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ABSTRACT

We explored a counterintuitive approach to increasing happiness: Imagining time as scarce. Participants were randomly assigned to try to live this month (LTM) like it was their last in their current city (time scarcity intervention; $n = 69$) or to keep track of their daily activities (neutral control; $n = 70$). Each group reported their activities and their psychological need satisfaction (connectedness, competence, and autonomy) weekly for 4 weeks. At baseline, post-intervention, and 2-week follow-up, participants reported their well-being – a composite of life satisfaction, positive emotions, and negative emotions. Participants in the LTM condition increased in well-being over time compared to the control group. Furthermore, mediation analyses indicated that these differences in well-being were explained by greater connectedness, competence, and autonomy. Thus, imagining time as scarce prompted people to seize the moment and extract greater well-being from their lives.

The curious thing was that with the loss of Paris threatening, we became more Parisian. The same thing, I had noted, had happened in our last few months in New York. The city, which had become increasingly difficult, suddenly seemed like a playground – people eating outside, in T-shirts and shorts and sneakers in the Italian restaurants in SoHo; the open-all-nightness of New York; the sweet funkiness – registered as it hadn't in years.

Adam Gopnik, *Paris to the Moon*

'Gather ye rosebuds while ye may' advises seventeenth century poet Robert Herrick – emphasizing both the inescapable brevity of life and the need to enjoy it while it lasts. Indeed, research supports the age-old wisdom that people who savor the moment derive greater enjoyment and happiness from life (Jose, Lim, & Bryant, 2012; Quoidbach, Berry, Hansenne, & Mikolajczak, 2010). Given substantial evidence demonstrating the benefits of happiness on relationships, health, and work, encouraging people to appreciate daily events is worthwhile advice.

However, both anecdotal and empirical evidence suggest that savoring everyday life is often challenging. Even the most beautiful or noteworthy events are susceptible to the process of hedonic adaptation, whereby they lose their emotional impact over time and through repeated exposure (Lyubomirsky, 2011). In addition, the demands of daily life urge people to multitask or leave them distracted (Killingsworth & Gilbert, 2010), making savoring difficult. Building on previous theoretical and empirical work, the

current study tests a little-studied strategy for savoring the moment that Herrick's verses vividly emphasize – a deliberate focus on the scarcity of time.

Savoring and savoring interventions

Savoring is a type of emotion regulation in which people recognize and amplify the impact of positive events on positive emotions by responding in cognitively and behaviorally receptive ways (e.g. by being present and non-distracted during a positive moment with one's family or choosing to linger in an awe-inspiring location; Bryant & Veroff, 2007; Quoidbach, Mikolajczak, & Gross, 2015). 'Savoring interventions' are designed to encourage people's awareness of and receptivity to positive events. Past evidence-based approaches to enhancing savoring have included a direct and intentional focus on increasing savoring (i.e. through journaling about savoring efforts [Hurley & Kwon, 2012] or counting one's blessings [Emmons & McCullough, 2003]) or indirect strategies such as limiting exposure to something pleasurable (i.e. chocolate) to enhance its enjoyment (Quoidbach & Dunn, 2013), and, similarly, imagining what life would be like without a significant other (Koo, Algoe, Wilson, & Gilbert, 2008; Lyubomirsky, Sousa, & Dickerhoof, 2006; Suddendorf & Corballis, 2007). Researchers have also designed successful techniques to help people appreciate their pasts

(e.g. positive reminiscence; Bryant, Smart, & King, 2005 or positively anticipate their futures (Quoidbach, Wood, & Hansenne, 2009; Suddendorf & Corballis, 2007). The current investigation focuses on a previously untested strategy for fostering savoring in the present.

Activating a sense of temporal scarcity

As the epigraph suggests, having a limited amount of time left in Paris and New York increased the author's appreciation of his surroundings. Indeed, according to the scarcity principle, when a resource is limited, the value of it increases (Cialdini, 2001). Conversely, resources that are in ample supply have little value because they are readily obtainable (Quoidbach, Dunn, Hansenne, & Bustin, 2015). Thus, if people view time in a certain place or with a certain person as limited (i.e. if they are traveling or moving soon), they may relish each moment to a greater degree (see also Carstensen, Isaacowitz, & Charles, 1999). An experiment that randomly assigned students in their last semester of college to receive a description of graduation as occurring very soon (i.e. 'only 1200 h remain') versus far away (i.e. 'still have 1/10th of a year left') found that those in the 'graduating soon' condition engaged in relatively more college-oriented behaviors in their remaining time and reported relatively higher levels of happiness (Kurtz, 2008). We seek to extend this work to explore a more general and more broadly applicable strategy – that is, whether simply asking people to assume that time is scarce in a given location will show the same effects as framing time as limited when an actual life phase, like college, is ending. Specifically, we asked participants to imagine having only 30 days left before moving away and to intentionally engage in activities and spend time with people they will miss after they are gone.

