mail: LCatalin@scrippscollege.edu or patty.vancappellen@duke.edu or blf@unc.edu

ically active (Schneider, Khachadurian, Amorosa, Clemow, & Ruderman, 1992; Wilson & Brookfield, 2009). Although people initiate new health behaviors with good intentions, failure to sustain desired positive health behaviors in the months ahead appears to be the norm (Rhodes & Dickau, 2012).

Most research on behavior change has targeted behavior *initiation*, leaving the factors that predict the long-term maintenance of health behaviors less well understood (Rothman, 2000; Rothman, Baldwin, Hertel, & Fuglestad, 2011). Although conscious behavioral intentions and deliberate decisions play important roles in the initiation of new health behaviors, emotions and nonconscious motives are thought to play comparatively larger roles in their long-term maintenance (Iso-Ahola, 2013; Marteau, Hollands, & Fletcher, 2012; Papies & Aarts, 2011; Sheeran, Gollwitzer, & Bargh, 2013; Woolley & Fishbach, 2017). For instance, positive affect experienced during goal activation or behavioral initiation has been shown to energize subsequent behavioral efforts (Aarts, Custers, & Marien, 2008; Custers & Aarts, 2007; Layous, Nelson, Kurtz, & Lyubomirsky, 2016). Consistent with this notion, a follow-up of novice meditators found that individuals who were 1 *SD* above the mean in their initial positive affective responses to meditation were 4.5 times more likely to have maintained that behavior 15 months later, compared to those who were 1 *SD* below the mean (Cohn & Fredrickson, 2010). Positive affective responses have also been established as important factors in the maintenance of physical activity: A systematic review of 24 studies concluded that pleasant affect experienced during physical activity forecasted people's future physical activity (Rhodes & Kates, 2015), even among initially sedentary adults at 6- and 12-month follow-up (Williams et al., 2008; Williams, Dunsiger, Jennings, & Marcus, 2012). These findings raise the possibility that skillfully upregulating positive emotions during behavioral initiation may better prepare people to maintain that health behavior long-term.

The upward spiral theory of lifestyle change was developed to account for the evidence that positive affect experienced during positive health behaviors appears consequential for long-term behavioral maintenance (Fredrickson, 2013; Van Cappellen, Rice, Catalino, & Fredrickson, 2018). Typical explanations for such findings rest on learned associations, whereby actions that are rewarding or satisfying are more likely to be maintained (Lawton, Conner, & McEachan, 2009; Rhodes, Fiala, & Conner, 2009; Rhodes & Kates, 2015; Williams et al., 2008). Pushing for a deeper understanding of underlying mechanisms, the upward spiral theory integrates insights from affective science, behavioral neuroscience, and developmental plasticity. The theory holds that, to the extent that positive affect is experienced during a new positive health behavior, it creates nonconscious motives for that activity, which grow stronger over time as they are increasingly supported by developing vantage resources. Figure 1 presents the structure of the theory.

The inner loop of this spiral model (see Figure 1) links the positive affect experienced during an activity ("liking") to future reenactment of that activity ("wanting"). Inspired by incentive salience theory (Berridge, 2007), it further identifies nonconscious motives—that is, behavioral nudges that operate outside of awareness—as a central mediating mechanism. Our team's recent studies provide correlational and experimental evidence for this inner loop pathway (Rice & Fredrickson, 2017a, 2017b). This work demonstrated that the pleasantness of activity-related thoughts that simply "pop" to mind (i.e., positive spontaneous thoughts) functions as incentive salience that translates past enjoyment of an activity into subsequent urges to repeat it. In the domain of positive health behaviors, a cross-sectional study of 232 midlife adults found that positive spontaneous thoughts about physical activity mediated the relation between enjoyment of physical activity (assessed as harmonious passion for it) and the frequency of physical activity across 14 days (Rice & Fredrickson, 2017b, Study 2). Notably, the mere frequency of spontaneous thoughts showed no similar pattern, demonstrating that these effects were specific to the pleasantness of spontaneous thoughts.

The outer loop of the upward spiral model (see Figure 1) follows from the broaden-and-build theory of positive emotions (Fredrickson, 1998, 2013) as well as evidence for developmental plasticity (Pluess & Belsky, 2013). Briefly, the broaden-and-build theory posits that people's experiences of positive emotions (e.g., joy, gratitude, interest, pride, serenity) momentarily broaden their mindsets in ways that, over time, accumulate and compound to build their enduring personal resources, creating trajectories of

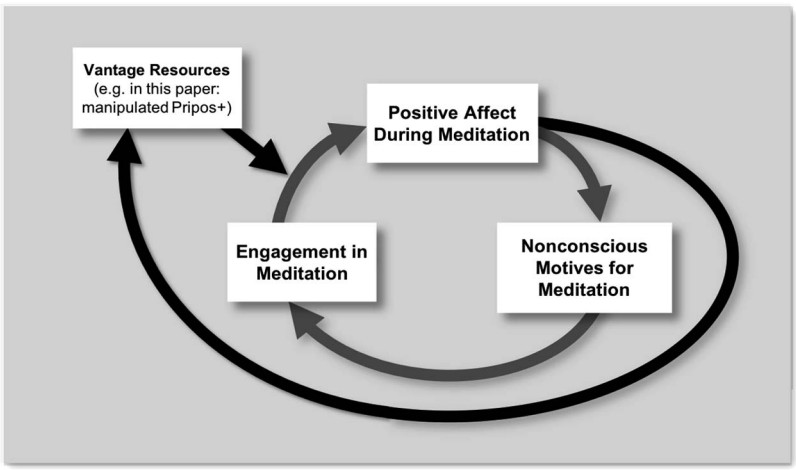

Figure 1. The upward spiral theory of lifestyle change as applied to sustained meditation practice.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

growth in biological (e.g., cardiac vagal tone), cognitive (e.g., mindfulness), psychological (e.g., resilience), and social (e.g., positive relations with others) resources (for a summary of evidence supporting the theory, see Fredrickson, 2013). Randomized controlled trials have shown that when people learn to self-generate more positive emotions they, over time, build consequential personal resources (Fredrickson, Cohn, Coffey, Pek, & Finkel, 2008; Kok et al., 2013). Critically, some of these resources, for instance, the ability to savor (Kiken, Lundberg, & Fredrickson, 2017) and cardiac vagal tone (Isgett et al., 2017), have been found to render people more sensitive to opportunities to experience further positive emotions. Taking a cue from Pluess and Belsky (2013), the upward spiral theory identifies such resources as vantage resources. A vantage resource is any endogenous asset that amplifies (i.e., statistically moderates) the positive affect experienced during positive health behaviors. Individuals with higher levels of vantage resources are able to derive greater enjoyment during positive health behaviors. Indeed, in recent work on meditation, our team found that the degree to which people experience positive emotions during meditation was contoured by two different biological vantage resources. We've shown, for instance, that individuals who initially had higher cardiac vagal tone (indexed as high-frequency heart rate variability) experienced more positive emotions when taking a 6-week meditation workshop (Kok et al., 2013, see also Fredrickson & Kok, 2018; Kok & Fredrickson, 2015). We've also shown, in a double-blind experimental design, that exposure to synthetic oxytocin (vs. a placebo) increased the positive emotions individuals experienced the first time they meditated (Van Cappellen, Way, Isgett, & Fredrickson, 2016).

