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Does practising diverse savouring techniques enhance subjective well-being? A randomised controlled trial of design-mediated savouring

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Abstract: When we anticipate enjoyable events or share positive experiences with others we can prolong and amplify our positive emotions. These and other savouring techniques can increase our subjective well-being. Yet, it remains unknown whether practising of diverse savouring techniques adds its own positive effect. In this 1×3 randomised controlled trial, 71 participants used a novel, interactive poster to facilitate high vs. low savouring diversity over eight days, or they journaled in the control condition. Unlike other positive psychology interventions (PPIs), the poster was designed to inspire users to self-select their own positive activities. Regression analyses showed that while cognitive well-being increased in the high savouring diversity condition, emotional well-being did not. These results suggested that assigning savouring diversity may have modestly contributed to users' cognitive well-being. Written responses further convey the poster's potential effectiveness in promoting positive experiences. Implications for design practice and directions for future research are discussed.

Keywords: positive design; experience design; positive psychology; design for emotion; subjective well-being; savouring; PER; positive emotion regulation; regulatory diversity.

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Biographical notes: Jeremy D. Faulk earned a BA in Psychology from the University of Texas at San Antonio in 2009 and an MSc in Human Environment Relations from Cornell University in 2020. His PhD research, also at C.U., explores ways in which design and technology can support the subjective well-being and happiness of groups and individuals.

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1 Introduction

Subjective well-being encompasses the 'cognitive and affective evaluations' of a person's life (Diener et al., 2002, p.463); therefore, a person may bolster their subjective well-being by adopting beneficial cognitive and affective mental practices. Diener and colleagues add further context by stating, "the positive experiences embodied in high subjective well-being are a core concept of positive psychology because they make life rewarding" (Diener et al., 2002, p.463). Yet, despite its acknowledged role in sustaining a person's mental health (see Deci and Ryan, 2008; Mansueto and Cosci, 2021; Ruini and Ryff, 2016; Seligman, 2011), many individuals are not skilled in purposefully enhancing their subjective well-being (Lyubomirsky, 2008; Mahmoodi Kahriz et al., 2020), leading some to seek self-administered tools (e.g., books and mobile apps) to help themselves engage in positive experiences and adopt well-being-enhancing practices (see, e.g., Parks et al., 2012). For those individuals who would seek guidance, design carries a unique opportunity to communicate methods of bolstering subjective well-being by enabling and supporting positive experiences (Desmet and Pohlmeyer, 2013; Yoon and Kim, 2022). Following this line of thinking, a wave of positive psychology interventions (PPIs) that support subjective well-being has emerged (see Sin and Lyubomirsky, 2009; Bolier et al., 2013; Schueller and Parks, 2014; Smith et al., 2014; White et al., 2019; Hendriks et al., 2020). Concurrently, designers, who often find inspiration from empirical studies in Positive Psychology (see Seligman, 2002; 2011), have established the fields of Positive Design (Desmet and Pohlmeyer, 2013), Positive Technology (Gaggioli et al., 2017), Positive Computing (Calvo and Peters, 2014), and Experience Design (Hassenzahl et al., 2013). In line with these initiatives, this paper follows the paradigm of evidence-based well-being (Smits et al., 2022) to investigate how evidence-based design can contribute to users' subjective well-being.

Research has suggested that certain behavioural strategies increase the chances of boosting subjective well-being (Lyubomirsky, 2008). According to the positive-activity model (Lyubomirsky and Layous, 2013), positive activities – both behavioural and mental – can help enhance positive emotions (Lyubomirsky et al., 2005; Gross, 2015) thereby bolstering subjective well-being (e.g., Fredrickson and Joiner, 2002). Many categories of positive activities – collectively known as positive emotion regulation (PER; see Dunn, 2017) techniques – can help us up-regulate our positive emotions. One important category of PER techniques is called *savouring* (see Bryant and Veroff, 2017; Bryant, 2021). Savouring refers to purposeful activities that amplify, prolong, or dampen positive emotions. Examples of savouring activities in daily life could include celebrating a team's success together, vividly recalling a cherished memory, or mindfully sipping tea to enjoy its flavour. Savouring actions both mediate and moderate the relationship between practicing positive activities and sustaining subjective well-being (Jose et al., 2012, 2021), leading some researchers to speculate that using multiple savouring techniques may moderate the relationship between positive activities and well-being (e.g., Quoidbach et al., 2010). Other researchers have empirically observed that practicing a variety of emotion regulation techniques can buffer against depressive symptoms (e.g., Wang et al., 2020); however, research regarding the impact of savouring diversity (i.e., PER techniques) on mental health has been limited to exploratory evaluations (e.g., Quoidbach et al., 2010). Our paper takes this research direction a step

further by empirically addressing the relationship between savouring diversity and subjective well-being.

Since little was known about how users can be supported to practice diverse savouring techniques, we decided to develop an understanding through design considerations, inspiration, and reflections that emerged while developing and testing an interactive intervention. The overarching research approach was research-through-design (RtD), wherein the act of designing new solutions, and reflecting in and on the processes, is regarded as a means of generating knowledge (Frayling, 1994; Zimmerman et al., 2007; Stappers, 2007). Thus, our paper focuses on the development and testing of a PPI called *Revealing Moments*, a scratch-off poster that encourages users to practice multiple savouring techniques in response to interactive, open-ended word prompts (see Figure 1). Whereas typical savouring-focused design interventions facilitate only one PER technique at a time (e.g., Costa et al., 2018; Yoon et al., 2022; Uhde and Hassenzahl, 2021), *Revealing Moments* was designed to facilitate up to four savouring techniques: *sharing with others, absorption, self-congratulation,* and *anticipating*. The techniques were originally identified by Bryant and Veroff (2017) and are described in the following section (see Table 1).