Proposed mechanism: Need satisfaction

We predict that inducing time scarcity will enhance well-being in part because it will increase an individual's receptivity to the positive aspects of his or her surroundings, including locations, events, and people. Additionally, we explore a previously untested hypothesis – namely, that the individual's increased receptivity will in turn facilitate psychological need satisfaction, which will drive changes in well-being. Self-determination theory proposes that people have three fundamental psychological needs that promote optimal motivation, development, and well-being (Ryan & Deci, 2000): Autonomy (feeling in control of one's own actions), competence (feeling skilled and effective), and connectedness (feeling close and connected to others). When people take action to savor their surroundings, including their nearby friends, family, and

colleagues, they may feel like they are just where they want to be – making their own choices (e.g. spending their last week-end relishing the outdoors), effectively managing their lives (e.g. finally finishing that work project), and engaging in meaningful relationships (e.g. making plans for more outings with friends), thus satisfying their needs for autonomy, competence, and connectedness, respectively. Alternatively, when people distractedly move through their days – or worse, repetitively focus on their days' negative aspects – they may feel forced or trapped in their current situation, ineffective in managing daily tasks, and unfulfilled by their relationships (e.g. Killingsworth & Gilbert, 2010). Although research has shown that savoring enhances well-being, no studies to our knowledge have tested whether psychological need satisfaction may be driving these effects.

The present research

In a 4-week-long experiment, we tested whether students prompted to imagine that they were moving in one month – thereby activating a sense of temporal scarcity – would show greater global well-being over time than students asked to list their weekly activities. Additionally, we tested a mechanism by which this savoring strategy might boost well-being (i.e. via need satisfaction), as well as the duration of the effect with a 2-week follow-up.

Method

Participants

Participants were 139 undergraduate students ($M_{age} = 18.73$, SD = 2.24) at a large mid-Atlantic university who were given course credit in exchange for their participation. They were mostly female (86.3%), White (84.2%), and first-year students (65.7%). Twenty-two participants failed to complete the post-intervention time point (remaining $N = 117$), but the attrition was evenly spread across gender, $\chi^2(1) = 0.45$, $p = 0.50$, ethnic background, $\chi^2(5) = 3.41$, $p = 0.64$, and condition, $\chi^2(1) = 2.05$, $p = 0.15$. Twenty-eight participants failed to complete the follow-up time point (remaining $N = 111$) and again, the attrition was evenly spread across gender, $\chi^2(1) = 0.01$, $p = 0.92$, ethnic background, $\chi^2(5) = 3.86$, $p = 0.57$, and condition, $\chi^2(1) = 0.22$, $p = 0.64$. Based on previous research, we expected a medium effect size to represent the difference in well-being between the intervention and control groups (Cohen's $d = 0.61$; Sin & Lyubomirsky, 2009) and sought to have 70 participants per group to achieve over 90% power. We planned to recruit as many participants as possible in one quarter of subject pool participation and then to recruit in a subsequent quarter if we had not reached 70 participants

per cell. We were able to complete recruitment in our first quarter of data collection.[1]

Design and procedure

The study, conducted entirely online, consisted of a 4-week intervention period and a follow-up assessment 2 weeks later, with a total duration of 6 weeks. The 2-week follow-up period was chosen out of convenience – we needed to include enough time to recruit a sufficient number of participants and have them complete the study within the semester. Upon logging in to the study website for the first time, students were randomly assigned to one of two possible conditions: living this month like it was their last in their college town for a while ('live this month' [LTM]; $n = 70$) or keeping track of what they do over the course of the week (the neutral comparison condition; $n = 69$).[2] Our study website used simple random assignment, such that each participant had equal chance of being assigned to each condition, regardless of the assignment of previous participants. To minimize potential demand effects, all participants were told that they would engage in positive practices designed to increase well-being.

