

# Emotion

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# Be Here Now: Perceptions of Uncertainty Enhance Savoring

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Savoring—an emotion-regulation strategy that involves deliberately upregulating positive affect—has many benefits, but what enhances savoring in the present moment? Drawing from life-history theory, affective and developmental science, and social-psychological frameworks, we examined the idea that perceptions of uncertainty—perceiving the world as random and unpredictable—enhance subsequent savoring. In a large experience-sampling study (Study 1,  $N = 6,680$ ), we found that individuals who perceived more uncertainty showed increases in subsequent savoring in their daily lives. In a preregistered experiment (Study 2,  $N = 397$ ), individuals who watched a film that induced uncertainty (vs. order or a control condition) subsequently reported higher savoring intentions. Finally, in a field experiment on a busy urban street (Study 3,  $N = 201$ ), we found that passersby who received fliers that induced uncertainty (vs. order) subsequently engaged in more savoring behavior by stopping to smell a bouquet of roses. These findings from three studies with diverse samples and methodologies underscore an upside to the specter of uncertainty: it can cause people to savor the positives of the present.

**Keywords:** emotion regulation, positive emotions, savoring, uncertainty

Gather ye rose-buds while ye may,  
Old time is still a-flying;  
And this same flower that smiles today,  
Tomorrow will be dying.

—Robert Herrick, “To the Virgins, to Make Much of Time”

Savoring is a form of emotion regulation that involves deliberately upregulating positive affect (e.g., Bryant, 1989; Quoidbach et al., 2010). Simple acts of savoring in the quotidian, for example, taking a detour through a park or stopping to smell a rose, can infuse ordinary moments with positivity. Numerous studies have documented the benefits of savoring on well-being and health outcomes (e.g., Smith & Bryant, 2017), but surprisingly little is

known about what enhances savoring in the moment. Drawing from life-history, affective and developmental science, and social-psychological frameworks (e.g., Carstensen et al., 1999), across three methodologically diverse studies, we tested whether perceptions of uncertainty—perceiving that the world is unpredictable and could change at any moment—enhance savoring.


## The Psychology of Savoring

Laypeople, scholars, and practitioners have long been interested in how individuals regulate emotions. Perhaps unsurprisingly, given their profound impact and evolutionary significance (Baumeister et al., 2001; Fredrickson, 2001), much work has focused on the downregulation of negative emotions (e.g., Levenson et al., 2013). However, an ever-growing body of work has documented the importance of understanding how individuals upregulate positive emotions (Fredrickson, 2013; Pressman et al., 2019)—a set of processes typically referred to as *savoring* (Bryant, 2003; Quoidbach et al., 2010).

According to the process model of emotion regulation, savoring can be accomplished by (a) seeking positive situations, (b) taking specific actions to further increase their pleasantness, (c) purposefully paying attention to their positive features, (d) changing one’s appraisals, and (e) altering one’s behavioral responses, all of which aim to make the most of the positive stimuli that are available (Quoidbach et al., 2015). For example, by taking the time to fully immerse oneself in the sensory experience of eating a piece of candy, people can increase the positive emotion they derive from such an experience (Quoidbach & Dunn, 2013; Vohs et al., 2013). Likewise, by reframing their current situation as a special

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Paul K. Piff and Jordi Quoidbach developed the study concept. All authors contributed to the study design. Testing and data collection were performed by all authors. Jordi Quoidbach and Andrew L. Gregory performed the data analysis and interpretation with the help of all of the authors. Andrew L. Gregory drafted the article, and all authors provided critical revisions. All authors approved the final version of the article for submission.

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moment to be cherished, people can extract greater positive emotion from their daily experiences (Layous et al., 2018).

Elaborating and prolonging positive experiences in this way has many benefits for both mental and physical health (for a review, see Quoidbach et al., 2015). Savoring has been shown to promote well-being (Smith & Bryant, 2017), boost self-esteem (Wood et al., 2003) and happiness (Lambert et al., 2013), and reduce depression (McMakin et al., 2011). Savoring is associated not only with more pleasure and positive life events but also with more meaning in life (eudaimonic well-being; Chadwick, 2012). Savoring's benefits also include buffering against stressors, both severe and mundane, such as the stresses of aging (Smith & Bryant, 2019) and combat exposure (Sytine et al., 2018). Savoring is also commonly targeted in positive-affect interventions for its positive effects on physical health outcomes (e.g., Pressman et al., 2019). Savoring's benefits to positive emotion are associated with better health through multiple mechanisms, including counteracting the harmful inflammatory effects of stress (Ong, 2010; Stellar et al., 2015). Burgeoning research on savoring shows that trait levels of savoring are even associated with fewer physical symptoms in patients with cancer (Hou et al., 2017). Given its myriad benefits, in the current work, we examined one psychological process that may enhance tendencies to savor: perceptions of uncertainty.

## Uncertainty and Savoring

From a sudden hailstorm on a summer day to a global pandemic and economic turmoil, life is replete with reminders that the world can change at any moment. Uncertainty is ubiquitous and typically unpleasant, upending people's desire to view the world as ordered and controllable (Kay et al., 2008). When the predictability of the social world is threatened, chaos and uncertainty produce anxiety and distress (e.g., Pennebaker & Stone, 2004; Peters et al., 2017; Skinner, 1995). To mitigate these negative effects, people may engage in various emotion-regulation and coping strategies, including pursuing material or social resources (Piff et al., 2012), enhancing certainty in social judgments (Hogg, 2007), or even engaging in violent religious zealotry (McGregor et al., 2008). Here we propose that uncertainty may also enhance subsequent savoring.