Turning our focus to a psychological vantage resource—one that stands to be far cheaper and accessibly gained—we have examined the degrees to which people prioritize positivity (Catalino, Algoe, & Fredrickson, 2014). That is, to what extent do they seek out happiness (defined here as positive emotions) as a key criterion for how to organize their daily life? (Sample items include "I structure my day to maximize my happiness" and "A priority for me is experiencing happiness in everyday life.") Both cross-sectional and longitudinal studies have shown individual differences in prioritizing positivity to predict the degree to which people experienced positive emotions (Catalino et al., 2014; Datu & King, 2016). Prioritizing positivity, an approach to emotion regulation based on situation selection, thus appears to be a healthy way to pursue happiness. Yet at times people also pursue happiness in unhealthy ways, such as by holding rigid beliefs about happiness or excessively high standards for achieving it. Measuring a construct called "valuing happiness to an extreme" (sample items include "How happy I am at any given moment says a lot about how worthwhile my life is," and "I am concerned about my happiness even when I feel happy;" Mauss, Tamir, Anderson, & Savino, 2011), Mauss and colleagues found links to both depressive and bipolar tendencies (Ford, Mauss, & Gruber, 2015; Ford, Shallcross, Mauss, Floerke, & Gruber, 2014). Intriguingly, we found that individual differences in prioritizing positivity correlated positively with individual differences in valuing happiness to an extreme ($N = 233$, $r = .25$, $p < .001$; Catalino et al., 2014). Also, the aforementioned links between prioritizing positivity and markers of well-being (i.e., positive emotions and life satisfaction) were strengthened when the variance it shared with Mauss and colleagues' scale was statistically removed (Catalino et al., 2014). This pattern of results suggests that healthy and unhealthy pursuits of happiness may at times be fused or confused. Prescriptive statements about prioritizing positivity thus require appropriate nuance so that rigid or extreme tendencies may be avoided.

In the study we report here, analogous to our prior work that manipulated the biological vantage resource of oxytocin (Van Cappellen et al., 2016), we experimentally manipulated the psychological vantage resource of prioritizing positivity, together with cautions about rigid or extreme approaches to happiness. The microintervention that we introduce here informs people both about the benefits of setting aside time for pleasant events (prioritizing positivity) as well as the dangers of willing oneself to feel positive emotions (a correlate of valuing happiness to an extreme), a message we term *prioritizing positivity plus* (PriPos+). By contrast, our matched control passage discusses the neuroscience of positive emotions. Although both passages are anchored in empirical facts and matched on the number of positive emotion terms they mention, the neuroscience passage serves as a control condition because it does not include recommendations for upregulating positive emotions. We predict the PriPos+ microintervention will render people more sensitive to activities that provide opportunities to experience positive emotions. In the domain of meditation, loving-kindness meditation is one such activity. Through the repetition of classic phrases (e.g., "May you be peaceful" "May you be happy" "May you be healthy"), the practice of loving-kindness meditation becomes an opportunity to self-generate greater positive emotions. Here we use mindfulness meditation as a control meditation. Although both practices have been found to raise day-to-day experiences of positive emotions in the long term (Fredrickson et al., 2017), mindfulness meditation is not framed as a way to upregulate positive emotions. Thus, targeting the outer loop of the upward spiral theory, we tested whether study participants randomized to read the PriPos+ (vs. control) passage would report more positive emotions during loving-kindness (vs. control) meditation. In other words, does prioritizing positivity function as a vantage resource that moderates the positive emotion yield of loving-kindness meditation? Targeting the inner loop of the upward spiral theory, we further predicted that those randomized to read the PriPos+ (vs. control) passage would be more likely to continue practicing loving-kindness (vs. control) meditation in the ensuing weeks, and that this effect would be mediated by positive emotions experienced during the first exposure to meditation.

Using a 2×2 shortitudinal experimental design (Dormann & Griffin, 2015), we randomized study participants to read about either the benefits of prioritizing positivity (plus cautions) or the neuroscience of positive emotions. Fully crossed with passage type, we also randomized novice meditators to experience either loving-kindness meditation or mindfulness meditation. The study design included both a laboratory component, during which study participants read their randomized passage, practiced their randomized meditation for the first time and then reported their associated emotions. Next followed a 21-day period, during which participants were encouraged (but not required) to practice meditation again at a frequency and duration of their choice. The laboratory session thus models the processes of health behavior initiation, whereas the follow-up period models the processes of health behavior maintenance, albeit on a short timescale. We tested the following two hypotheses:

Hypothesis 1: The PriPos+ (vs. control) passage amplifies the effect of loving-kindness (vs. control) meditation on (a) people's positive emotions in the laboratory and (b) the subsequent frequency and duration of their meditation practice over the ensuing 21 days. If Hypotheses 1a and 1b are each supported, we can then test (c) whether the experimental effects predicted in Hypothesis 1b are mediated by people's experience of positive emotions in their initial exposure to meditation.

Because upward spiral theory states that positive emotions experienced during *any* health behavior will predict its maintenance, we also make the following prediction to test the behavioral maintenance pathway of the inner loop (here bypassing mediation by nonconscious motives):

Hypothesis 2: Positive emotions at initial exposure to meditation (loving-kindness and control) forecasts the subsequent frequency and duration of meditation over the ensuing 21 days.

Method

Participants

Participants were recruited from the Durham and Orange counties in North Carolina, via Craigslist and e-mail advertisements. To be eligible to participate, participants had to be U.S. citizens, fluent in written and spoken English, between the age of 35 and 64 years old, and new to meditation. Participants were eligible to receive up to $120 in total compensation for their participation. A total of 240 participants took part in the study (n_{female} = 146; M_{age} = 47.2, SD = 8.9). A total of 71.7% of participants were White, 19.2% African American, 6.7% Asian, 0.4% American Indian or Alaska Native, and 2.1% reported more than one race; 5% were Hispanic or Latino. Power analyses for a small to moderate effect size (f = 0.20, drawn from our team's past study that manipulated oxytocin prior to first exposure to meditation and measured the positive emotions associated with meditation; Van Cappellen et al., 2016) and an alpha level of .05, suggested that 199 participants were needed to achieve 80% power in two-way analysis of covariance models. Factoring in attrition and data loss, we targeted N = 240.

At the lab session, participants were randomly assigned to read the PriPos+ passage (n = 121) or the control passage (n = 119) and then engaged in loving-kindness meditation (n = 116) or the control meditation (mindfulness meditation, n = 124). After the lab session, participants completed follow-up online surveys after 1 week (n = 226), 2 weeks (n = 223), and 3 weeks (n = 215).

Procedure

The institutional review board of the University of North Carolina at Chapel Hill approved all procedures and questionnaires. The study was a randomized, dual-blind, placebo-controlled 2 × 2 experimental design that involved one initial online survey, a 90-min laboratory visit, and three weekly online follow-up surveys. The study took place between December 2014 and October 2015. Before coming for their lab session, participants completed an online survey including demographic questions and a measure of trait prioritizing positivity (measures described below). At the beginning of the lab session, participants completed a baseline measure of emotions, which assessed the greatest degree to which participants experienced different emotions in the last 24 hr. Participants were then randomized to the PriPos+ condition with presentation of a passage entitled "Prioritizing Positive Emotions is Beneficial," or to the control condition with a passage entitled "Neuroscience of Positive Emotions" (passages described below). Immediately after, they completed a reading comprehension question to assess whether they understood their assigned passage. Participants were then randomized to one of two meditation conditions, loving-kindness meditation or a control meditation (mindfulness meditation), which entailed following a 20-min guided meditation over noise-cancelling headphones. Next, participants completed another measure of emotions and a set of additional items described in online supplemental materials but not analyzed here. At the end of the lab session, participants received a tote bag with various objects to support their meditation practice should they choose to begin one. Participants were given an iPod Shuffle (4th generation, Apple, Cupertino, CA) containing additional tracks of their respective meditation type to guide their practice over the next 3 weeks of the study. They also received a study-specific logbook with printed prompts on each page to record their meditation practice times and thoughts related to their practice. The logbook also contained multiple pages of the modified Differential Emotion Scale (see description below) that participants could use to record the emotions they felt in the past 24 hr. Finally, participants received a small, polished malachite stone, introduced as a "meditation stone" to hold during their practice, center their mind, or use as a visual reminder to meditate. Importantly, participants were encouraged, but not required, to continue their meditation practice. The experimenter said during the laboratory session ("We encourage you to use these items to help you if you choose to practice meditation in the following weeks") and later ("There are no requirements of whether or how often you decide to meditate, that would all be up to you"; see the online supplemental materials for complete verbatim of instructions received regarding meditation practice and objects gifted to support meditation practice). Then, once a week over the next 3 weeks, participants completed online surveys related to any meditation practice they chose to undertake.