Participants in the LTM condition were administered the following instructions:

> Think about where you live right now. Consider all of the reasons that you like this area – special people, specific restaurants, places that are remarkably beautiful. Now, imagine that you will be moving far away in 30 days [countdown days depending on how far participants are in the study – e.g. 23 days a week after the first day]. Plan the next 30 days [countdown] like they will be your last chance for a long while to enjoy your surroundings (e.g. people, places, other comforts). During this month, do all of the things you are going to miss while you're away. For example, get in touch with friends who are special to you and spend time in the spots that have made your current location feel like home to you. Seize the moment and take the time to enjoy what you love most about where you live, work, and study.

Next, participants were told that they do not need to spend a lot of money or extra time to live their lives in this way and that, as much as they can, they should try to actively appreciate and savor the activities they do while they do them. Lastly, they were asked to keep track of what they did and the thoughts and emotions they experienced, as they would be reporting back weekly on their activities and experiences. When participants logged back into the website the following week, they wrote for 8 min about what they did, with whom they spent time (if anyone), and what thoughts and emotions they experienced. The following is an example from one participant in the LTM condition:

> During this week I enjoyed the beautiful campus I live on by doing many different things. I walked around campus

to classes instead of taking the bus. I sat on the quad and enjoyed the scenery. I also visited skyline drive off campus with my boyfriend to stargaze. We went to dinner off campus in downtown Harrisonburg. I went shopping and spent time with my roommate watching movies and eating Taco Bell. I spent time with my friend Casey studying the bible like we do every week and tried to get the most out of it as much as I could. I enjoyed surprising my boyfriend for his birthday with all of his friends waiting to sing happy birthday and. Focusing on others gives me a sense of purpose. I worked on homework and studied a lot. I did well on my health exam after studying very hard which was a great accomplishment. I was productive but didn't spend too much time doing work without spending time with friends.

Participants in the control group were given the following instructions:

> During the next 7 days, keep track of your daily activities. You do not need to remember who you were with or how you might have felt during that time. Instead, just remember factual information about what you did. Do not alter your routine in any way; simply keep track of what you do. When you log back in to the study, you will be asked to write an outline of what you did. For example: Monday: Went to school, gave a presentation in class, went to the gym, ate dinner, did homework, watched tv, went to bed. Tuesday: Went to work, had a meeting for new student organization, did homework, etc. Only the facts are important.

Upon logging back into the study website the following week, they wrote for 8 min about the activities they had done without considering their emotions or opinions pertaining to their plans. The following is an example from one participant in the control group:

> Monday I went to lunch with a sorority sister, worked out, hungout with my hallmates and attended classes.

> Tuesday I went to lunch with another sorority sister, met my group at carrier library for my psych project and worked with them for a few house. I went to my 5 o clock math class. Then went to Urec with my friend Rachel. When we got back to the dorm, we did hw together.

> On Wednesday, I met with some girls for lunch, attended classes, napped inbetween and went to a sorority meeting afterwards. Late at night I watched tv on my computer.

> Thursday two of my classes were canceled so I slept ALOT. Literally I stayed in bed and watched Modern Family until 4:30 when I got ready for 5 pm math class. I went to carrier to meet for my project afterwards and then met with my sorority group to study for our national test. At night, my friend and I watched tv and did our nails.

> On Friday, I went to my GCOM class and got my grade back for my speech (A) and I was so excited! I spent the day with my roommate getting coffee and walking around campus. We hungout in TDU until 4 pm. We then went shopping at wall mart and had a rough time with the bus schedule. We bought halloween stuff and arts and craft materials. When we finally returned from that

Table 1. Well-being means (standard deviations) by condition and time point.

	Baseline (T$_1$)		Post-intervention (T$_5$)		Follow-up (T$_6$)	
	n	M(SD)	n	M(SD)	n	M(SD)
Live this month	70	−0.11 (0.82)	62	0.07 (0.90)	57	0.35 (0.88)
Control	69	−0.05 (0.93)	55	−0.002 (1.00)	54	0.17 (0.99)

adventure, we watched a movie in my friends room and made calendars that we found on Pinterest. Afterwards, we did some cleaning and went to sleep.

Saturday was the start of family weekend. I woke up and went for a jog through campus because my family wasn't coming. Then, I showered and got ready for the game. My friends family was here and they brought us tailgate food that we had in our dorm rooms. Then my roommate and I attended the game together. We sat with just ourselves but still had a blast! The dukes won. After the game, I went home and tried to do hw but ended up watching tv and then getting dinner with a hallmate.