This idea draws from several lines of research. First, economic and life-history frameworks indicate that when future rewards are uncertain, people prioritize immediate rewards (Dasgupta & Maskin, 2005; Maner et al., 2017). For example, using the "marshmallow paradigm" in which individuals are confronted with a choice between an immediate reward and a larger but more delayed reward, Kidd et al. (2013) showed that children in an uncertain situation preferred pleasure in the moment and ate the marshmallow earlier compared with children in a more certain situation.

Second, life-span developmental and affective science frameworks suggest that uncertain futures may increase savoring. Drawing from socioemotional selectivity theory (e.g., Carstensen et al., 1999), this line of work has documented how perceived endings may increase savoring in the present moment. When reminded of their upcoming college graduation or when considering moving away from their hometown, participants valued their friends more than those participants who were not provided with cues of an

uncertain future of their friendships (Ersner-Hershfield et al., 2008; Fredrickson & Carstensen, 1990). In a similar vein, there is a large literature documenting how individuals, as they get older and become increasingly aware that the end of life is approaching, upregulate positive emotions through attentional (e.g., Mather & Carstensen, 2003; Reed et al., 2014), motivational (e.g., Haase & Shiota, in press), and interpersonal processes (e.g., Verstaen et al., 2020). Although this literature has put less emphasis on uncertainty, it is worth noting that a common thread through all these endings is that the future is uncertain (e.g., the end of life yields great uncertainty about what comes afterward).

Third, social-psychological literature shows that when faced with uncertainty, people manage their uncertainty by focusing on secure and pleasurable experiences. For example, when dealing with unreliable loved ones, the appeal of treasured belongings increases (Keefer et al., 2012). People seek the concrete and known positive of soft haptic sensations, which in turn reduce their perceptions of uncertainty (Van Horen & Mussweiler, 2014). Insofar as savoring typifies a focus on secure pleasurable experiences, people experiencing uncertainty may subsequently savor the present to restore a sense of coherence and order.

## The Present Studies

In three studies using diverse samples and methods, we tested the hypothesis that uncertainty enhances savoring. In a large experience-sampling study (Study 1), we tested whether perceptions of uncertainty were associated with subsequent increases in everyday savoring. In a preregistered experiment (Study 2), we tested whether uncertainty increased subsequent savoring intentions. Finally, in a field experiment on a busy street (Study 3), we tested whether uncertainty enhanced later savoring behavior.

The studies have several noteworthy methodological features: sizable samples affording satisfactory statistical power, diverse methods and study designs to enhance the generalizability of the findings, and robustness checks by controlling for relevant covariates (e.g., individual traits). Moreover, given our focus on savoring as an emotion-regulation strategy (Quoidbach et al., 2015), we also tested whether the effects of uncertainty on savoring were driven by negative affect or distinct from it (i.e., by controlling for affect when the study design allowed us to, as in Studies 1 and 2). All study materials, analysis code, and data are available on the Open Science Framework (<https://osf.io/8dy7m>).

### Study 1

In our first study, we used a large-scale experience-sampling methodology to test whether everyday perceptions of uncertainty lead to more savoring of the present moment. We used a hierarchical linear regression to adjust for individual differences, weekly variations, and other covariates. We hypothesized that uncertainty would predict increased subsequent savoring and that this association would be independent of affect.

## Method

### Participants

All studies were approved by the institutional review boards of the respective institutions: ESADE (Study 1); University of California, Irvine (Study 2); and University of California, Berkeley (Study 3). The sample consisted of 6,680 people (mean  $[M]_{\text{age}} = 29.33$ , standard deviation  $[SD]_{\text{age}} = 9.52$ ; 71.1% women) who took part in the “58 Seconds” research project—a large-scale set of experience-sampling studies (see later description). Participants were predominantly French (92%; others mostly Belgian and Swiss). For this study, we selected pairs of consecutive reports within 1 day over a maximum range of 12 hr, resulting in a final sample of 18,208 observations (i.e., 9,104 observations at time  $t$  and 9,104 observations at time  $t + 1$ ). The observed power was estimated to be greater than .99 using the *simr* package for R.

### Procedure and Measures

Participants volunteered for the study by installing 58 Seconds, a free mobile application created to assess well-being via brief surveys. Participants were asked their age, gender, country of residence, preferred survey times (default = 7 days/week from 9:00 AM to 10:00 PM), and desired number of daily survey requests (default = 4, minimum = 1, maximum = 12). The application then divided each participant’s availability by the number of requests, and each day, a random time was chosen within each interval to send the surveys, with a minimum of 1 hr between questionnaires (to prevent the influence of autocorrelations). Surveys were delivered through a push notification system that did not require an Internet connection. Upon receiving a survey, participants could accept or decline to participate.

Several independent studies have been run on the 58 Seconds app, each consisting of one or several consecutive sets of three to six questions (e.g., Taquet et al., 2016; Trampe et al., 2015; for a description of the larger item pool, see Quoidbach et al., 2019). For the current study, we designed a set of three questions asked on two consecutive measurement occasions.<sup>1</sup> The three questions were as follows: “At this very moment, how chaotic and unpredictable does the world feel to you?” (slider from 0 [*not at all*] to 100 [*very much*];  $M = 49.52$ ,  $SD = 29.56$ ); “Were you currently savoring the present moment?” (from 0 [*not at all*] to 100 [*very much*];  $M = 60.86$ ,  $SD = 29.89$ ); “How happy do you currently feel?” (from 0 [*very unhappy*] to 100 [*very happy*];  $M = 55.20$ ,  $SD = 31.11$ ). All items were presented in random order. Analyses were performed using the *lmer* and *lmerTest* packages for R.