Materials

Prioritizing positivity plus (PriPos+) versus control passages. Participants were randomly assigned to read and reflect on one of two bogus newspaper articles that were largely based on factual scientific knowledge at the time of writing (see Appendix for complete texts). In the PriPos+ condition, participants learned about the benefits of setting aside time for pleasant events (e.g., "People who devote time each day to activities that generate positive emotions [e.g. interest, amusement] fare the best") as well as the dangers of willing oneself to feel positive emotions (e.g., "Research also shows that if you simply 'will' or 'wish' yourself to feel positive emotions, it can backfire, ironically making you feel worse"). In the control condition, participants learned about the regions of the brain associated with positive emotions. The number of times the terms *positive emotions* and *good* and the specific emotions *interest* and *amusement* were stated was equal across conditions. Thus, in both conditions, participants were exposed to the concept of positive emotions, yet only in the

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

PriPos+ condition did participants learn about healthy ways to relate to positivity. After reading the passage, participants were asked to reflect on it and make a one- to two-paragraph argument for it (for the PriPos+ passage, why one's potential to experience positive emotions should be one of the primary considerations when making decisions about which activities to engage in after work or deciding which career to pursue; for the control passage, why continuing to conduct scientific research on the brain is worthwhile). In both conditions, they were encouraged to call upon personal examples from their own life and the lives of others they know, as well as basic logic. Next, participants completed a multiple-choice reading comprehension question specific to each passage to assess whether they paid attention and understood the text. Only participants who responded correctly were included in the analyses, resulting in a final sample of $N = 228$.

Loving-kindness versus control meditation practices. During the lab session, participants were also randomly assigned to engage in one of two 20-min guided meditations: loving-kindness or a control meditation (i.e., mindfulness). At the end of the lab session, participants received an Apple iPod Shuffle with six additional 20-min guided meditations of the same type provided during the lab session (either loving-kindness or mindfulness). To keep experimenters blind to meditation condition when selecting which iPod to give to participants, we created a color-coding scheme to which experimenters were blind. At the end of the survey, the experimenters noted the iPod color (out of a total of six possible colors) that had been randomly assigned to the participant. Certain iPod colors signified the loving-kindness meditation condition and other iPod colors signified the control meditation condition. The research team discovered at the end of the 3-week follow-up that four participants had inadvertently received the wrong meditation tracks. These four participants are removed from analyses on meditation behavior in the following 3 weeks.

In the control meditation condition (i.e., mindfulness), participants followed instructions to focus on their breath. They were invited to notice the physical sensations of their breath and to try to not let their mind wander off or become judgmental. In the loving-kindness meditation condition, participants followed instructions to focus on feelings of kindness, joy, and friendliness. They were invited to silently repeat a set of phrases (e.g., "May you be safe," "May you be peaceful") while thinking about someone they cared about, someone they only occasionally saw, themselves, and all people. While the intent of both practices was to develop concentration, only loving-kindness meditation focused on developing concentration toward social, positive emotions like love and compassion. The full transcript of each guided meditation used in the laboratory is available in the online supplemental materials.

Measures

Emotions (modified Differential Emotion Scale; Fredrickson, 2013). Emotions were measured during the lab session, both at baseline and after the randomized guided meditation. At baseline, participants were instructed to indicate the greatest degree that they felt the indicated emotions in the past 24 hr. After meditating, participants were instructed to report on how they felt while following the guided meditation. (Emotions were also measured at the Week 1, 2, and 3 follow-ups. Participants were instructed to report on how they generally felt during the past week and not while meditating; therefore these data are not analyzed here.) Following each of these prompts, participants reported on 11 positive emotions (amusement, love, awe, joy, gratitude, hope, inspiration, interest, pride, contentment, and compassion; each assessed by a trio of adjectives) and 10 negative emotions (anger, shame, fear, hate, disgust, embarrassment, guilt, sadness, disdain, and stress; each also assessed by a trio of adjectives) on a scale that ranged from 0 (*not at all*) to 4 (*extremely*). In the online supplemental materials, we also report analyses using a composite score based on the two trios of positive emotions most relevant to loving-kindness meditation, "love, closeness, trust" and "sympathy, concern, compassion." Participants reported extremely low levels of negative emotions following meditation (the composite of all negative emotions postmeditation $M = 0.14$, $SD = 0.22$, range = 0–1.60); thus, we restrict our analyses to the examination of positive emotions. Reliability for baseline positive emotions was $\alpha = .91$ and for postmeditation positive emotions $\alpha = .92$. All scale scores presented in this article reflect means, unless otherwise noted.

Meditation practice. Both the total number of times participants practiced meditation in the past week and the total duration of their meditation practice were assessed at the Week 1, 2, and 3 follow-ups. Participants were first asked to consult any notes they had made in their logbook. Indeed, at the lab session, participants were told,

> You'll also find a notebook in which you can record the time and duration of your meditation session. If you would like, there is also room to record your thoughts and feelings and you'll notice in the back of the journal there are emotions surveys that you can use if you would find that useful. Whatever you add to this journal may help you to complete your weekly surveys.

Participants were asked to indicate whether they had engaged in any meditation in the last week. If the response was yes, participants were then asked, "How many times did you engage in formal meditation?" (answering on a scale from 1 to 9, for 9 or more times; assessing frequency), followed by, "How much time (in minutes) did you spend on meditation since the last time you answered this question? If there were multiple episodes, make sure to add them all together" (assessing duration). If the response to the first question was no, the duration and amount variables were coded with a value of 0. We report results on these two measures, frequency and duration, separately.

Potential moderator: trait prioritizing positivity. In addition to gender and age, we tested whether trait prioritizing positivity moderated the effects of experimental condition. The prioritizing positivity scale measures the tendency to seek out positive emotional experiences when making decisions about how to organize daily life (Catalino et al., 2014). Participants indicated their agreement or disagreement on a 9-point scale (1 = *disagree strongly*, 9 = *agree strongly*) with five items,[1] including "I structure my day to maximize my happiness" and "A priority for me is experiencing happiness in everyday life" ($\alpha = .79$).

[1] The reliability of the prioritizing positivity scale was higher when the item "I admire people who base their decisions on the happiness they will gain" was removed. In the interest of scale refinement, we removed this variable from the scale and recommend future researchers to do so from this point forward. A manuscript focusing on the psychometric development (and improvement) of the prioritizing positivity scale is in preparation by Catalino and Boulton (2019).

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Results

Descriptive Statistics and Preliminary Analyses

Of the 240 participants who came for the initial laboratory session, 11 participants failed their reading comprehension check, which assessed their grasp of their randomly assigned passage, and one person did not report on their emotions following the initiation to meditation, resulting in an analysis sample of 228 participants for Hypothesis 1a. When analyses included follow-up meditation behavior outcomes (Hypotheses 1b, 1c, and 2), we further excluded four participants because they received the wrong guided meditations for home use (i.e., the meditation tracks on their Apple iPod Shuffle did not match the type of meditation they were introduced to in the laboratory), resulting in an analysis sample of 224 participants. Participants who did not complete home practice diaries, or only did so partially, were included in analyses. Two related outcomes were relevant to meditation behavior: total number of times participants had meditated (frequency) and total number of minutes participants meditated (duration). Given that participants' meditation behavior was tracked over 3 consecutive weeks, we first used multilevel modeling to test whether significant linear changes emerged in people's meditation behavior over time in the sample overall and found that they did not (see the online supplemental materials for details: participants' degree of engagement in meditation in Week 1 remained steady for Weeks 2 and 3). This null effect suggested that whatever behavior changes participants initiated in Week 1 were sustained over the 21 days. We therefore aggregated each participants' meditation behavior data across the 3 weeks, resulting in a mean score for frequency of meditation in Weeks 1–3 and a mean score for duration of time spent meditating in Weeks 1–3. Means and standard deviations for all dependent variables are provided in Table 1.