After reporting on their activities, all participants completed the Brief Measure of Psychological Needs (Sheldon & Hilpert, 2012) and received instructions to engage in the activity again during the following week (except during the last time point). The need satisfaction items were averaged across the middle time points and the composite was used to assess mediation (Cronbach's αs > 0.79 across time points). At baseline, post-intervention, and follow-up, participants completed measures of the outcome variables – namely, we assessed life satisfaction with the Satisfaction with Life Scale (αs ≥ 0.86 for each time point; Diener, Emmons, Larsen, & Griffin, 1985), and positive and negative emotions with the Modified Differential Emotions Scale (αs > 0.83 for each subscale at each time point; Fredrickson, Tugade, Waugh, & Larkin, 2003). We standardized life satisfaction, positive emotions, and reverse-scored negative emotions separately and combined into a well-being composite for analyses (Diener, Suh, Lucas, & Smith, 1999). See Table 1 for well-being means by condition at baseline, post-intervention, and follow-up time points.

Lastly, two independent coders rated participants' written responses in the LTM condition after the first week to explore what participants actually did in this condition. We found adequate agreement on whether participants spent time with a romantic partner (Cohen's κ = 0.69) or family (κ = 0.72), but less agreement on whether they spent time with friends (κ = 0.52) or time alone (κ = 0.56; Garson, 2013). We also found adequate agreement on whether participants shared a meal with another person (κ = 0.64), but much less agreement on whether participants interacted with nature (κ = 0.39), spent time reflecting (κ = 0.25), did something new (κ = 0.38), or did something familiar to them (κ = −0.04). To improve agreement, we included ratings from a new independent coder and checked whether agreement was better between the third (new) coder and

either of two original coders, but it was not. We did not directly ask participants to state whether they engaged in a familiar or new activity or whether they interacted with nature; thus, there was sufficient ambiguity to undermine reliable ratings of those particular activities.

Results

Analyses of baseline well-being (WB) revealed no significant differences by condition, $t(137) = -0.42$, $p = 0.68$ (LTM dummy-coded as '1'), sex, $t(137) = 1.34$, $p = 0.18$, ethnicity, $F(5, 133) = 1.12$, $p = 0.35$, or between participants who did versus did not complete the post-intervention, $t(137) = 0.28$, $p = 0.78$, and follow-up time points, $t(137) = -1.15$, $p = 0.25$.

During the first week of the activity, coders indicated that 15.2% of participants in the LTM condition spent time with a romantic partner, 87.9% spent time with friends, 34.8% spent time with family, 22.7% spent time alone, and 33.3% shared a meal with another person.

To assess within-person changes in WB over time and condition differences in WB trajectories, we estimated multilevel growth models (Pinheiro & Bates, 2014; Singer & Willett, 2003). Participants in the LTM condition showed steeper gains in linear WB than the control group, $\gamma_{11} = 0.11$, SE = 0.06, $t(228) = 2.00$, $p = 0.05$, 95% CI [0.002, 0.22], $d = 0.25$, which also showed linear gains in well-being over time, $\gamma_{10} = 0.09$, SE = 0.04, $t(228) = 2.13$, $p = 0.03$, 95% CI [0.007, 0.16], $d = 0.21$. Thus, by the end of the intervention, participants in the LTM condition increased in well-being by nearly a half a standard deviation ($d = 0.46$), whereas those in the control group increased in well-being by less than half as much ($d = 0.21$).[3]