### Model Specification

We assessed whether people’s current perceptions of uncertainty would relate to their tendency to savor the present moment a few hours later using a multilevel time-lagged regression to account for the nested structure of the data (with multiple observations nested within individuals). Because our goal was to capture high-frequency dynamics in the perception of uncertainty (e.g., hourly changes) while controlling for low-frequency dynamics (e.g., daily or weekly changes), we included the daily average perception of uncertainty as a covariate. This guarantees that associations between current perceptions of uncertainty and subsequent savoring did not merely reflect longer-term psychological trends. Specifically, we let  $U_t$  and  $U_{\text{day}}$  denote participants’ perception of

uncertainty at time  $t$  and the average of all other uncertainty reports that day (excluding time  $t$ ), respectively.  $S_t$  and  $S_t + 1$  denote the extent to which participants savored the present moment at time  $t$  and time  $t + 1$ , respectively. The regression model has the following expression:

$$S_{t+1} = \beta_{0i} + \beta_{ui}U_t + \beta_{di}U_{\text{day}} + \beta_{si}S_t + \sum_{k=1}^K \beta_k X_k,$$

with  $\beta_{0i} = \gamma_0 + u_{0i}$ .

$\beta_{0i}$  is the random intercept (for the  $i$ th individual),  $\beta_{ui}$  is the coefficient related to the current perception of uncertainty,  $\beta_{di}$  is the coefficient related to the daily average perception of uncertainty, and  $\beta_{si}$  is the coefficient related to current savoring. Moreover, we examined the robustness of our findings by controlling for covariates (represented by the terms in  $X_k$ ), including the day of the week (e.g., people could be more likely to savor on Saturdays), the time of day (e.g., people could be more likely to savor at dinner time), and previous happiness levels (e.g., people’s savoring after a chaotic period could be explained by a simple mood-repair mechanism). The day of the week was included as a categorical variable (i.e., weekday, Saturday, Sunday). The time of day was included as a categorical variable by binning time into 12 periods of 2 hr (from 00:00–1:59 to 22:00–23:59).

## Results

In line with the aversive nature of the experience, uncertainty was negatively related to concurrent savoring in the moment ( $b = -.27$ , standard error  $[SE] = .01$ , 95% confidence interval  $[CI]: -.27, -.25$ ,  $t = 22.13$ ,  $p < .001$ ). However, consistent with the notion that people might use savoring as a coping mechanism in response to uncertainty, our time-lagged regression revealed that perception of chaos predicted higher subsequent savoring at the next measurement time ( $b = .12$ ,  $SE = .01$ , 95% CI  $[.09, .14]$ ,  $t = 9.48$ ,  $p < .001$ ; mean interval between time points was 4.21 hr,  $SD = 2.93$ ). This relationship remained significant when controlling for day of the week, time of the day, and previous happiness levels ( $b = .16$ ,  $SE = .04$ , 95% CI  $[.09, .14]$ ,  $t = 4.10$ ,  $p < .001$ ). In fact, in a random intercept model of the effects of happiness on subsequent savoring, happiness was positively associated with savoring ( $b = .73$ ,  $SE = .03$ , 95% CI  $[.67, .78]$ ,  $t = 26.86$ ,  $p < .001$ ).

The variability of the time between the uncertainty and the savoring measures allowed us to perform exploratory analyses to investigate whether the effects of uncertainty upon subsequent savoring varied as a function of time. For example, it is plausible that the association between perceived uncertainty and savoring would be strongest when the two were measured close together; the association between experienced uncertainty at one time point and savoring at a later time point may subside as the time between measurements increases. Our analyses yield preliminary evidence

<sup>1</sup> The system was designed such that if participants completed all the studies ran on the platform, the app would loop over the different studies again. Most app users completed the present study once (44%) or twice (38%), providing one or two pair(s) of data points (i.e., uncertainty/savoring/affect at time  $t$  and time  $t + 1$ ). Some diligent users (0.5%) repeated the study over 10 times.



to this effect. In a hierarchical regression model, we included the duration of the time lag between measures and its interaction with uncertainty at time  $t$  to examine if the strength of the relationship between uncertainty and savoring changed over time. Although not statistically significant, the interaction term was negative ( $b = -.004$ ,  $SE = .003$ , 95% CI  $[-.01, .002]$ ,  $t = 1.25$ ,  $p = .21$ ), indicating a decreased uncertainty–savoring association with time. To further explore changes in the effect over time, we limited our analyses to the shortest and longest time lags. When limiting observations to the bottom 10% of the time distribution (1.36 hr or less,  $n = 958$ ), the regression showed a similar magnitude of the association between uncertainty and savoring ( $b = .13$ ,  $SE = .04$ , 95% CI  $[.05, .21]$ ,  $t = 3.27$ ,  $p = .001$ ). However, when limiting the observations to the top 10% of time-lag duration (greater than 7.80 hr,  $n = 912$ ), the association of interest was no longer significant ( $b = .01$ ,  $SE = .03$ , 95% CI  $[-.04, .08]$ ,  $t = .57$ ,  $p = .56$ ). These findings indicate that the association between uncertainty and savoring was undetectable when the lag between measures was the longest.

## Discussion

This study provides correlational evidence that uncertainty is linked to subsequent savoring, even when taking into account individual differences, periodic variations in savoring, and other potential confounds. It is important to note that savoring and uncertainty were negatively related when measured concurrently; this could be because, temporally, reported savoring actually preceded uncertainty on occasion due to the randomized order of the items. In addition, if savoring is a successful coping mechanism for uncertainty, one is unlikely to feel uncertain while concurrently savoring the moment. Further, as predicted, the effect of uncertainty was distinct from affect. In fact, in line with previous research (Wood et al., 2003), negative affect was associated with less subsequent savoring.