Figure 1 *Revealing Moments*' high savouring diversity scratch-off poster as it appears before (left) and after (right) user interaction (see online version for colours)

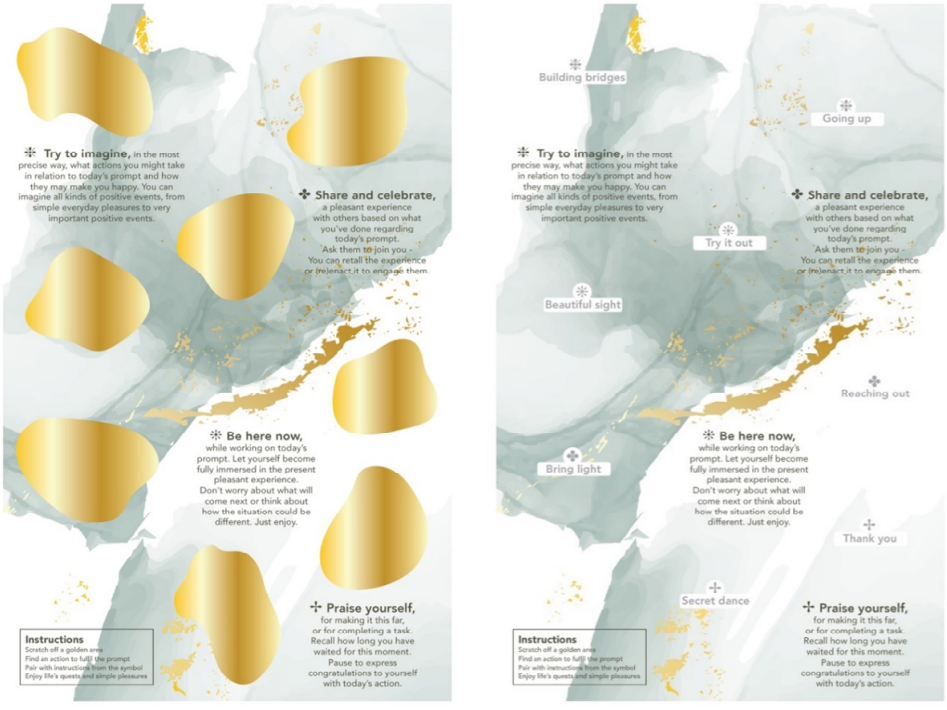


Table 1 Twelve activity-based savouring techniques

Memory building	Engaging in the present moment while intentionally looking forward to its future recall (e.g., taking a mental photograph)	Comparing	Engaging in a downward situational comparison to boost one's estimation of the current situation (e.g., feeling relieved that you bowled above average after seeing a scoreboard)
Self-congratulation	Pausing to give oneself praise for achievements and milestones (e.g., creating a visual marker of progress towards a valued goal)	Absorption	Becoming totally engrossed in an activity to the point of losing oneself in it (e.g., creating a mural at a school with students, focusing only on the act of painting together)
Sensory-perceptual sharpening	Giving an abundance of attention to one's sensory experience (e.g., intensely enjoying the flavour of a delicious meal)	Counting blessings	Engaging in a cognitive appraisal of everything good in one's life, in a specific situation, or in a relationship (e.g., giving thanks)
Temporal awareness	Giving attention to the fleetingness of time, wishing the moment could last longer but knowing that it will end (e.g., reminding oneself to enjoy the moment now)	Kill-Joy thinking	Dampening one's positive emotions for sensible social reasons (e.g., squashing laughter at a funeral), or out of poor emotion regulation hygiene (e.g., negative rumination)
Behavioural expression	Showing positive facial expressions that are consistent with one's emotional state, or one's desired emotional state (e.g., smiling, placing a hand on one's heart, cheering)	Sharing with others	Communicating positive experiences to enhance and prolong the pleasure (e.g., seeking out others to share the experience with, telling others how much you value the moment)
Anticipating	Vividly picturing likely positive experiences that will occur in the future, and looking forward to them (e.g., feeling joy at the thought of receiving a new order of shoes soon)	Reminiscing	Recalling and reliving past positive experiences for emotional or sentimental reasons (e.g., seeing a refrigerator magnet from the local market and recalling the delicious meal you made)

Source: Bryant and Veroff (2017)

Using *Revealing Moments* as a research means, we addressed the question: *Does savouring diversity moderate the relationship between positive activities and well-being?* We hypothesised that increasing the facilitated diversity of savouring techniques would also increase – or help maintain – users' subjective well-being over time.

The paper consists of two parts. The first part describes the development of *Revealing Moments* while the second part describes an eight-day validation study. This study represents a push to explore how design can systematically support users to engage in positive experiences, a need that was recently highlighted by Bryant (2021). On a broader

level, we intend to contribute our preliminary findings to the dual fields of Positive Design and Positive Psychology to inform the development of future PPIs by exploring

1 how design can contribute to the development of effective PPIs

2 how knowledge from psychology can inspire and inform the design process.

2 Considerations for the intervention's development

Five key considerations informed the development of *Revealing Moments*:

1 Who will use the intervention?

2 Which savouring techniques should be included?

3 How long should the intervention last?

4 How will the intervention sustain engagement?

5 What form should the intervention take?

2.1 Consideration 1: who will use the intervention?

Revealing Moments was designed for emerging adults who seek positive experiences in their daily lives to nurture their well-being. Emerging adulthood is a period between the late teens and late twenties in industrialised countries, characterised by an exploration and instability of personal identity (Arnett et al., 2014). Research has noted large increases in several adverse mental health metrics within the US emerging adult population between 2011 and 2018, including anxiety and depression (Duffy et al., 2019). More recently, this population has endured mounting concerns that stem from the lingering societal effects of COVID-19, such as social isolation and economic downturn (Mahmud et al., 2021), and have undergone the most pronounced decline in mental health within US population during the pandemic (Kaiser Family Foundation, 2021). Although the emotional challenges facing emerging adults is considerable, literature on the effects of savouring has shown that its impact can be protective for emerging adults against mental ailments (McRae et al., 2012; Troy et al., 2017). Additionally, reporting more positive emotions during the COVID-19 pandemic has been associated with greater resilience, especially for those experiencing increases in negative emotions (Israelashvili, 2021; Waugh et al., 2020). However, emerging adults generally show a lack of skills in handling everyday emotional experiences (Blanchard-Fields et al., 2004; Scheibe and Blanchard-Fields, 2009). Thus, expanding the ability and frequency of savouring has been considered key to improving emerging adults' well-being (Park et al., 2020).