Using Preacher and Hayes (2008) recommended procedures, we estimated bootstrap bias-corrected confidence intervals (with 5000 bootstrapped samples) for the specific indirect effect of condition (LTM = 1; Control = 0) on post-intervention and follow-up well-being via average level of need satisfaction throughout the intervention (see Figures 1 and 2 for OLS regression coefficients). The bootstrap analyses supported our prediction of a positive indirect effect of the LTM condition on well-being via need satisfaction for both the post-intervention, 95% CI [0.03, 0.27], and follow-up, [0.002, 0.19], time points, suggesting that the LTM condition prompted greater need satisfaction than the control group, which precipitated higher well-being at post-intervention and follow-up.
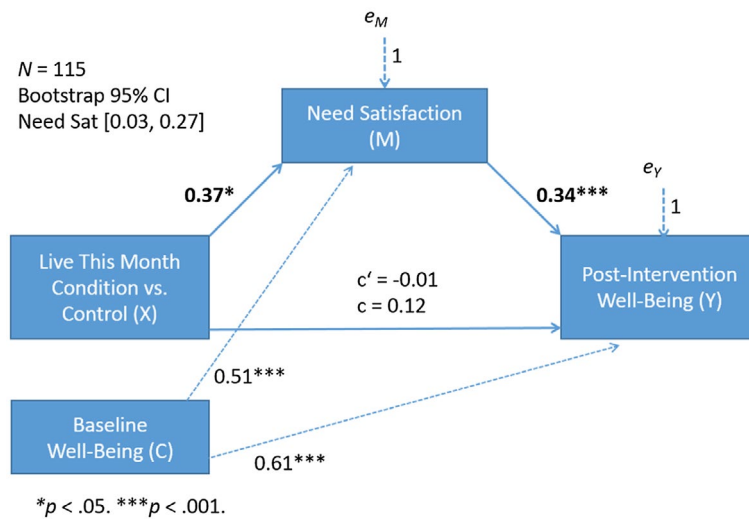
Figure 1. Effect of LTM condition (versus control group) on post-intervention well-being via average need satisfaction, controlling for baseline well-being.
Note: All continuous variables (need satisfaction, baseline well-being, and post-intervention well-being are standardized.
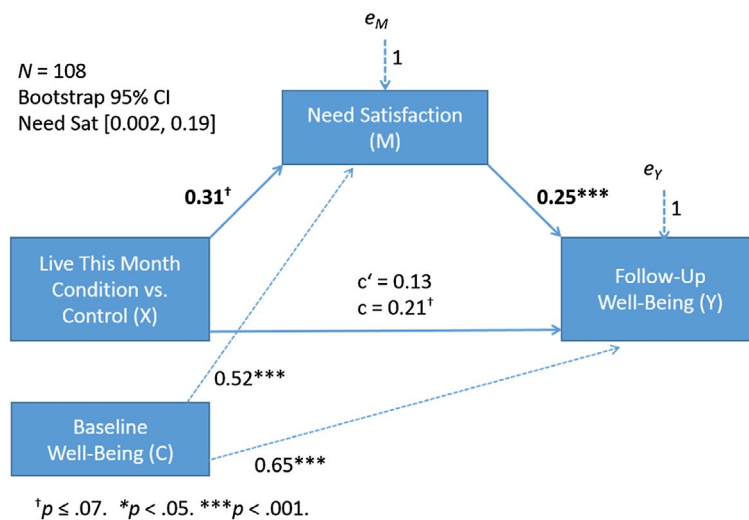

Figure 2. Effect of LTM condition (versus control group) on follow-up well-being via average need satisfaction, controlling for baseline well-being.
Note: All continuous variables (need satisfaction, baseline well-being, and follow-up well-being are standardized.

Discussion

College students who were prompted to savor the next 30 days showed steeper gains in well-being over time than students in the control group, thus supporting our prediction that framing time as limited helps people derive greater happiness from their surroundings. While previous research found that this strategy was effective for students several weeks prior to their college graduation, when the move was imminent (Kurtz, 2008), the current findings suggest that this strategy has broader utility. Our sample was primarily college freshmen, who still have an abundance of time left in college, and yet they could still mentally simulate the experience of scarcity. Additionally, we found one mechanism by which savoring enhances well-being – by leading individuals to feel more connected, competent, and in control.

Whereas activities like intentionally thinking gratefully or optimistically are intuitively positive, thinking about time scarcity is a counterintuitive way of increasing happiness because it involves the contemplation of an upcoming loss (see also Koo et al., 2008). Indeed, people tend to underestimate the degree to which thinking about time scarcity will make them feel happy and overestimate the degree to which it will make them feel sad, perhaps

because they fixate on the impending loss (Kurtz, 2006; Wilson & Gilbert, 2005). The practice of manufacturing scarcity is a 'stealth' counterintuitive happiness strategy that works in spite of individuals' assumptions (who tend to believe it will be bad for them), and thus, succeeds in spite of the placebo effect that plagues other straightforwardly positive interventions such as practicing gratitude or optimism.