Although the effective time frame of the uncertainty–savoring association was not possible to pinpoint in this study, the association between uncertainty and savoring did appear to decrease at the maximum time lags observed. These findings point to a possible time limit to how long uncertainty may reasonably be expected to increase savoring. Indeed, rather than being enhanced in perpetuity, people may engage in savoring behavior as an immediate coping response to uncertainty.

One limitation of the current correlational findings is that they preclude causal inference. The question remains: Does uncertainty directly cause increases in savoring? We explored this possibility in our subsequent experiments.

## Study 2

Study 2 experimentally tested whether perceptions of uncertainty increase self-reported savoring tendencies compared with perceptions of certainty and predictability. Preregistered using AsPredicted.org, Study 2 used an online sample and short videos for experimental manipulations. We hypothesized that our uncertainty manipulation would increase self-reported savoring and that these results would hold when statistically adjusting for affect.

## Method

We preregistered our hypotheses, sample size, measures, exclusion criteria, and analytic plan (<http://aspredicted.org/blind.php?x=67jr69>).

## Participants

According to a pilot study of university undergraduates ( $N = 282$ ), the expected effect size was small ( $f^2 = .021$ ). To achieve a power ( $1 - \beta$ ) of .90 for a one-tailed test, we recruited 410 participants on Amazon's Mechanical Turk (MTurk) in exchange for \$.50.

Participants who did not finish the videos used for our experimental manipulation (according to the Qualtrics survey software timer function), were not fluent in English, or failed an attention check asking about the gist of the video they watched were excluded, as outlined in our preregistration plans. Unexpectedly, however, there were many duplicate Internet provider (IP) addresses and Global Positioning System (GPS) coordinates (e.g., one set of exact GPS coordinates appeared 83 times), which necessitated a deviation from the preregistration protocol. As recommended by Bai (2018), we excluded all participants with duplicate GPS coordinates (who were likely automated response “bots” that have become increasingly common) and continued data collection until we reached our desired sample size. After excluding incomplete observations, our final sample consisted of 397 participants. The mean age was 35.75 years ( $SD_{\text{age}} = 11.01$ ), and 61.1% of participants were male.

## Procedure

Participants were randomly assigned to view (a) a video portraying the future as uncertain and unpredictable, (b) a video portraying the future as certain and predictable, or (c) a control video about the history of trains. In the experimental conditions (a) and (b), participants ostensibly listened to the conclusions of a week-long scientific conference about how unpredictable or predictable events in people's lives are (based on Tullett et al., 2015). A voice-over read a script (see Appendix) intended to convince participants that “the events in our lives are largely random” (uncertainty condition) or that “there is an underlying order, or structure, to all of the events that happen in our lives” (certainty condition). As the narrator read the description of the conference, a slideshow of rolling dice and chaotic graphs illustrated the uncertainty condition, as opposed to a sequence of dominoes and structural patterns in the certainty condition. Pilot data with a separate sample ( $N = 393$ ) demonstrated that these videos, each approximately 75 s long, were effective at inducing perceptions of uncertainty, as indexed by two items: “In your opinion, how predictable are the events in our lives?” and “How random is the future?” (reverse-coded;  $r = -.56$ ,  $p < .001$ ). On a 5-point scale, the uncertainty video increased perceptions of uncertainty by .56 ( $M = 3.95$ ,  $SD = .82$ ,  $t = 6.77$ ,  $p < .001$ ), and the certainty video decreased it by .53 ( $M = 2.86$ ,  $SD = .93$ ,  $t = -4.20$ ,  $p < .001$ ) relative to the control video ( $M = 3.39$ ,  $SD = .93$ ).

## Measures

After the video, participants completed a single-item slider of their current affect, from 0 (*more negative*) to 100 (*more positive*) and three

savoring measures. Specifically, participants first completed a four-item measure of savoring beliefs on a scale of 1 (*strongly disagree*) to 7 (*strongly agree*): “I should try to savor the simple things in life,” “I should try to enjoy the present moment as much as possible,” “I should always try to ‘stop and smell the roses,’” and “I should enjoy the here and now as much as I possibly can” (\$2). For the next two measures, participants were asked to imagine a personal success (“Imagine that you have just achieved a great success—perhaps you have won an important award or scholarship, or you have just been offered your dream job”) and a friend’s miraculous medical recovery (Wood et al., 2003) in counterbalanced order. Two subscales of deliberate savoring and dampening (reverse-coded) were analyzed and averaged across five items per scenario, as outlined in our preregistration. Deliberate savoring items included the following: “I want to keep feeling good as long as I can,” “I know what to do to maintain these good feelings,” and “I will do things specifically to make myself feel good as long as I can.” Dampening items included the following: “I feel a need to ‘dampen’ my good feelings—to make myself feel not as good,” and “I feel a need to ‘dampen’ or lower my excitement.” Participants rated their agreement with each statement on a scale of 1 (*very strongly disagree*) to 9 (*very strongly agree*; personal scenario:  $M = 6.88$ ,  $SD = 1.34$ ,  $\alpha = .74$ ; friend scenario:  $M = 6.58$ ,  $SD = 1.31$ ,  $\alpha = .68$ ).