Several savouring interventions (e.g., counting blessings; pausing to appreciate positive experiences) have been introduced to this population, but the interventions have been underutilised (Sin and Lyubomirsky, 2009) because they do not necessarily correspond to the interests and needs of emerging adult users, or account for their low savouring abilities. Further, traditional interventions have not been well received due to stigma, lack of awareness, and threats to users' autonomy because of seeking care (Park et al., 2020; Walker et al., 2015). Similarly, in our recent pilot studies (e.g., Faulk et al., 2022), emerging adults expressed difficulty in savouring, including feeling too busy,

having a lack of awareness, limited resources, and skepticism about the positive effects of savouring. Taking these as developmental challenges, this study describes our attempt to develop and test an intervention for savouring facilitation that can be deeply integrated into the daily lives of emerging adults.

2.2 Consideration 2: identifying which, and how many savouring techniques to include

The current study builds on the savouring techniques validated by Bryant and Veroff (2017; see Table 1). The 12 techniques in Table 1 have been observed to act as both mediators and moderators of one's well-being (Jose et al., 2012). Among the 12, our study specifically focused on four techniques:

1 absorption

2 anticipating

3 self-congratulation

4 sharing with others.

We followed the precedent set by Quoidbach et al. (2010) who compared the unique impact of four savouring techniques and were among the first researchers to observe and propose the importance of savouring diversity; thus, selecting four techniques was considered an appropriate benchmark. In addition, the number of techniques was based on practicality; an intervention should support diverse savouring techniques, but it should not be too complex. In selecting which four techniques, we attempted to balance the diversity of the techniques in terms of their categorisation within the process model of emotion regulation, an overarching theory widely used in emotion research (for an overview of the model and categorisation of savouring techniques, see Gross, 1998). The chosen techniques were deemed to be distributed across different emotion regulation strategies represented in the process model, i.e., *absorption* and *anticipating* (as part of attentional deployment); *sharing with others* (as part of response modulation); *self-congratulation* (as part of positive reappraisal).

2.3 Consideration 3: duration of the intervention

Two considerations informed the intervention's duration. The first was estimating how long users would remain engaged without losing interest. Secondly, the intervention should provide sufficient dosage of savouring activities to increase well-being. Such a balance has been achieved with other behavioural interventions at a dosage of, for example, one activity daily for a week (Gander et al., 2016; Peterson and Seligman, 2004). Since our intervention includes four savouring techniques, an eight-day intervention ensured that participants would receive two 'doses' of each technique.

2.4 Consideration 4: how to maintain engagement

Maintaining engagement is key to an effective behavioural intervention (Desmet and Pohlmeyer, 2013; Schueller and Parks, 2014). Thus, three design goals were considered. First, concerning engagement, the design needs to foster a feeling of interest through

interaction. Interest has been found to increase engagement in various contexts of human-design interactions such as museum exhibits (Skydsgaard et al., 2016), products (Yoon et al., 2012), and augmented reality (van Aart et al., 2010). To increase interest in the intervention, we decided to design an interaction in which savouring techniques are prompted in an intriguing way.

Second, the interaction should facilitate various activities instead of asking users to repeat activities. As found in Parks et al. (2012), participants were less likely to gain consistent well-being benefits when they repeated the same positive activities. To this end, we sought to increase activity diversity with the next goal.

Third, the design should support users' autonomy by giving them the ability to tailor activities to suit their lifestyle, interests, and resources. Even designs that encourage a variety of positive activities may follow a prescriptive model, telling users which activities they should perform instead of giving them the freedom to choose their own. Research suggests that the psychological need for autonomy can support user motivation (Peters et al., 2018) and, furthermore, that customisable product interactions can imbue users with a sense of ownership and choice (Rigby and Ryan, 2018). Related research has found that participants who were randomly assigned to perform positive activities without their input showed fewer well-being gains than those who were assigned to perform activities that fit with their preferences (Schueller, 2011; Heintzelman et al., 2023). In other words, the prescriptive approach to behavioural interventions may create a poor Person-Activity Fit (see Lyubomirsky and Layous, 2013; Schueller and Parks, 2014). Therefore, it was decided to use Directional Ambiguity (i.e., providing non-specific instructions to engage users' creativity in their interpretations; Boon et al., 2018) as our design principle for interaction to encourage users to self-select *their own* positive activities in response to ambiguous prompts (e.g., "Bring light"). The effectiveness of this approach has been assessed in a small series of cases leading up to the current design (Faulk et al., 2022).