Table 1
Descriptive Statistics of Dependent Variables by Conditions and in Total

Meditation condition	Passage conditions, *M* (*SD*)		Total, *M* (*SD*)
	Control	PriPos+	
Postmeditation positive emotions[a]			
Control	1.44 (.73)	1.34 (.83)	1.39 (.79)
Loving-kindness	1.62 (.81)	1.91 (.82)	1.76 (.83)
Total	1.54 (.78)	1.59 (.87)	1.57 (.83)
Meditation minutes, Weeks 1–3[b]			
Control	38.55 (35.93)	43.77 (41.81)	41.60 (39.39)
Loving-kindness	37.82 (35.67)	47.83 (39.52)	42.44 (37.64)
Total	38.15 (35.61)	45.48 (40.73)	42.00 (38.47)
Meditation frequency, Weeks 1–3[b]			
Control	2.08 (1.83)	2.23 (1.82)	2.17 (1.82)
Loving-kindness	1.93 (1.49)	2.34 (1.94)	2.12 (1.72)
Total	2.00 (1.65)	2.28 (1.86)	2.14 (1.77)

Note. PriPos+ = prioritizing positivity plus.
[a] Excluded participants who failed the reading comprehension check. [b] Excluded participants who failed the reading comprehension check and who received the wrong meditation tracks on their Apple iPod for their weekly practice.

Hypothesis 1a: Experimental Effects on Positive Emotions During First Meditation

We first hypothesized that participants randomized to read the PriPos+ (vs. control) passage would experience more positive emotions in response to their initial exposure to loving-kindness (vs. control) meditation. We ran a two-way analysis of covariance to test the effects of passage type (PriPos+ vs. control passage—coded 1 and 0, respectively), meditation type (loving-kindness meditation vs. control meditation—coded 1 and 0, respectively) and the interaction of these two factors on self-reported postmeditation positive emotions. We controlled for baseline levels of positive emotions and report below the estimated marginal means and standard errors (conclusions remained unchanged when not controlling for baseline levels of positive emotions, see the online supplemental materials). We tested for outliers by examining the residuals in each cell of the experiment. The boxplots revealed five nonextreme outliers (more than 1.5 but less than 3 box-lengths from the edge of the box). With these observations removed,[2] the Meditation Type × Passage Type interaction was significant, $F(1, 218) = 4.86$, $p = .029$, $\eta_p^2 = .022$. Figure 2 presents the adjusted estimated means by experimental condition. Follow-up tests of the simple main effects of passage type (still controlling for baseline levels of positive emotions) revealed that in the control meditation condition, there was no difference between passage types (PriPos+ passage: $M = 1.23$, $SE = 0.08$; control passage: $M = 1.39$, $SE = 0.09$, $F(1, 218) = 1.52$, $p = .219$, $\eta_p^2 = .007$, mean difference = −.16, 95% confidence interval [CI: −0.40, 0.09]. In the loving-kindness meditation condition, participants reported marginally significantly more positive emotions in the PriPos+ condition ($M = 1.90$, $SE = 0.09$) than in the control passage condition ($M = 1.66$, $SE = 0.09$, $F(1, 218) = 3.54$, $p = .061$, $\eta_p^2 = .016$, mean difference = .24, 95% CI [−0.01, 0.49]). Follow-up tests of the simple main effects of meditation type (still controlling for baseline levels of positive emotions) revealed that participants in the control passage condition reported more positive emotions in the loving-kindness meditation condition ($M = 1.66$, $SE = 0.09$) than in the control meditation condition ($M = 1.39$, $SE = 0.09$, $F(1, 218) = 4.55$, $p = .034$, $\eta_p^2 = .020$, mean difference = .27, 95% CI [0.02, 0.53]). This was also the case in the PriPos+ condition (loving-kindness meditation $M = 1.90$, $SE = 0.09$; control meditation $M = 1.23$, $SE = 0.08$; $F(1, 218) = 28.84$, $p < .001$, $\eta_p^2 = .117$, mean difference = .67, 95% CI [0.42, 0.91]). In sum, loving-kindness meditation increased participants' experience of positive emotions compared to the control meditation (supporting the idea that our mindfulness meditation indeed did not focus as much on positive emotions) and, supporting Hypothesis 1a, this difference was even greater for participants who had just learned about judicious ways to prioritize positivity.

[2] To test for normality, we used the Shapiro–Wilk normality test, which revealed no violations in any of the four cells of the experiment. To test for homogeneity of variance, we used Levene's test, which confirmed the assumption was not violated ($p = .679$). Note that when the outliers were included the pattern of results was similar: The main effect of meditation type emerged as significant, $F(1, 223) = 17.96$, $p < .001$, $\eta_p^2 = .075$, whereas the main effect of passage type was not significant, $F(1, 223) = 0.66$, $p = .417$, $\eta_p^2 = .003$. The Meditation Type × Passage Type interaction was marginally significant, $F(1, 223) = 3.02$, $p = .084$, $\eta_p^2 = .013$.

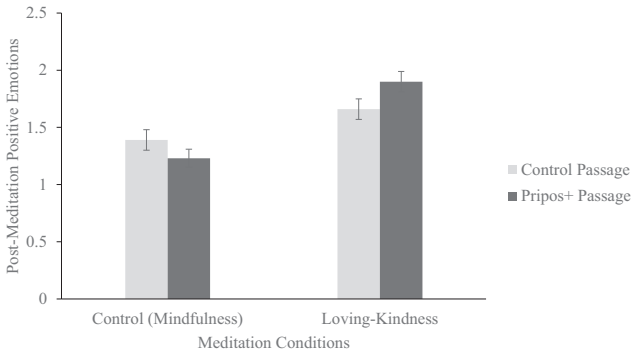

Figure 2. Adjusted mean scores of positive emotions after initial exposure to meditation, controlling for baseline positive emotions, by meditation type and passage type. Participants who failed the reading comprehension check and five outliers are excluded. Error bars denote one standard error around the mean.

In subsequent sensitivity analyses (see the online supplemental materials for details), we found that the pattern of results remained the same when the outcome variable was a composite score of the two positive emotions most relevant to loving-kindness meditation, love and compassion. In addition, we tested whether the variables gender, age, or trait levels of prioritizing positivity moderated the effects of the experiment (main effect of meditation type, main effect of passage type, interaction between passage type and meditation type), and found no evidence that they did (see the online supplemental materials). Thus, the intervention appears to be equally effective for people differing in gender, age, and dispositional levels of prioritizing positivity.

Hypothesis 1b: Experimental Effects on Future Meditation Behavior

We further hypothesized that the PriPos+ (vs. control) passage would amplify the effect of loving-kindness (vs. control) meditation on the subsequent frequency and duration of participants' practice of meditation over the ensuing 21 days. We ran a two-way analysis of variance[3] to test the effects of passage type, meditation type, and the interaction of these two factors separately on the mean frequency and duration of meditation behavior reported over 3 weeks. We tested for outliers by examining the residuals in each cell of the experiment. For the frequency of meditation, inspection of the boxplots revealed nine nonextreme and one extreme outliers. With these outliers removed, results showed no main effects of meditation type, $F(1, 208) = 0.10$, $p = .753$, $\eta_p^2 < .001$, or passage type, $F(1, 208) = 0.54$, $p = .465$, $\eta_p^2 = .003$, and no Meditation Type × Passage Type interaction, $F(1, 208) = 0.59$, $p = .443$, $\eta_p^2 = .003$, and these null results remained with outliers included. Regarding mean weekly duration of meditation (in minutes), inspection of the boxplots revealed nine nonextreme outliers and two extreme outliers. Removing these outliers, results were similar, showing no main effects of meditation type, $F(1, 207) = 0.02$, $p = .881$, $\eta_p^2 < .001$, or passage type, $F(1, 207) = 1.73$, $p = .190$, $\eta_p^2 = .008$, and no Meditation Type × Passage Type interaction, $F(1, 207) = 2.14$, $p = .145$, $\eta_p^2 = .010$, and these null results remained with outliers included. Hypothesis 1b was therefore not supported.