### Model Specification

We used a structural equation modeling approach (using Stata 13) to estimate a latent variable using the three savoring measures as effect indicators (savoring beliefs:  $R^2 = .33$ ; savoring personal scenario:  $R^2 = .71$ ; savoring other scenario:  $R^2 = .51$ ). To compare the effects of the experimental conditions, two planned contrasts were estimated (paralleling Piff et al., 2015). The variable of interest (uncertainty contrast) contrasted the uncertainty condition against the other conditions (uncertainty = 2, certainty =  $-1$ , control =  $-1$ ), whereas the certainty contrast contrasted the other two conditions against each other (uncertainty = 0, certainty = 1, control =  $-1$ ). To parse out the effects of affect on savoring, we tested if affect was driving changes in savoring itself (as a predictor of the latent variable; Model 1) or changes in the way that participants responded to the

savoring measures (as a predictor of the savoring measures; Model 2). Model 1 was not an exact fit,  $\chi^2(6) = 30.45$ ,  $p < .001$ . Model 2, shown in Figure 1, was an exact fit to the data,  $\chi^2(4) = 2.51$ ,  $p = .643$ ; root mean square error of approximation (RMSEA) CI [0, .061]; standardized root mean square residual (SRMR) = .011. Model 2 likely provided a better fit because affect was associated with some savoring measures (i.e., savoring beliefs:  $r = .31$ ,  $p < .001$ ) but not others (i.e., savoring in the other scenario:  $r = .09$ ,  $p = .057$ ) and was used in subsequent analyses.

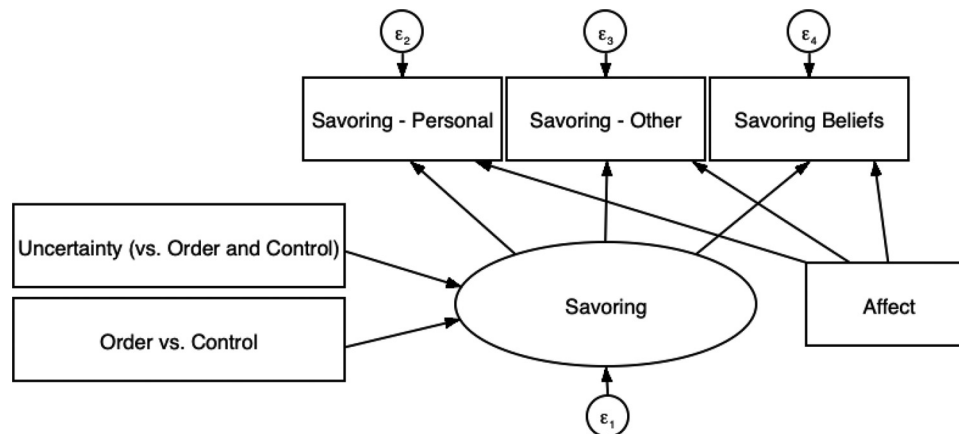
### Results

Consistent with our preregistered prediction and analytical plan, the chaos contrast effect was significant ( $b = .07$ , 95% CI [ $-.008$ , .16],  $z = 1.76$ ,  $p = .039$ ), indicating that the chaos condition led to an increase in savoring compared with the other two conditions. This represents a small mean difference of .232 over the mean of the other two conditions, equivalent to .210  $SD$ . The order contrast was not significant, suggesting that perceiving the world as ordered and predictable did not affect savoring relative to the control condition (95% CI [ $-.03$ , .09],  $z = .85$ ,  $p = .397$ ). It should be noted that our first preregistered test—that the uncertainty condition would enhance savoring without accounting for affect—showed very similar estimates but did not reach statistical significance ( $b = .05$ , 95% CI [ $-.03$ , .13],  $z = 1.14$ ,  $p = .127$ ). When affect was included, the beta coefficient of the contrast code increased. The uncertainty condition was associated with a more negative affect, and both uncertainty and affect were positively correlated with the three savoring dependent variables (affect and savoring beliefs:  $r = .31$ ,  $p < .001$ ; savoring in the other scenario:  $r = .09$ ,  $p = .057$ ; savoring in the personal scenario:  $r = .14$ ,  $p = .004$ ). This suggests that omitting affect was negatively biasing the effect of the chaos condition and obscuring the true effect (Cohen et al., 2014).

### Discussion

The results of Study 2 support the idea that perceptions of uncertainty can cause increased savoring tendencies. Importantly,

**Figure 1**  
Savoring Latent Variable Regressed on Experimental Condition Contrast Codes While Adjusting for Affect



negative affect did not explain this effect and, consistent with our findings from Study 1, was associated with less savoring. An important limitation of our results thus far is that they have relied on self-reports of savoring or savoring tendencies. Thus, in our final study, we tested whether perceptions of uncertainty enhance savoring behavior.

### Study 3

In a field experiment, participants walking down a busy street were handed uncertainty- or certainty-inducing fliers before being given an opportunity to savor the present. Participants were presented with a bouquet of roses and had the choice to stop and smell the flowers—to savor the experience and upregulate positive emotions—or simply continue walking.