2.5 Consideration 5: form of the intervention

Most interactive PPIs for savouring rely upon automation and use screen displays (e.g., Howells et al., 2016; Parks et al., 2012; Riboldi et al., 2023), leading some researchers to note the potential benefits of developing tangible PPIs that are *not* screen-based, owing to users' increased awareness when interacting with tangible objects (e.g., Desmet and Sääksjärvi, 2016; Yoon et al., 2021; Bharmal et al., 2020). In other words, tangible PPIs may help designers to overcome the "out of sight, out of mind" issue (e.g., Mittelman et al., 2020), stimulating users to remember and carry out positive activities during their daily lives (Lyubomirsky et al., 2005). Some have addressed this issue by integrating the intervention with everyday products. One design by Desmet and Sääksjärvi (2016) uses keychains to deliver instructions for positive activities over a 6-week period. The intervention, called *Tiny Tasks*, and its facilitated positive activities led to a measurable increase in users' subjective well-being. After exploring a series of potential forms for our intervention (Faulk et al., 2022), a scratch-off poster (see Figure 1) became the favoured form for two main reasons:

1 its flexibility to be installed in a prominent place

2 its potential to engage users to interact with the intervention over time.

3 Creating the intervention: Revealing Moments

3.1 A brief description of Revealing Moments

Revealing Moments is an interactive, self-administered PPI created in the form of a scratch-off poster with the intention to promote self-selected, positive activities in users' everyday lives. This poster provides a flexible starting point for the practice of savouring while also affording opportunities to pair user-selected actions with targeted savouring techniques. Written prompts are central to the design. Ambiguous prompts (e.g., "Secret dance" or "Bring light") appear beneath scratch-off areas on a 28×43 cm poster with instructions for users to select any activity that will fulfil the prompt to their satisfaction (see Figure 1). Instructions for savouring techniques (e.g., *anticipating*) are incorporated into the interaction via text blocks that appear on the poster (e.g., "*Try to imagine, in the most precise way, what actions you might take in relation to today's prompt and how they may make you happy. You can imagine all kinds of positive events, from simple everyday pleasures to very important positive events*"). Savouring techniques are systematically paired with prompts to guide users through different techniques over time.

The remainder of this section details the phases followed for developing *Revealing Moments*:

1 generating savouring activity prompts

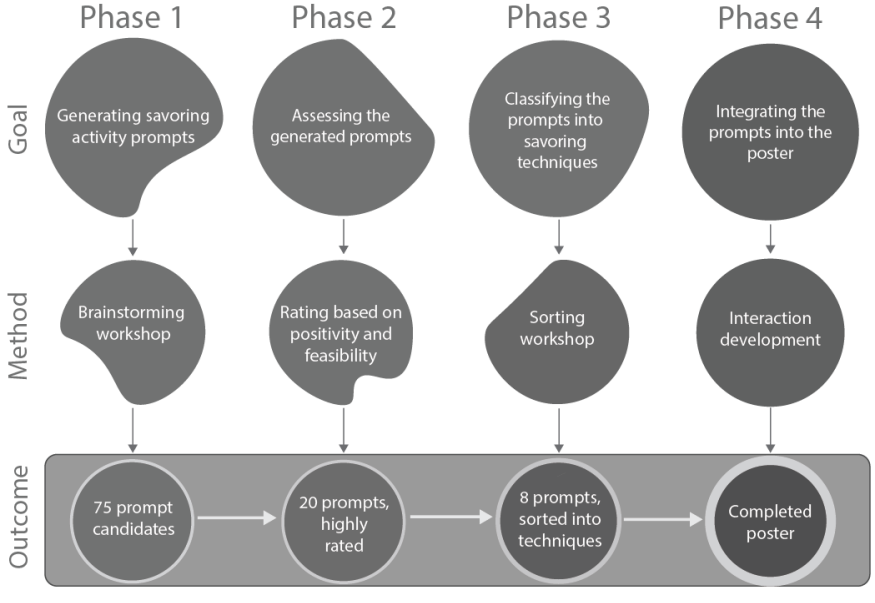
2 assessing the generated prompts

3 classifying the prompts into savouring techniques

4 integrating the prompts into *Revealing Moments* (see Figure 2).

All methods and procedures described in this paper were approved by the Cornell University Institutional Review Board (protocol ID number: 1910009152).

Figure 2 Goals, methods, and outcomes during each phase of the intervention's development



3.2 Phase 1: generating savouring activity prompts

A brainstorming workshop was conducted with six artists to generate potential word prompts. The participating artists' creative proficiencies included poetry, immersive theatre, architecture, music, and dance. The workshop began with outlining the features of a suitable prompt: i.e., the prompts should be concise, open-ended, and non-prescriptive. The workshop resulted in 41 initial prompts with eight being eliminated due to redundancy. When combined with prompts from a preceding study (Faulk et al., 2020), a total of 75 prompts were generated for further assessment.

3.3 Phase 2: assessing the generated prompts

The prompts generated in Phase 1 were assessed based on their perceived positivity and difficulty of translating them into action (i.e., feasibility). A convenience sample of 27 participants (20 females, median age 35) completed an online survey. Judges rated the prompts' subjective 'difficulty' to interpret through action, (i.e., "*I find it DIFFICULT to imagine an action that would fulfil this prompt*"), along with each prompt's potential to promote positive emotions (i.e., "*POSITIVE emotions arise because of imagined actions associated with this prompt*"). These questions were repeated for each of the 75 prompts (i.e., 150 questions in total). Based on the survey's results, 45 of the most "difficult" prompts were eliminated. Using positivity ratings as a secondary filter to identify the most 'positive' prompts, a list of 20 emerged. On a 7-point scale of low-to-high agreement, these 20 prompts showed an average difficulty rating of 2.23 ($SD = 0.43$) and an average positivity rating of 4.81 ($SD = 0.53$). Although the median age of the sample was outside of the target end-users (i.e., emerging adults), we did not observe any noticeable differences in the assessment of prompts affected by the judges' ages. A list of the prompts appears in the linked Appendix (See online Appendix, linked at the end of this manuscript).