Hypothesis 1c: Testing for Mediation

Finally, given that Hypothesis 1a was supported but not Hypothesis 1b, we could not test Hypothesis 1c, that is, whether the experimental effects predicted in H1b were mediated by people's experience of positive emotions in response to their initial exposure to meditation.

Hypothesis 2: Predicting Future Meditation Behavior From Positive Emotions During First Meditation

We also hypothesized that greater positive emotions at initial exposure to meditation (loving-kindness and control) would forecast the subsequent frequency and duration of meditation over the ensuing 21 days. We ran a regression model[4] in which positive emotions experienced at initial exposure to meditation in the laboratory predicted meditation behavior and included experimental conditions (meditation type, passage type), their interaction, and baseline levels of positive emotions as covariates.

For frequency of meditation, the casewise diagnostic procedure revealed two outliers (>3 *SD* from the mean) and when these observations were excluded, positive emotions felt during the first meditation (i.e., in the laboratory) predicted more times spent meditating in the subsequent 3 weeks $^*b = .29$, $b = .59$, $SE\ b = .16$, 95% CI_b [.27, .90], $p < .001$. Results were similar when the identified outliers were included $^*b = .29$, $b = .64$, $SE\ b = .17$, 95% CI_b [.30, .97], $p < .001$. Descriptively, for every 1-unit increase in residualized positive emotions, there was a .59 increase in number of times spent meditating. None of the covariates entered in the model were significant (all *p*s > .41).

Regarding minutes spent meditating, the casewise diagnostic procedure revealed four outliers (>3 *SD* from the mean) and when these observations were excluded, positive emotions felt while meditating in the laboratory predicted more minutes spent meditating in the subsequent 3 weeks $^*b = .27$, $b = 11.05$, $SE\ b = 3.26$, 95% CI_b [4.63, 17.48], $p = .001$. Results were similar when the identified outliers were included $^*b = .34$, $b = 15.99$, $SE\ b = 3.63$, 95% CI_b [8.84, 23.15], $p < .001$. Descriptively, for every one unit increase in residualized positive emotions, there was about an 11 min increase in time spent meditating. Again, none of the covariates entered in the model were significant (all *p*s > .40).

Figures 3a and 3b show the predicted means for weekly meditation behavior (frequency and duration, respectively) in the 21-day follow-up period at three levels of positive emotions felt while meditating in the laboratory using weighted *b* scores. All other regression parameters are estimated at their mean.

[3] To test for normality, we used the Shapiro–Wilk normality test, which revealed violations in all four cells of the experiment for both meditation behavior outcomes. To test for homogeneity of variance, we used Levene's test, which confirmed the assumption was not violated for both meditation behavior outcomes (meditation frequency $p = .367$; meditation duration $p = .461$).

[4] We tested the assumptions of the regression models by examining the residuals. To test for normality, we visually inspected the shape of the distribution of residuals and observed some positive skew. Because regression coefficients remain unbiased if this assumption is violated, and standard errors are typically affected only if sample sizes are small, we decided to proceed in spite of this violation. To test for homogeneity of variance, we visually inspected the residuals and observed no significant violations of this assumption. To test for outliers, we used the casewise diagnostic procedure (see the main body of text for further discussion of the outliers detected).

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

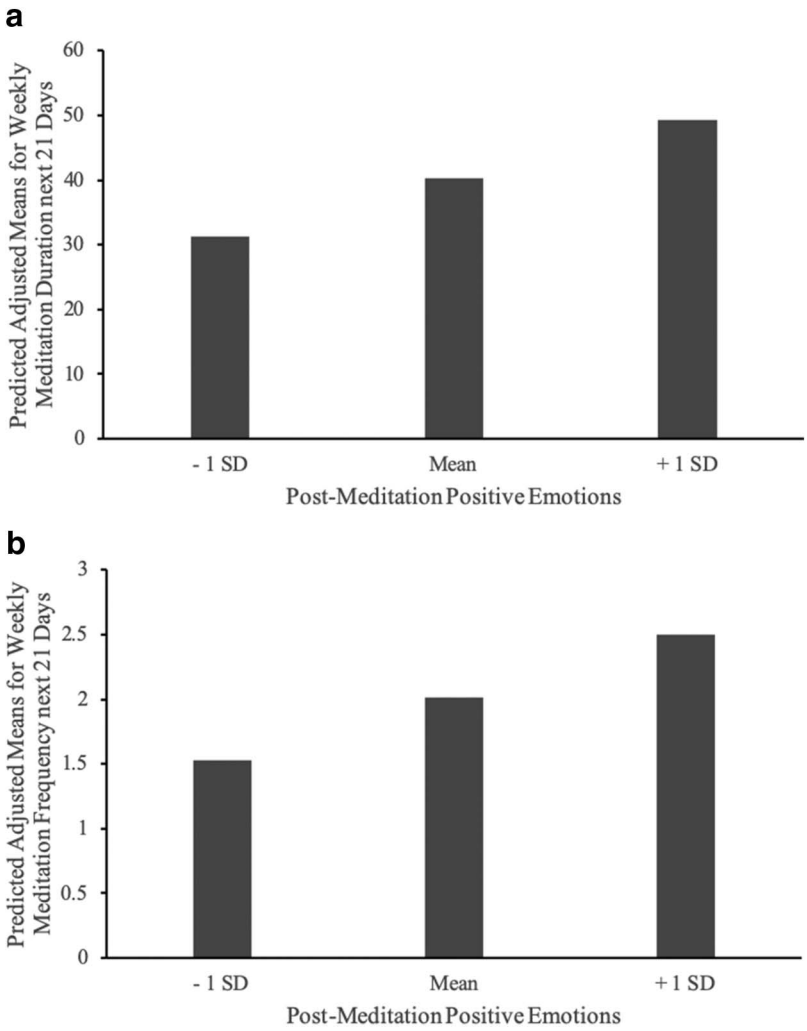

Figure 3. Predicted adjusted means for weekly (a) frequency and (b) duration of meditation behavior in the 21-day follow-up period at three levels of postmeditation positive emotions. All other parameters are estimated at their means (baseline positive emotions, conditions, and their interaction). Participants who failed the reading comprehension checks, received the wrong Apple iPod, and outliers are excluded.

For both frequency and duration of meditation behavior, the pattern of results remains the same when the predictor variable was a composite score of the two most relevant emotions for loving-kindness meditation, love and compassion, and the covariates were experimental conditions (meditation type, passage type), their interaction, and baseline levels of love and compassion (see the online supplemental materials).

Discussion

People initiate positive health behaviors with good intentions. Most people, however, fail to sustain those health behaviors in the long-term. The study reported here tests key hypotheses drawn from the upward spiral theory of lifestyle change, which illuminate factors that may better predict the successful maintenance of newly adopted positive health behaviors. Two factors were studied here. The first factor was the positive emotions experienced during a positive health behavior. Within the upward spiral model (see Figure 1), this factor is key to setting in motion the processes of repeating and maintaining a new health behavior. A second factor relates to vantage resources. A vantage resource is any individual difference that augments the degree to which a person experiences positive emotions while engaging in a positive health behavior. Here we used a large-sample ($N = 240$), randomized, tightly controlled laboratory experiment with a 3-week follow-up to assess sustained behavior engagement in a positive health behavior, namely, meditation. We found that a microintervention created to judiciously increase the vantage resource of "prioritizing positivity" (Catalino et al., 2014), PriPos+, increased participants' experiences of positive emotions in response to loving-kindness versus a control meditation (supporting Hypothesis 1a). We also found that participants who experienced greater positive emotions at initial exposure to meditation (loving-kindness and control) were more likely to choose to incorporate meditation into their daily activities (i.e., more frequently and for longer durations) over the next 3 weeks (supporting Hypothesis 2). The data thus support two key pathways in

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

the upward spiral model: Both the affect amplification pathway of the outer loop and the behavioral maintenance pathway of the inner loop (see Figure 1).