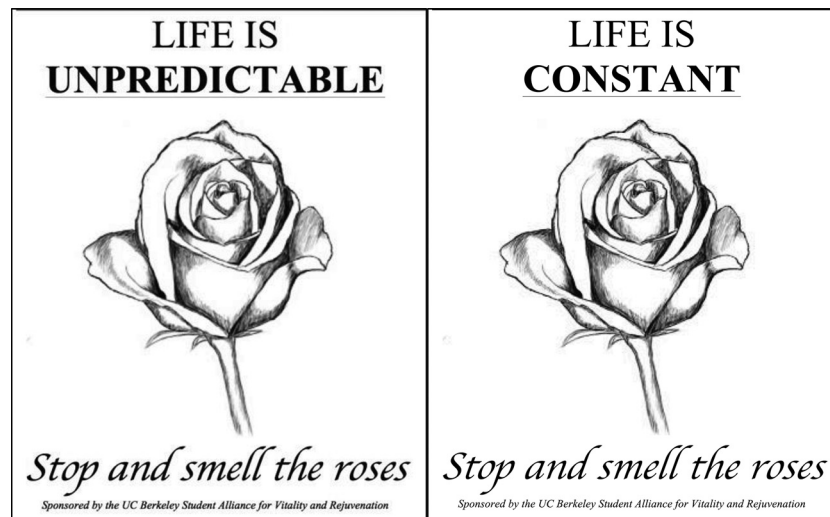
### Method

Participants included 201 individuals walking through a busy urban intersection in northern California. We chose this sample size to provide a power of .8 in a two-tailed test with a small-medium effect ( $d = .4$ ,  $\alpha = .05$ ). An experimenter (the “flier-giver”) was positioned at the intersection and gave a flier to each participant about to cross. Fliers were in two piles of 20, facedown, arranged by data recorders before each round of data collection to keep flier-givers blind to condition. Flier-givers were instructed to hand out fliers upside-down without saying anything, simply smiling. We exclusively handed out fliers to individuals walking alone as opposed to in groups to eliminate any possible effects of conformity or social influence (e.g., a person might be more likely to stop if the person/people they are walking with stop first). After each round of 20 fliers, the flier-giver signaled to the data recorders that there was a change in condition or to come prepare for another round, depending on if the first or second stack was completed, respectively.

The fliers, about 4 by 5 inches, featured two conditions: “Life is unpredictable” and “Life is constant.” Other than serving as reminders of life’s chaotic versus constant nature, the fliers were identical. The center of each flier featured a black-and-white figure of a rose and the message “Stop and smell the roses” with the subcaption “Sponsored by the UC Berkeley [University of California, Berkeley] Student Alliance for Vitality and Rejuvenation” (see Figure 2). In a pilot study ( $N = 38$ ), we validated that the “Life is unpredictable” flier successfully induced perceptions that the world is unpredictable and uncertain ( $M = 4.44$ ,  $SD = .89$ ) relative to the “Life is constant” flier ( $M = 3.86$ ,  $SD = .71$ ), with a medium-large effect size ( $d = .72$ ,  $t = -2.14$ ,  $p = .039$ ). Crucially, “unpredictable” fliers did not trigger differences in negative affect relative to “constant” fliers ( $M = 2.94$ ,  $SD = 1.24$  and  $M = 2.69$ ,  $SD = .97$ , respectively;  $t = 1.0$ ,  $p = .501$ ).

Approximately 150 feet down the street from where passersby received fliers was a small 2- by 4-ft wooden table with a silver tablecloth, topped with a bouquet of 12 red roses in a glass vase. Along each side of the vase was an 8- by 11.5-in. enlarged version of the flier, featuring the figure of the rose, “Stop and smell the roses,” and the sponsorship subcaption to help participants associate the flier they had received with our rose table. Two friendly table attendants (always one female and one male to help eliminate possible effects of attendee gender), blind to condition and hypotheses, were positioned behind the table and instructed to smile and be equally friendly or inviting to everyone who approached. Attendants were instructed to answer questions from passersby and to identify themselves as part of the UC Berkeley Student Alliance for Vitality and Rejuvenation whose objective was “trying to get people to stop and smell the roses.” The key dependent variable was whether individuals would stop and smell the roses, premised on the popular idiom “to stop and smell the roses” (i.e., slow down, enjoy life, and savor the present moment). More than a platitude, the behavior captures whether or not participants chose to expand upon their experience with the roses and upregulate

**Figure 2**  
*Fliers Used in Study 3: Uncertainty and Certainty Conditions, Respectively*



positive emotions (i.e., situation selection and attentional deployment; see Quoidbach et al., 2015).

Two data coders (to reduce coder demand) who were blind to hypotheses remained well hidden behind a hedge of bushes along the opposite side of the street. Coders recorded the current condition (unpredictability condition:  $n = 102$ ; constant condition:  $n = 99$ ), the time of day, the perceived gender of the participant (46.2% female), the perceived age of the participant (in three age groups: under 35, 65.6%; 36–55, 21.8%; 55 and older, 12.4%), whether the participant stopped to smell the roses, and—to account for any social influence effects—how many people were also standing at the rose table at the same time if they did stop to smell. If a person stopped to smell without receiving a flier, it was not recorded. Expectedly, given the unambiguous nature of the rose-smelling behavior, there was 100% agreement among coders on who stopped and who did not.

## Results

Participants who were reminded that “Life is unpredictable” were significantly more likely to engage in savoring behavior by stopping to smell the roses on the table (logit  $b = .95$ , 95% CI [.17, 1.73],  $z = 2.42$ ,  $p = .015$ ) than participants in the “Life is constant” condition (26.4% and 11.1%, respectively), even when controlling for perceived age and gender (logit  $b = 1.04$ , 95% CI [.24, 1.83],  $z = 2.58$ ,  $p < .001$ ). In other words, participants who received the “unpredictable” flier were 2.58 times more likely to stop and smell the roses than those who received the “constant” flier.

In Study 3, a field experiment, pedestrians in a busy urban intersection received fliers reminding them of life’s uncertain or certain nature prior to being given an opportunity to stop and smell a bouquet of roses. As expected, reminders of life’s unpredictability triggered subsequent savoring behavior. These findings provide a compelling demonstration that perceptions of uncertainty can directly lead to increased tendencies to act in ways that upregulate positivity in the present moment.