3.4 Phase 3: classifying the prompts into savouring techniques

A workshop was conducted with four design researchers to pair the prompts with the targeted savouring techniques through a card-sorting procedure (in which participants sort the items based on their perceived similarities; Sinha and Boutelle, 2004). The recruited researchers had expertise in both design methods and emotion-driven design so that they could readily grasp the procedure and the concept of savouring. The top 20 prompts were printed on paper and placed into a grid formation on a table. Alongside the prompts were placards denoting different savouring techniques. The facilitator (the first author) briefly explained the definition of each savouring technique, then the participants selected any prompts for which they could imagine performing a positive action during their everyday lives (e.g., calling a beloved friend on the phone or planning a week-long trip).

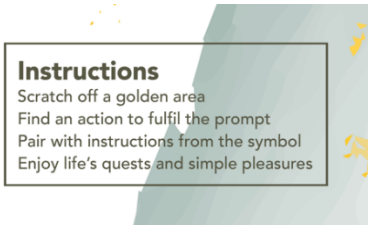
There were four sorting sessions, one for each targeted savouring technique (i.e., *absorption, anticipating, self-congratulation*, and *sharing with others*). Each session ended with a discussion about why participants chose certain prompts. For example, one participant said, "*I chose* '*Try it out*' *[for* anticipating*] because you need to know what you will try to anticipate it. It should be something good, and that's why you want to try it: it's positive.*" The workshop resulted in the final set of eight prompts with two prompts

for each of the four savouring techniques. The remaining prompts were eliminated because they recurred across multiple sessions and thus lacked a discriminating quality. On a 7-point scale, the final eight prompts showed a mean difficulty rating of 2.40 (*SD* = 0.51) and a mean positivity rating of 4.87 (*SD* = 0.45).

3.5 Phase 4: integrating the prompts into Revealing Moments

The eight prompts were integrated into the design of *Revealing Moments* so that users can envision an activity that would fulfil the prompt to their own satisfaction while also pairing their self-selected activity with a systematically selected savouring technique. The instructions on the poster framed the experience as a series of 'quests,' with limited explanation as to their purpose (see Figure 3).

Figure 3 Instructions written on the poster (see online version for colours)



Next the instructional text for the four savouring techniques was added to the poster by adapting the descriptions from Seligman (2002). In addition to the textual instructions, visual instructions were also created. Beneath each scratch-off area appears the ambiguous prompt along with one of four, unique, star-like symbols (see Figure 1). The symbol serves as a visual reference to the prompt's systematically selected savouring technique with the instructive text appearing as four short paragraphs on the poster (e.g., for *self-congratulation:* "*Praise yourself for making it this far or for completing a task. Recall how long you have waited for this moment. Pause to express congratulations to yourself with today's action*"). A supplementary instruction page provided further context for interaction with the poster, giving examples of the kinds of activities one might perform (see online Appendix, linked at the end of this manuscript). The interaction design thus permits users to self-select positive activities inspired by an ambiguous prompt and strategically paired savouring technique (see Figure 4).

4 Main study: identifying the impact of practising diverse savouring techniques on subjective well-being

An eight-day, mixed methods experiment was conducted to test if and how practising a diversity of savouring techniques moderates the relationship between positive activities and subjective well-being. We assumed that performing diverse savouring techniques would show advantages in well-being gains because of the principle of regulatory diversity (e.g., Quoidbach et al., 2010; Bonanno and Burton, 2013) which proposes that it is more adaptive for one's well-being to practise a diversity of emotion regulation techniques instead of focusing only on one (i.e., for the increased ability to adapt to

different circumstances; see Figure 5). Our hypothesis about the potential role of regulatory diversity in savouring was operationalised as:

H1. Greater diversity in savouring techniques predicts increased well-being.

Figure 4 Interaction scenarios for Revealing Moments in which two individuals self-select different positive activities (i.e., gathering with friends vs. photographing the sunset) with different savouring techniques (i.e., sharing with others vs. anticipating) in response to the same ambiguous prompt (i.e., "Bring light") (see online version for colours)

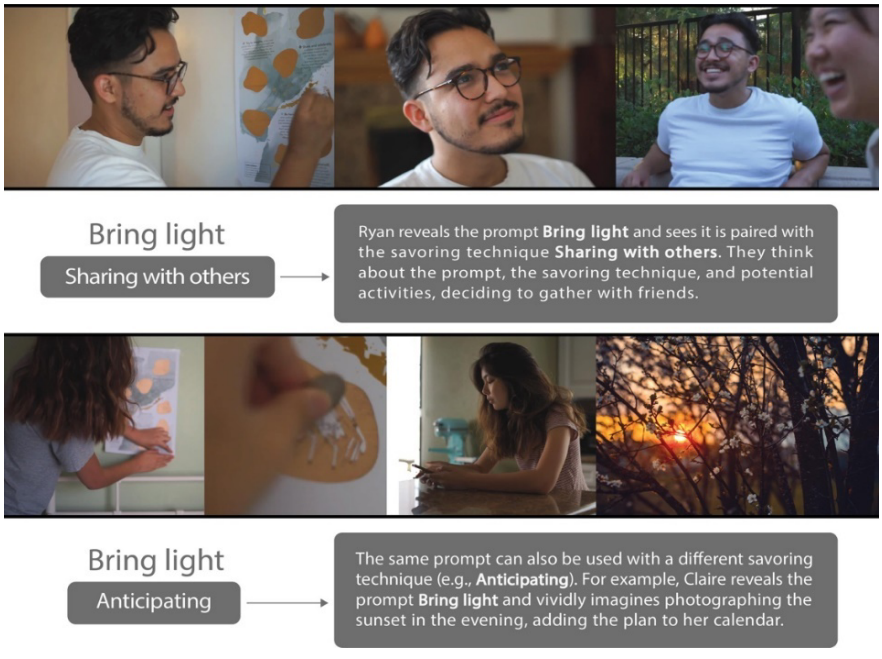
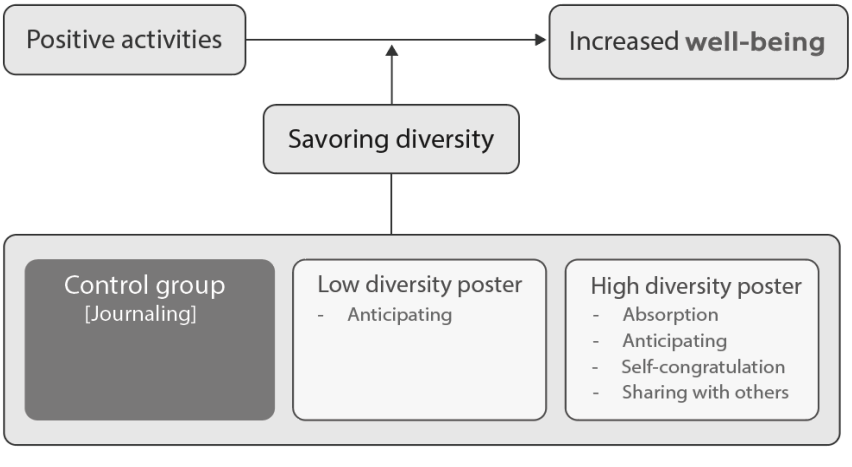