Despite the observed significant interaction effect that supports Hypothesis 1a, the effect size was small and one of the anticipated simple main effects was only marginally significant. That is, for participants assigned to loving-kindness meditation, those who received the PriPos+ microintervention reported marginally significantly more positive emotions than participants who received the Control passage. Further, the predicted interaction effect did not extend to changes in behaviors over the ensuing 3 weeks, failing to support Hypothesis 1b. We therefore could not test the hypothesized mediational pathway (Hypothesis 1c). Speculating on the observed pattern of results, we note that factors beyond those manipulated in this study may shape people's affective responses to their initial exposure to meditation. Table 1 shows, for instance, that although participants primed with the prioritizing positivity passage and exposed to loving-kindness meditation reported the greatest positive emotions, those in other experimental conditions reported positive emotions as well. We speculate that positive affect experienced during behavioral initiation may well energize subsequent behavioral efforts regardless of the source of that affect.

This study adds needed experimental data to the growing evidence that vantage resources render people more sensitive to opportunities to experience positive emotions as they undertake positive health behaviors. To our knowledge, only one prior experiment has randomized study participants to different levels of a vantage resource to test causal processes central to the upward spiral theory. That prior experiment (Van Cappellen et al., 2016) used a nasal spray in a double-blind research design to introduce synthetic oxytocin or a placebo in individuals naïve to meditation and found that oxytocin caused positive emotions experienced during meditation to heighten (in this prior study, effects emerged for both loving-kindness and mindfulness meditation, an effect mediated by increases in overall spirituality in the oxytocin condition). Here, we likewise used a double-blind research design to introduce ideas consistent with prioritizing positivity (or not) and found this psychological microintervention caused positive emotions to heighten specifically during a meditation designed to provide clear opportunities to up-regulate positive emotions (loving-kindness meditation), relative to one that did not (mindfulness meditation).

The current results join prior correlational and experimental evidence for the inner loop of the upward spiral theory that shows statistical mediation by incentive salience (i.e., research on positive spontaneous thoughts; Rice & Fredrickson, 2017a, 2017b) and prior correlational, experimental, and longitudinal evidence for the outer loop prediction that shows positive emotions build endogenous resources (Cohn, Fredrickson, Brown, Mikels, & Conway, 2009; Fredrickson et al., 2008), a subset of which may function as vantage resources. Taken together, empirical backing for the distinct processes posited in the upward spiral theory of lifestyle change has deepened.

Strengths of this study include its experimental design, rigorous control conditions, 3 weeks of follow-up data, and large sample size. These features increase the reliability and robustness of the observed findings. Alongside these many strengths, this study also has limitations. Participants were all midlife adults open to trying out meditation, which represents a critical step needed for behavior engagement. Even though beginning meditators may be drawn from a similar population, generalization to other age groups or to those uninterested in meditation is not warranted. Also, although ample past research has demonstrated that meditation practice improves well-being (e.g., Fredrickson et al., 2008, 2017), the benefits of meditation practice were not thoroughly assessed here (but see the online supplemental materials for null effects on participants' positive emotions in 21-day follow-up period.). Another limitation is that meditation behavior during the 21-day follow-up period was self-reported. Objective behavioral assessment is difficult to achieve given that participants may meditate at any time, with or without listening to guided meditations. Even so, future research would benefit from using ecological momentary assessments, triggered by bouts of meditation, to gain more reliable indicators of behavioral engagement. Ecological momentary assessments would also provide opportunities to measure positive emotions felt as a result of meditation during the maintenance follow-up period. In addition, researchers consider lifestyle change to be successful when a new health behavior is maintained for 12–24 months. Maintaining a new meditation practice over 21 days thus cannot be taken as evidence for lifestyle change. Even so, the current study meets a recent call for large-sample "shortitudinal" research designs that can produce data suitable for detecting maximal effect sizes in contexts of reciprocal causality (Dormann & Griffin, 2015). Supportive evidence from shortitudinal studies like the one reported here raise confidence that more ecologically valid longitudinal designs may be worthy investments for the currently limited resources available for translational research in the behavioral sciences. The findings reported here suggest that the emotional appeal of a new health behavior can lead to higher self-initiated behavioral engagement in the very next week, with this higher engagement sustained in subsequent weeks.

The microintervention introduced here nods to both the benefits and the drawbacks of pursuing positivity. More broadly, results from the current study contribute to the ongoing debate within affective science on whether and when the pursuit of happiness backfires. Some suggest that trying to become happier ironically makes people feel worse. For example, work by Mauss and colleagues shows that when people try to feel extreme levels of happiness during a pleasant event it backfires. In that work, participants read one of two fabricated articles before viewing a happy or sad film clip (Mauss et al., 2011). Some participants read an article about the benefits of being able to make oneself feel the "greatest amount of happiness" from moment to moment whereas others read an article that did not mention happiness at all. Compared to those in the control group, participants who tried to maximize their happiness during the happy film felt worse. By contrast, the current study provides initial evidence that, given more nuanced psychoeducation, people may indeed be able to unlock the positive emotions available in a behavior that is framed as an opportunity for pleasant experiences to arise, relative to one that lacks such framing.

A question unaddressed by the current work concerns the processes by which exposure to the PriPos+ microintervention augmented positive emotions. Several mediating mechanisms are plausible. We speculate that the manipulation taught participants to value their pleasant experiences more, and thus regard the loving-kindness meditation—an activity focused on the repetition of positive emotional phrases (e.g., "May you be peaceful," "May you be happy")—as more important. Given that loving-kindness meditation may seem saccharin or "Pollyannish" to some, the increased valuation of loving-kindness meditation may have softened participants' potential resistance toward it. Reduced resistance may have in turn allowed them to engage with the practice more deeply. In addition, the manipulation may have been effective in part because it cautioned participants from trying to

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

force themselves to feel good, a strategy that has been shown to make people feel worse (Mauss et al., 2011). In sum, we speculate that the manipulation provided wise psychoeducation on how to engage with this novel meditation practice effectively, thereby unlocking the positivity available within it. Future research is needed to fine-tune the microintervention for greater impact on positive emotions. For instance, does direct emphasis on these potential mechanisms (i.e., valuing pleasant experiences, softening resistance to pleasant experiences, not forcing pleasant feelings) strengthen the intervention? Alternatively, given the effects of narratives on attitude change (Green & Brock, 2000), might adding a story about someone who prioritizes positivity strengthen the intervention? In addition to strengthening the intervention, more precise measurement of its effects is also needed. For example, in this study we found stronger support for our first hypothesis when we focus on love and compassion, the emotions most likely to be experienced during loving-kindness meditation (see the online supplemental materials for full analyses).

Here, meditation is framed as a positive health behavior. Yet for many it is also (or instead) a spiritual practice, perhaps mandated by one's religious affiliation. As such, the results reported here may also hold relevance for sustained adherence to spiritual and religious practices (e.g., meditation, but also prayer and church attendance). Indeed, these practices often generate positive and meaningful emotions, such as love, gratitude, or awe (Van Cappellen, 2017). In turn, the very experience of these emotions, within and outside religious contexts, may represent an overlooked mechanism to explain why people who are religious sustain repeated costly behaviors over time. On the one hand, the present results suggest that spiritual and religious behaviors that foster positive emotions may have a greater likelihood of being maintained through nonconscious processes described in the upward spiral theory. On the other hand, other research has demonstrated that certain positive emotions, experienced in secular contexts, promote spiritual-type beliefs (Saroglou, Buxant, & Tilquin, 2008; Van Cappellen, Saroglou, Iweins, Piovesana, & Fredrickson, 2013), which may in turn motivate the further pursuit of spiritual behaviors. These processes, fueled by experiences of meaningful positive emotions, could be targets of future research to inform theories on the evolution of religion (e.g., Norenzayan et al., 2016).