## General Discussion

The 16th-century poet Pierre de Ronsard (1524–1585) once wrote, “And since what comes tomorrow who can say . . . live, pluck the roses of the world today.” Using three diverse samples, methods, and measures, we found that people do indeed respond to life’s uncertainties by savoring the present moment. In Study 1, we found that perceptions of uncertainty were associated with subsequent self-reported savoring in a large experience-sampling study. In Study 2, we experimentally demonstrated that perceptions of uncertainty were associated with increased savoring tendencies. In Study 3, we documented savoring behavior in the field in response to subtle reminders of the uncertainties of life.

These results contribute to a growing body of evidence suggesting that negative life experiences may actually promote well-being (Seery, 2011), and they align with previous findings showing that people who experience more adversity—be it in terms of wealth, experiences, or life hardship—report more savoring (Croft et al., 2014; Quoidbach et al., 2015). Although life-history theories of development accentuate the dangers of a fast life history—in which factors like environmental uncertainty can promote a more present orientation and the risky behavior that comes with it (e.g.,

Griskevicius et al., 2011)—this research presents savoring as an unexpected upside to short-term uncertainty in the environment.

This research comes at a time of great uncertainty brought about by the ongoing global COVID-19 pandemic and the social, environmental, and economic instability it has triggered. As coronavirus cases wane and spike again seemingly without warning and people’s lives are upended, our findings underscore one possible avenue to help with coping: upregulating positive emotion by savoring the present moment. Preliminary research provides suggestive evidence for just this. In a recent study of mental health amid the pandemic, activities typically associated with positive emotion (and, we posit, savoring)—such as going for walks, pursuing hobbies, and gardening—were associated with the greatest gains in daily well-being (Lades et al., 2020). Conversely, lockdown measures seem to increase the risk of depression in part because they reduce the range of daily pleasant activities people can use to upregulate their emotions (Taquet et al., 2021). It will be important to test whether an orientation to savoring positive features of the present, whatever those may be, could prove effective in coping with the uncertainty brought about by the COVID-19 pandemic. Because many people may be finding themselves with more recreational time than usual (Kurmann et al., 2020), an intervention to boost savoring may be particularly fruitful and scalable.

Although documenting that a positive outcome like savoring can be triggered by perceptions of uncertainty, we do not mean to suggest that experiences of uncertainty have unmitigated psychological benefits, nor do we believe they should necessarily be promoted. Uncertainty is aversive, threatening, and stressful, and it can exact serious deleterious effects, ranging from adverse physiological changes (Pham et al., 2001) and stress (e.g., Peters et al., 2017) to religious zealotry (McGregor et al., 2008) and, in extreme cases, even terrorism (Kruglanski et al., 2014). As such, interventions that seek to enhance savoring by increasing perceptions of uncertainty in everyday life should proceed with extreme caution. In this regard, future research could delineate the “varieties of uncertainty worth having”—that is, the types of uncertainty that motivate people to attend to the present and extract as much positive emotion as they can from it.

The present studies found positive associations between uncertainty and savoring across diverse methodologies, measures, and samples. At the same time, important questions remain. Our studies focused on relatively mild forms of uncertainty experienced in the quotidian. Future research should examine whether more personally threatening forms of uncertainty (e.g., natural disaster, physical illness) also enhance savoring or, alternatively, undermine it. Given the inhibitory effects of negative affect on savoring shown in Studies 1 and 2, catastrophic events that cause a decrease in affect for long periods of time may inhibit savoring. Poor health, for example, is associated with a decreased perceived ability to savor (Geiger et al., 2017) but may also be experienced as uncertain. The effects of negative affect and uncertainty may work in opposition (as seen in Study 2). One way to address this question is with experience-sampling data examined in relation to a catastrophic but uncertainty-provoking event, such as an act of terrorism.

Our findings indicate that savoring may be a response to perceived uncertainty as opposed to a tendency that co-occurs with it. In Study 1, perceptions of uncertainty were negatively related to



self-reported savoring tendencies at the same time point but positively related to savoring when it was measured at the subsequent time point. This divergence is not altogether surprising, given that reported savoring tendencies as assessed in that study may have slightly preceded assessments of uncertainty. In addition, if savoring is a successful coping mechanism in response to uncertainty, then it should be associated with less uncertainty. Although we found evidence for savoring across a shorter timeframe in Studies 2 and 3, future research should delineate the potential time-lagged nature of savoring in response to uncertainty and whether savoring serves to successfully buffer against the concurrent threat of uncertainty.

Although we found that uncertainty is related to a general tendency to savor, the magnitude of these tendencies varied across studies. Specifically, the experience sampling (Study 1) and field experiment (Study 3) yielded much larger effect sizes than did the laboratory experiment (Study 2). This discrepancy could be for a few reasons. The smaller effect size in Study 2 could be due to the nature of the video manipulation, the online sample, or the hypothetical nature of the dependent variable. The analysis of Study 2 was also distinct, using structural equation modeling and a latent dependent variable of savoring, which predicted changes in the three observed self-report measures. Finally, Study 2 also had the shortest lag between uncertainty and savoring, which merits consideration in further research; Study 1's self-reported uncertainty was associated with savoring after 1 hr, and Study 3's measurement came after a walk of 150 ft down the street, whereas Study 2's dependent variable was presented almost immediately after the manipulation. It may be that people need some time after an acute episode of uncertainty before they engage in savoring.