Figure 5 A diagram that depicts how practicing diverse savouring techniques may increase participants' subjective well-being



4.1 Materials and methods

We utilised a 1×3, single-blind, randomised controlled trial (RCT; see Jadad and Enkin, 2008). Those in the control group journaled, which is a general practice in PPI studies (e.g., Peterson and Seligman, 2004; Sin and Lyubomirsky, 2009; Desmet and Sääksjärvi, 2016). Savouring diversity included two levels (i.e., low diversity vs. high diversity). The low savouring diversity group received a poster that facilitated only one savouring technique (i.e., *anticipating*), while the poster for the high savouring diversity group facilitated four savouring techniques: i.e., *absorption, anticipating, self-congratulation*, and *sharing with others* (see Figure 5).

4.2 Participants

A total of 83 participants (75% female; ages 18-24) were recruited at Cornell University during the Spring of 2020. All participants were recruited through the institution's research recruitment platform. Eligibility depended upon residing in US to control for participants' start times (i.e., because study materials were mailed). Compensation was offered in the form of university research participation credits with a chance to win a raffled gift card for $50.

4.3 Measures

The measurement instruments used in the study are explained in this section. Table 2 provides an overview of independent variables (IVs) and dependent variables (DVs).

Table 2 Key IVs and DVs along with their associated constructs and measurement instruments

Variable	*Construct*	*Instrument*
IV	Trait savouring beliefs	Savouring beliefs inventory (SBI; Bryant, 2003)
IV	Perceived stress	Perceived stress scale (PSS; Cohen et al., 1983)
DV	Cognitive well-being	Flourishing scale (FS; Diener et al., 2010)
DV	Cognitive well-being	Satisfaction with life scale (SWLS; Diener et al., 1985)
DV	Emotional well-being	Scale of positive and negative experiences, positive subscale (SPANE-P; Diener et al., 2010)

4.3.1 Independent variables

Two covariate factors (i.e., trait savouring beliefs and perceived stress) were measured to account for their assumed modulating effect on savouring-based interventions.

Trait savouring beliefs: The participants' baseline savouring ability was measured as a covariate by administrating the savouring beliefs inventory (SBI; Bryant, 2003), a questionnaire that assesses attitudes towards savouring, which is known to correlate with savouring practices (e.g., Wood et al., 2003) and subjective well-being (e.g., Hurley and Kwon, 2013).

Perceived stress: The perceived stress scale (PSS; Cohen et al., 1983) was included to account for the known moderating effect of stress on well-being (see Schiffrin and Nelson, 2010). Perceived stress was measured because of our assumption that utilising

multiple savouring techniques would increase participants' well-being, thereby mitigating their stress.

4.3.2 Dependent variables

The well-being of participants was measured at two levels by combining validated scales of cognitive and emotional well-being. Baseline measurements of key variables can be found in Table 3 of the results section.

Table 3 Baseline means for pretest DVs with one-way ANOVAs and chi-squared tests

	Low savouring diversity	*High savouring diversity*	*Control group*		
	n = 23	*n = 21* *n = 20*	*n = 27*		
Variable	*Mean (SD) or Percentage*	*Mean (SD) or Percentage*	*Mean (SD) or Percentage*	*F-value or Chi-square*	*p-value*
FS pretest	43.96 (*5.60*)	43.52 (*6.48*)	45.00 (*6.46*)	0.37	0.69
SWLS pretest	23.43 (*6.17*)	[a]23.95 (*5.69*)	23.33 (*5.70*)	0.07	0.93
SPANE-P pretest	20.13 (*4.27*)	22.62 (*3.71*)	21.78 (*3.71*)	2.35	0.10
SPANE-N pretest	16.87 (*4.38*)	15.05 (*3.02*)	14.56 (*3.07*)	2.85	0.06
SPANE-B pretest	3.26 (*7.07*)	7.57 (*6.14*)	7.22 (*6.12*)	3.18	**0.048***
PSS pretest	29.52 (*7.94*)	26.90 (*8.72*)	26.00 (*7.46*)	1.26	0.29
SBI pretest	6.17 (*6.45*)	4.52 (*6.68*)	4.85 (*6.10*)	0.42	0.66
Sex (Female)	70%	76%	78%	0.23	0.79

*=$p < 0.05$. Baseline scores with p-values of $p < 0.05$ are **bolded**. [a] = sample size of 20 instead of 21. FS = Flourishing Scale. SWLS = Satisfaction with Life Scale. SPANE-P = Scale of Positive and Negative Experiences, positive subscale. SPANE-N = Scale of Positive and Negative Experiences, negative subscale. SPANE-B = Scale of Positive and Negative Experiences, balanced scale. PSS = Perceived Stress Scale. SBI = Savouring Beliefs Inventory.