In sum, we found that a nuanced form of psychoeducation augmented the positive emotions people experienced when they tried out loving-kindness (vs. mindfulness) meditation for the first time and, separately, that positive emotions experienced during either form of meditation forecasted the sustained practice of meditation over the ensuing weeks. Although future research is needed to replicate these findings and pinpoint underlying mechanisms, the present investigation provides the first evidence that people's enjoyment of meditation can be improved when they understand the benefits and pitfalls of prioritizing positivity in daily life and that this early enjoyment has implications for the maintenance of the practice.

References

Aarts, H., Custers, R., & Marien, H. (2008). Preparing and motivating behavior outside of awareness. *Science, 319,* 1639. http://dx.doi.org/10.1126/science.1150432

Berridge, K. C. (2007). The debate over dopamine's role in reward: The case for incentive salience. *Psychopharmacology, 191,* 391–431. http://dx.doi.org/10.1007/s00213-006-0578-x

Burke, A., Lam, C. N., Stussman, B., & Yang, H. (2017). Prevalence and patterns of use of mantra, mindfulness and spiritual meditation among adults in the United States. *BMC Complementary and Alternative Medicine, 17,* 316. http://dx.doi.org/10.1186/s12906-017-1827-8

Catalino, L. I., Algoe, S. B., & Fredrickson, B. L. (2014). Prioritizing positivity: An effective approach to pursuing happiness? *Emotion, 14,* 1155–1161. http://dx.doi.org/10.1037/a0038029

Catalino, L. I., & Boulton, A. J. (2019). *The psychometric properties of the prioritizing positivity scale*. Manuscript in preparation.

Cohn, M. A., & Fredrickson, B. L. (2010). In search of durable positive psychology interventions: Predictors and consequences of long-term positive behavior change. *The Journal of Positive Psychology, 5,* 355–366. http://dx.doi.org/10.1080/17439760.2010.508883

Cohn, M. A., Fredrickson, B. L., Brown, S. L., Mikels, J. A., & Conway, A. M. (2009). Happiness unpacked: Positive emotions increase life satisfaction by building resilience. *Emotion, 9,* 361–368. http://dx.doi.org/10.1037/a0015952

Custers, R., & Aarts, H. (2007). In search of the nonconscious sources of goal pursuit: Accessibility and positive affective valence of the goal state. *Journal of Experimental Social Psychology, 43,* 312–318. http://dx.doi.org/10.1016/j.jesp.2006.02.005

Datu, J. A. D., & King, R. B. (2016). Prioritizing positivity optimize positive emotions and life satisfaction: A three-wave longitudinal study. *Personality and Individual Differences, 96,* 111–114. http://dx.doi.org/10.1016/j.paid.2016.02.069

Dormann, C., & Griffin, M. A. (2015). Optimal time lags in panel studies. *Psychological Methods, 20,* 489–505. http://dx.doi.org/10.1037/met0000041

Ford, B. Q., Mauss, I. B., & Gruber, J. (2015). Valuing happiness is associated with bipolar disorder. *Emotion, 15,* 211–222. http://dx.doi.org/10.1037/emo0000048

Ford, B. Q., Shallcross, A. J., Mauss, I. B., Floerke, V. A., & Gruber, J. (2014). Desperately seeking happiness: Valuing happiness is associated with symptoms and diagnosis of depression. *Journal of Social and Clinical Psychology, 33,* 890–905. http://dx.doi.org/10.1521/jscp.2014.33.10.890

Fredrickson, B. L. (1998). What good are positive emotions? *Review of General Psychology, 2,* 300–319. http://dx.doi.org/10.1037/1089-2680.2.3.300

Fredrickson, B. L. (2013). Positive emotions broaden and build. *Advances in Experimental Social Psychology, 47,* 1–53. http://dx.doi.org/10.1016/B978-0-12-407236-7.00001-2

Fredrickson, B. L., Boulton, A. J., Firestine, A. M., Van Cappellen, P., Algoe, S. B., Brantley, M. M., . . . Salzberg, S. (2017). Positive emotion correlates of meditation practice: A comparison of mindfulness meditation and loving-kindness meditation. *Mindfulness, 8,* 1623–1633. http://dx.doi.org/10.1007/s12671-017-0735-9

Fredrickson, B. L., Cohn, M. A., Coffey, K. A., Pek, J., & Finkel, S. M. (2008). Open hearts build lives: Positive emotions, induced through loving-kindness meditation, build consequential personal resources. *Journal of Personality and Social Psychology, 95,* 1045–1062. http://dx.doi.org/10.1037/a0013262

Fredrickson, B. L., & Kok, B. E. (2018). The upward spiral stands steady: Response to Nickerson (2018). *Psychological Science, 29,* 467–470. http://dx.doi.org/10.1177/0956797617707319

Galante, J., Galante, I., Bekkers, M. J., & Gallacher, J. (2014). Effect of kindness-based meditation on health and well-being: A systematic review and meta-analysis. *Journal of Consulting and Clinical Psychology, 82,* 1101–1114. http://dx.doi.org/10.1037/a0037249

Green, M. C., & Brock, T. C. (2000). The role of transportation in the persuasiveness of public narratives. *Journal of Personality and Social Psychology, 79,* 701–721.

Isgett, S. F., Kok, B. E., Baczkowski, B., Algoe, S. B., Grewen, K. M., & Fredrickson, B. L. (2017). Influences of oxytocin and respiratory sinus arrhythmia on social behavior and emotions in daily life. *Emotion, 17,* 1156–1165. http://dx.doi.org/10.1037/emo0000301

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Iso-Ahola, S. E. (2013). Exercise: Why it is a challenge for both the nonconscious and conscious mind. *Review of General Psychology, 17,* 93–110. http://dx.doi.org/10.1037/a0030657

Kiken, L. G., Lundberg, K. B., & Fredrickson, B. L. (2017). Being present and enjoying it: Dispositional mindfulness and savoring the moment are distinct, interactive predictors of positive emotions and psychological health. *Mindfulness, 8,* 1280–1290. http://dx.doi.org/10.1007/s12671-017-0704-3

Kok, B. E., Coffey, K. A., Cohn, M. A., Catalino, L. I., Vacharkulksemsuk, T., Algoe, S. B., . . . Fredrickson, B. L. (2013). How positive emotions build physical health: Perceived positive social connections account for the upward spiral between positive emotions and vagal tone. *Psychological Science, 24,* 1123–1132. http://dx.doi.org/10.1177/0956797612470827

Kok, B. E., & Fredrickson, B. L. (2015). Evidence for the upward spiral stands steady: A response to Heathers, Brown, Coyne, and Friedman (2015). *Psychological Science, 26,* 1144–1146. http://dx.doi.org/10.1177/0956797615584304

Lawton, R., Conner, M., & McEachan, R. (2009). Desire or reason: Predicting health behaviors from affective and cognitive attitudes. *Health Psychology, 28,* 56–65. http://dx.doi.org/10.1037/a0013424

Layous, K., Nelson, S. K., Kurtz, J. L., & Lyubomirsky, S. (2016). What triggers prosocial effort? A positive feedback loop between positive activities, kindness, and well-being. *The Journal of Positive Psychology, 12,* 385–398. http://dx.doi.org/10.1080/17439760.2016.1198924

Marteau, T. M., Hollands, G. J., & Fletcher, P. C. (2012). Changing human behavior to prevent disease: The importance of targeting automatic processes. *Science, 337,* 1492–1495. http://dx.doi.org/10.1126/science.1226918

Masci, D., & Hackett, C. (2018). *Meditation is common across many religious groups in the U.S. Pew Research Center.* Retrieved from http://pewrsr.ch/2lHc0HC

Mauss, I. B., Tamir, M., Anderson, C. L., & Savino, N. S. (2011). Can seeking happiness make people unhappy? Paradoxical effects of valuing happiness. *Emotion, 11,* 807–815. http://dx.doi.org/10.1037/a0022010

Norenzayan, A., Shariff, A. F., Gervais, W. M., Willard, A. K., McNamara, R. A., Slingerland, E., & Henrich, J. (2016). The cultural evolution of prosocial religions. *Behavioral and Brain Sciences, 39,* e1. http://dx.doi.org/10.1017/S0140525X14001356

Papies, E. K., & Aarts, H. (2011). Nonconscious self-regulation, or the automatic pilot of human behavior. In K. D. Vohs & R. F. Baumeister (Eds.), *Self-Regulation: Research, Theory, and Applications* (pp. 125–142). New York, NY: Guilford Press.