Another vital consideration is that effects may differ across different individuals; certain people might exhibit decreased savoring in response to uncertainty, and future work should examine possible moderators of our effects. For example, those with already-high state anxiety may have more difficulty transitioning out of the inhibiting anxiety of uncertainty into proactive coping behaviors (Jonas et al., 2014). Another moderator for consideration is tolerance for ambiguity, a construct that shapes how individuals construe and react to uncertainty (for a review, see Furnham & Marks, 2013). Importantly, the less tolerance for ambiguity a person has, the more they perceive threats and the less mindfulness they tend to have (Le et al., 2012). As such, those low in tolerance for ambiguity may be less inclined to savor in the face of uncertainty. Likewise, future studies should explore which specific families of savoring strategies (i.e., situation selection, situation modification, attention deployment, cognitive change, and response modulation; Gross, 1998; Quoidbach et al., 2015) are more likely to be used as a response to uncertainty.

Future research should examine alternative accounts of our findings, particularly those stemming from the meaning maintenance model (MMM; Heine et al., 2006) and terror management theory (for a review, see Burke et al., 2010). The MMM specifically posits that uncertainty is an aversive state of arousal that arises from a violation of meaning (Proulx et al., 2012). Within this framework, savoring could be an effort to restore meaning to palliate the aversive feelings rather than an emotion-regulation strategy to prolong positivity. It is also possible that an uncertain world brings to mind death and mortality, and people may engage in savoring in an effort to ward off the existential threat of their eventual demise. It

will be interesting for future research to disentangle these differing accounts by contrasting the effects of uncertainty with those of meaning violations and death reminders on savoring.

In a similar vein, studies should explore the psychological process underlying the uncertainty-savoring association. We have proposed that savoring is a coping response to uncertainty. However, it may also be that uncertainty leads to a shift in savoring-related values—feeling like the world *could* change at any moment may prompt people to believe they *should* savor the present as much as possible. This values-based account of savoring may be particularly applicable to Study 3, where the manipulation of uncertainty—a single sentence on a flyer—may have been unlikely to generate an aversive emotional state to be palliated. Manipulations that pit more cognitive forms of uncertainty against more affective ones could prove fruitful in disentangling these possibilities.

Finally, it will be important to further examine the mechanisms and functions of savoring in response to uncertainty. Savoring may buffer against the threat of uncertainty by increasing attention to concrete positive emotional experience; heightening appreciation of what may come to an end; or reaffirming personal resources, values, or control. That is, savoring may help restore a sense of certainty and coherence. In this regard, an experiment that presents participants who are experiencing uncertainty with an opportunity to savor an experience or not, followed by assessing their affect, feelings of scarcity, and perceptions of uncertainty, could shed light on whether savoring effectively reduces uncertainty and increases perceptions of control and coherence—a promising future avenue of study.

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(Appendix follows)



## Appendix

### Study 2 Scripts

#### Neutral

Every year, philosophers and scientists from around the world commune for a week-long conference at Harvard University to discuss historical events related to a particular topic. According to conference organizer Kenneth Burton, this year the various research projects and analyses have been focused on the historical origins of the locomotive. Prior to locomotives, the motive force for railroads had been generated by various lower-technology methods such as human power, horse power, gravity or stationary engines that drove cable systems. While there had previously been much debate, it is becoming more and more apparent that the first successful locomotives were built by Cornish inventor Richard Trevithick. In 1804 his unnamed steam locomotive hauled a train along the tramway of the Penydaren ironworks, near Merthyr Tydfil in Wales. “Although the locomotive hauled a train of 10 long tons (11.2 short tons; 10.2 t) of iron and 70 passengers in five wagons over nine miles (14 km),” notes Burton, “it was too heavy for the cast iron rails used at the time. The locomotive only ran three trips before it was abandoned.” (<https://youtu.be/MOu1nN8GRtk>)

#### Order

Every year, philosophers and scientists from around the world commune for a week-long conference at Harvard University to discuss one of the questions that has fascinated and frustrated the human species for centuries: Is there an order or predictability to the events that make up our lives? According to conference organizer Kenneth Burton, this year the various research projects and theories are beginning to converge on a strong theme. It is becoming more and more apparent that “there is an underlying order, or structure,” to all of the events that happen in our lives, large or small. Whether we see this “as a divine plan” or not, it is becoming clear that “the events in our lives are not random, but are part of a large and complicated order.” Again and again, researchers demonstrated that despite how they may seem, the factors in your life, what happens to you—your experiences and circumstances—are predictable, ordered, and systematic.

We should remember, notes Burton, “the human mind is almost unlimited in its ability to comprehend great complexity. We have the capacity to understand how everything makes sense within the grand scheme of things; we just need to utilize this ability to its fullest.” ([https://youtu.be/7v8jw4\\_W2S8](https://youtu.be/7v8jw4_W2S8))

#### Chaos

Every year, philosophers and scientists from around the world commune for a week-long conference at Harvard University to discuss one of the questions that has fascinated and frustrated the human species for centuries: Is there an order or predictability to the events that make up our lives? According to conference organizer Kenneth Burton, this year the various research projects and theories are beginning to converge on a strong theme. It is becoming more and more apparent that “there is no underlying order, or structure,” to all of the events that happen in our lives, large or small. Whether we see this “as evidence against a divine plan” or not, it is becoming clear that “the events in our lives are largely random, and not part of some large and complicated order.” Again and again, researchers demonstrated that despite how they may seem, the factors in your life, what happens to you—your experiences and circumstances—are unpredictable, chaotic, and random.

We should remember, notes Burton, that “this means it doesn’t matter how advanced our understanding of the world becomes. It is pointless to make sense out of everything that happens; there might not always be any sense to make.” (<https://youtu.be/7zTkIjGrPac>)

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