Cognitive well-being: The flourishing scale (FS; Diener et al., 2010) was included, which measures self-perceived psychosocial prosperity across domains such as relationships, purpose, optimism, and self-esteem. As a second instrument, the satisfaction with life scale (SWLS; Diener et al., 1985), which focuses on global life satisfaction, was used to measure the cognitive well-being of participants.

Emotional well-being: The scale of positive and negative experiences (SPANE; Diener et al., 2010) was included to measure emotional well-being. The SPANE measures self-reported feelings of persistent positive affect (6 items, SPANE-P) and negative affect (6 items, SPANE-N) in response to the question, "*how often have you experienced the following feelings during the past week?*" A combined score (SPANE-B) can be generated by subtracting the total negative sub-scale score from the total positive sub-scale score. The SPANE-B serves as a general measure of emotional well-being with the two SPANE sub-scales providing additional valence information.

4.3.3 Written responses

To provide a source of qualitative assessment of the intervention, two open-ended questions were adapted from a community activism evaluation methodology called Ripple Effects Mapping (Washburn et al., 2020) and included in the posttest questionnaire. The first question reads, "*What was the single greatest benefit from engaging with the prompts?*", while the second question asked, "*What was the best story that came out of the prompt interactions?*" These questions were modified for the journaling control group. Participants were also made aware they could report no benefit from the intervention.

4.4 Procedure

The study took place during the Spring of 2020. Participants who consented to participation and completed an intake questionnaire were included in the study and randomly assigned to a group. Study materials were mailed to participants' homes. Participants in the two experimental groups received a mailed packet that included their poster along with general instructions and QR codes to questionnaires, while the control group received instructions for journaling along with QR codes for questionnaires. The study began when the participant received their mailed packet and completed the first questionnaire. The behavioural intervention occurred in the eight days between the pretest and posttest surveys, which were distributed on the days immediately preceding and following the study, respectively.

Participants in the experimental groups engaged in eight self-selected, positive activities along with practicing eight associated savouring techniques during the intervention period. Participants in the journaling group were asked to write about their daily experiences once per day. Participants were sent regular email reminders to complete their daily activities, also completing a brief, daily check-in questionnaire about the prior day's study-related activities. The experiment concluded once the posttest questionnaire was finished.

4.5 Analysis

All quantitative analyses were conducted in Stata/MV 16.1. All qualitative coding was completed using ATLAS.ti 8. Between-group comparisons were achieved with multiple linear regression models. Note that all models control for pretest scores of the outcome variable and adhere to the following perimeters:

$$\begin{aligned}&\text{Model-Adjusted-Posttest-Dependent-Variable}\\&= B_1 + B_2\text{Low-Savouring-Diversity-Group-Assignment}\\&\quad + B_3\text{High-Savouring-Diversity-Group-Assignment}\\&\quad + B_4\text{Pretest-Perceived-Stress} + B_5\text{Savouring-Beliefs}\\&\quad + B_6\text{Dependent-Variable-Pretest} + e\end{aligned}$$

5 Results

Of the 83 individuals who joined the study, 12 participants (4 per group) dropped out, leaving 71 in the final sample. We report the results by synthesising both qualitative and

quantitative outcomes to reflect the mixed-methods approach. Baseline means for pretest dependent variables appear in Table 3. Unadjusted pre- and post-test means for key variables are shown in the Appendix (see online Appendix, linked at the end of this manuscript).

5.1 Subjective well-being outcomes

The assessment of cognitive well-being based on Flourishing Scale (FS) supported *H1* (see Table 4). Assignment to the high savouring diversity condition predicted the greatest change in pre-post FS scores ($p = 0.005$) with a large effect size (*partial* $\eta^2 = 0.119$). In comparison with the control group, participants in the high savouring diversity condition showed a mean pre-post increase of 3.54 points on the FS. Thus, participants in the high savouring diversity group reported the highest cognitive well-being.

Table 4 Parameter estimates for a multiple linear regression model predicting the change in pre-post FS scores

			95% CI			
Variable	*Coefficient*	*SE*	*LL*	*UL*	*Partial* η^2	*p-value*
Intercept (Control Group)	6.776	5.605	–4.421	17.973	–	0.231
Low Savouring Diversity Group	1.441	1.175	–0.906	3.788	–	0.225
High Savouring Diversity Group	3.541	1.203	1.137	5.944	0.119	**0.005**
PSS (Pretest)	–0.075	0.075	–0.225	0.074	0.016	0.318
SBI	–0.019	0.079	–0.177	0.139	0.001	0.813
FS (Pretest)	0.880	0.095	0.691	1.070	0.574	**0.000**

$N = 70$. Significance levels of $p < 0.05$ are **bolded**. FS = Flourishing Scale. PSS = Perceived Stress Scale. SBI = Savouring Beliefs Inventory. $F(5,64) = 28.72$. $p > F = 0.000$. R-Squared = 0.692. Root MSE = 4.061. The partial η^2 (i.e., "partial eta squared") value represents an effect size estimate for how much of the FS score variability can be explained by that variable. In the case of group assignment, a three-level categorical variable (i.e., Control vs. Low Savouring Diversity vs. High Savouring Diversity) is combined for that variable's effect size evaluation.

The assessment of cognitive well-being based on SWLS did not support *H1*. Group assignment did not predict model-adjusted posttest scores on the SWLS for high savouring diversity and low savouring diversity groups. Thus, neither version of the intervention affected participants' life satisfaction.