Pluess, M., & Belsky, J. (2013). Vantage sensitivity: Individual differences in response to positive experiences. *Psychological Bulletin, 139,* 901–916. http://dx.doi.org/10.1037/a0030196

Rhodes, R. E., & Dickau, L. (2012). Experimental evidence for the intention-behavior relationship in the physical activity domain: A meta-analysis. *Health Psychology, 31,* 724–727. http://dx.doi.org/10.1037/a0027290

Rhodes, R. E., Fiala, B., & Conner, M. (2009). A review and meta-analysis of affective judgments and physical activity in adult populations. *Annals of Behavioral Medicine, 38,* 180–204. http://dx.doi.org/10.1007/s12160-009-9147-y

Rhodes, R. E., & Kates, A. (2015). Can the affective response to exercise predict future motives and physical activity behavior? A systematic review of published evidence. *Annals of Behavioral Medicine, 49,* 715–731. http://dx.doi.org/10.1007/s12160-015-9704-5

Rice, E. L., & Fredrickson, B. L. (2017a). Do positive spontaneous thoughts function as incentive salience? *Emotion, 17,* 840–855. http://dx.doi.org/10.1037/emo0000284

Rice, E. L., & Fredrickson, B. L. (2017b). Of passions and positive spontaneous thoughts. *Cognitive Therapy and Research, 41,* 350–361. http://dx.doi.org/10.1007/s10608-016-9755-3

Rothman, A. J. (2000). Toward a theory-based analysis of behavioral maintenance. *Health Psychology, 19,* 64–69. http://dx.doi.org/10.1037/0278-6133.19.Suppl1.64

Rothman, A. J., Baldwin, A. S., Hertel, A. W., & Fuglestad, P. T. (2011). Self-regulation and behavior change: Disentangling behavioral initiation and behavioral maintenance. In K. D. Vohs & R. F. Baumeister (Eds.), *Self-regulation: Research, theory, and applications* (pp. 106–122). New York, NY: Guilford Press.

Saroglou, V., Buxant, C., & Tilquin, J. (2008). Positive emotions as leading to religion and spirituality. *The Journal of Positive Psychology, 3,* 165–173. http://dx.doi.org/10.1080/17439760801998737

Schneider, S. H., Khachadurian, A. K., Amorosa, L. F., Clemow, L., & Ruderman, N. B. (1992). Ten-year experience with an exercise-based outpatient life-style modification program in the treatment of diabetes mellitus. *Diabetes Care, 15,* 1800–1810. http://dx.doi.org/10.2337/diacare.15.11.1800

Sheeran, P., Gollwitzer, P. M., & Bargh, J. A. (2013). Nonconscious processes and health. *Health Psychology, 32,* 460–473. http://dx.doi.org/10.1037/a0029203

Van Cappellen, P. (2017). Rethinking self-transcendent positive emotions and religion: Insights from psychological and biblical research. *Psychology of Religion and Spirituality, 9,* 254–263. http://dx.doi.org/10.1037/rel0000101

Van Cappellen, P., Rice, E. L., Catalino, L. I., & Fredrickson, B. L. (2018). Positive affective processes underlie positive health behaviour change. *Psychology & Health, 33,* 77–97. http://dx.doi.org/10.1080/08870446.2017.1320798

Van Cappellen, P., Saroglou, V., Iweins, C., Piovesana, M., & Fredrickson, B. L. (2013). Self-transcendent positive emotions increase spirituality through basic world assumptions. *Cognition and Emotion, 27,* 1378–1394. http://dx.doi.org/10.1080/02699931.2013.787395

Van Cappellen, P., Way, B. M., Isgett, S. F., & Fredrickson, B. L. (2016). Effects of oxytocin administration on spirituality and emotional responses to meditation. *Social Cognitive and Affective Neuroscience, 11,* 1579–1587. http://dx.doi.org/10.1093/scan/nsw078

Williams, D. M., Dunsiger, S., Ciccolo, J. T., Lewis, B. A., Albrecht, A. E., & Marcus, B. H. (2008). Acute affective response to a moderate-intensity exercise stimulus predicts physical activity participation 6 and 12 months later. *Psychology of Sport and Exercise, 9,* 231–245. http://dx.doi.org/10.1016/j.psychsport.2007.04.002

Williams, D. M., Dunsiger, S., Jennings, E. G., & Marcus, B. H. (2012). Does affective valence during and immediately following a 10-min walk predict concurrent and future physical activity? *Annals of Behavioral Medicine, 44,* 43–51. http://dx.doi.org/10.1007/s12160-012-9362-9

Wilson, K., & Brookfield, D. (2009). Effect of goal setting on motivation and adherence in a six-week exercise program. *International Journal of Sport and Exercise Psychology, 7,* 89–100. http://dx.doi.org/10.1080/1612197X.2009.9671894

Woolley, K., & Fishbach, A. (2017). Immediate rewards predict adherence to long-term goals. *Personality and Social Psychology Bulletin, 43,* 151–162. http://dx.doi.org/10.1177/0146167216676480

(*Appendix follows*)

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Appendix

Material for Experimental Manipulation of Vantage Resource (Prioritizing Positivity Plus) and Control Condition

Prioritizing Positivity^{+} Reading Passage

SCIENTIFIC AMERICAN

Mind Matters – January 29, 2012

Prioritizing Positive Emotions is Beneficial
By Francesca Orbizzi

What is the best way to organize your day? Scientific evidence suggests that when making decisions about how to spend your time, you should take into account your potential to experience positive emotions. Growing evidence suggests that good feelings lead to good health. Yet research also shows that if you simply "will" or "wish" yourself to feel positive emotions, it can backfire, ironically making you feel worse. By contrast, a recent study by Andrea McDevitt of the University of Arizona finds that people who devote time each day to activities that generate positive emotions (e.g. interest, amusement) fare the best. They experience more vitality, less stress, and have lower levels of inflammation in the body, a biological indicator of physical health. Setting aside time each day for feel-good activities, then, may be as vital to your health as eating your vegetables and staying active.

In the text box below, please make an argument for why one's potential to experience positive emotions should be one of the primary considerations when making decisions about which activities to engage in after work or deciding which career to pursue. Feel free to call upon personal examples from your own life and other people you know, as well as basic logic. The length of the arguments should be about 1-2 paragraphs long.

Control Reading Passage

SCIENTIFIC AMERICAN

Mind Matters – January 29, 2012

The Neuroscience of Positive Emotions
By Francesca Orbizzi

In recent years, psychological scientists have been studying the physiological underpinnings of positive emotions, and perhaps some of the most consistent findings in the literature point to the involvement of the left hemisphere of the prefrontal cortex. For instance, when people are induced to experience good feelings in the laboratory, they show increased activity in their left prefrontal cortex, in comparison to their right prefrontal cortex. Similarly, when the left prefrontal cortex is temporarily paralyzed, positive emotions are affected. In a study carried out by Andrea McDevitt of the University of Arizona, participants were injected with a substance that paralyzed the left prefrontal cortex. These participants also displayed significant deficits in positive emotions (e.g. interest, amusement). When the substance eventually wore off, however, participants began experiencing typical levels of positive emotions. Experiencing feel-good moments, then, seems to be aided by very specific brain areas.

In the text box below, please make an argument for why continuing to conduct scientific research on the brain is worthwhile. Feel free to call upon personal examples from your own life and other people you know, as well as basic logic. The length of the arguments should be about 1-2 paragraphs long.

Received January 18, 2019
Revision received August 13, 2019
Accepted August 13, 2019 ■

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.