Although the current study demonstrated increases in well-being after thinking about time as limited, other studies have suggested that thinking about endings (e.g. visiting a place of personal significance for the last time) elicits mixed emotions – higher positive affect, but also higher negative affect (Ersner-Hershfield, Mikels, Sullivan, & Carstensen, 2008). Additionally, certain types of time scarcity (e.g. too little time to accomplish a specific goal) can have detrimental consequences like increased stress and cognitive depletion (Mani, Mullainathan, Shafir, & Zhao, 2013; Shah, Mullainathan, & Shafir, 2012). In contrast, we did not observe increases in negative affect over the course of our study. Possibly, because time was not actually limited for our participants, they were able to extract positivity from their environments without the poignancy or stress that accompanies real endings. Furthermore, our study called for more than just using one's imagination; hence, participants' actual positive experiences during the course of the month-long study period may have offset any bittersweet feelings brought about by imagining a faraway move. Future studies could tease apart the emotional effects of different types of time scarcity inductions (e.g. involving imagination in the laboratory versus savoring in day-to-day naturalistic settings) and their proximity to real endings (e.g. knowing that college will not last forever may help one savor the moment as a freshman and sophomore, but might induce feelings of sadness as graduation draws nearer). In addition, future studies could employ experience sampling or day reconstruction methodology to track the moment-to-moment thoughts and emotions of people in the 'LTM' condition. For example, we currently do not know whether or how often they were actually thinking about time scarcity. Another possibility is that they experienced waves of negative emotions (such as sadness or anxiety) or at least nostalgic, bittersweet feelings that were not perceptible in our weekly reports.

In addition, in the current study, we cannot be sure whether our time scarcity manipulation boosted need satisfaction and global well-being because it prompted people to engage in more pleasant activities or because it prompted the active appreciation and enjoyment of those activities. Specifically, our experimental design leads us to conclude that our time scarcity instructions led participants to become more motivated to plan, do, and enjoy activities, but we did not disentangle the effects of planning, doing, and enjoying. Future studies could include a third condition in which participants are instructed to plan activities they enjoy throughout the intervention, but without the time scarcity framing (i.e. a positive comparison group). If our underlying theory is correct, we expect that simply planning and doing activities will be less effective than our time scarcity manipulation because it will lack the mindset toward savoring that we think is a key component of the current manipulation.

Importantly, although our use of a college student sample likely limits the generalizability of our findings, it points to an intriguing future direction. Past research has shown that younger people garner more happiness from extraordinary experiences in their lives, whereas older people garner more happiness from ordinary experiences (Bhattacharjee & Mogilner, 2014). Thus, college students may need encouragement – like the type provided by our time scarcity intervention – to derive need satisfaction and happiness from their daily experiences. However, this intervention may either not boost well-being in older adults, because they are already in the habit of savoring their daily experiences, or it may even reduce well-being, as they try to alter something they already do well (see Carstensen et al., 1999) or worry about leaving close friends and family whom they value. Future research could explore the age boundary condition on the effect of this intervention. In addition, our sample was largely female and we did not have enough power to explore moderation by gender. Lastly, our findings are preliminary and underpowered to detect the small effect size observed between the intervention and control group. Future research would do well to replicate this finding and include more male participants to ensure generalization to men.

In sum, our experiment provides preliminary evidence that intentionally viewing time as scarce can make people happier, perhaps by encouraging them to enjoy and derive autonomy, competence, and connectedness from their quotidian experiences and surroundings. Our success with manufacturing scarcity in a group of first-year college students (where no such actual scarcity exists) means that in line with Hendricks' poetic entreaties, one may benefit from 'gathering rosebuds' regardless of the season.

Notes

1. Because our between-condition effects on well-being ended up being relatively small, we only had 52% power to detect the reported between-condition slope effect.
2. A third condition, unrelated to the LTM condition, was run simultaneously for comparison with the control group and is reported in a separate paper. In this condition, participants were asked to 'make someone else happier' each week for 4 weeks. Although we predicted both conditions would increase well-being, we believed them to work via different mechanisms – the

make someone happier condition via gratitude and connectedness, and the LTM condition via need satisfaction in general. Critically, all results presented here were the same when the third condition was included in the analyses (Simmons, Nelson, & Simonsohn, 2011). We footnote the third condition for the sake of simplicity, brevity, and theoretical distinction. For the same reasons, several unrelated outcome measures are not reported here.

3. Cohen's ds for the slope predictors were calculated with the following formula: $d = b(\text{time})/\text{SD}_{raw}$ where b is the unstandardized regression coefficient of interest, time is the number of time points after baseline (2; time was coded as 0, 1, 2), and SD_{raw} is the standard deviation of well-being across groups at baseline ($\text{SD}_{raw} = 0.87$; Feingold, 2009).

Disclosure statement

No potential conflict of interest was reported by the authors.

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