The assessment of posttest positive emotions (i.e., Scale of Positive and Negative Experiences–Positive Subscale, SPANE-P) did not support *H1*. Group assignment did not predict participants' model-adjusted SPANE-P scores for either experiential group. Thus, neither intervention led to an increase in participants' self-reported positive emotions.

Thematic content analysis (Braun and Clarke, 2006) of the written responses illuminated trends in the subjective experiences of poster users. An emergent coding scheme revealed four broad, repeating patterns (i.e., themes) within the qualitative data:

1 indications of savouring diversity in the written responses

2 non-savouring positive outcomes

3 unique stressors as additional context

4 reactions to the overall experience.

Passages from the first two themes suggest that many self-selected experiences supported participants' cognitive well-being; for example, one poster user described how the prompt 'Beautiful sight' helped them to appreciate the beauty of a friendship, "*my friend and I planned on going on a hike for* '*beautiful sight*'*, but it was cold and rainy, so we decided against it. This is cheesy, but instead I decided to see the beauty in her while we were still living together*" (P1, low savouring diversity group). Another poster user described how the same ambiguous prompt (i.e., "Beautiful sight") inspired them to follow their artistic interests to make "*something I was actually really proud of in order to fill that prompt*" (P2, low savouring diversity group). Thus, the same prompt (i.e., "Beautiful sight") inspired both users to employ different savouring techniques (i.e., temporal awareness vs. self-congratulation) that can support cognitive well-being (Smith and Bryant, 2017; Lauzon and Green-Demers, 2020).

Speaking more generally about their experiences, some users wrote about how they "*came to appreciate the little things*" (P3, high savouring diversity group) or felt "*more engaged with daily activities*" (P4, high savouring diversity group), while others described how the intervention "*helped me to think about my actions*" (P3, high savouring diversity group). As one user wrote, "*even if I didn't do something that brought me overwhelming joy, I often did something that at the very least made me feel more accomplished in my day*" (P5, high savouring diversity group). A few individuals expressed how the experience led them to feel gratitude, for example: "*This was a beautiful experience and made me feel more thankful for my life*" (P6, high savouring diversity group). Others described how the intervention helped them to cope with stressful situations: "*With all the negativity and chaos going on in US, introspection is a calming and grounding task*" (P7, high savouring diversity group). For an in-depth analysis of the qualitative data in this study see Faulk (2020).

5.2 Correlation matrix

In pooled, Pearson correlations with Sidak-corrected significance tests, the cognitive- and emotional post-test well-being scores were highly intercorrelated (see Table 5) and were inversely associated with the post-test measure of negative persistent emotions (i.e., SPANE-N), meaning that the measures of well-being used in this study likely target related theoretical constructs (i.e., reinforcing their construct validity).

6 A brief discussion of the study

This study examined if and how practising diverse savouring techniques would predict subjective well-being. We developed and tested an interactive poster to support users in performing self-selected, positive actions as accompanied by systematically paired savouring techniques. The results suggest that an increase in savouring diversity may strengthen the relationship between positive activities and cognitive well-being; however, this finding is deemed limited by confounding factors associated with low dosage, a short

timeframe, and the onset of the COVID-19 pandemic. In the following section, we discuss our findings in relation to our hypothesis, i.e., greater diversity in savouring techniques predicts increased well-being.

Table 5 Pearson correlation matrix for continuous variables with Sidak-corrected, pairwise tests for significance (N = 70)

	1	*2*	*3*	*4*	*5*	*6*	*7*
1, FS posttest	1						
2, SWLS posttest	**0.67****	1					
3, SPANE-P posttest	**0.56****	**0.42***	1				
4, SPANE-N posttest	**–0.44****	–0.34	**–0.53****	1			
5, SPANE-B posttest	**0.57****	**0.43***	**0.87****	**–0.88****	1		
6, PSS posttest	**–0.52****	**–0.46****	**–0.61****	**0.63****	**–0.71****	1	
7, SBI	–0.19	–0.11	0.12	0.10	0.01	0.06	1

Bolded = significant. *=p < 0.05. **=p < 0.01. Sidak corrected significance tests were used to adjust p-values given the presence of multiple tests. FS = Flourishing Scale. SWLS = Satisfaction with Life Scale. SPANE-P = Scale of Positive and Negative Experiences (Positive Subscale). SPANE-N = Scale of Positive and Negative Experiences (Negative Subscale). SPANE-B = Scale of Positive and Negative Experiences (Balanced Scale). PSS = Perceived Stress Scale; SBI = Savouring Beliefs Inventory.

6.1 Cognitive well-being and savouring diversity

Written responses suggest that intervention users experienced boosts in cognitive well-being via, "*being more engaged with daily activities*" (P4, high savouring diversity group) or, "*being reminded that little things can make each day a bit brighter, and that happiness is a conscious effort*" (P8, low savouring diversity group). However, the two quantitative measures of cognitive well-being yielded mixed results. Below is a discussion of the two cognitive well-being outcomes observed by the quantitative instruments.

First, the flourishing scale (FS) followed the hypothesised outcome with increased savouring diversity predicting model-adjusted, post-test FS scores. These findings are consistent with the theory of regulatory diversity (e.g., Bonanno and Burton, 2013) which proposes that practising a wider variety of savouring techniques increases the likelihood of making adaptive adjustments to emotion regulation. It is also possible that the FS's inclusion of self-perceived accomplishment (e.g., "*I am competent and capable in the activities that are important to me*") was uniquely sensitive to the savouring technique of self-congratulation that was facilitated twice within the high savouring diversity condition. Indeed, research on eudemonic savouring (i.e., the cognitive appraisal of meaning in one's life; see Bryant et al., 2011) explains how savouring techniques such as gratitude (Lauzon and Green-Demers, 2020) can support cognitive well-being.

Second, the SWLS did not register between-group differences in model-adjusted, post-test scores. Given the short period and low dosage of this intervention, perhaps it is not a surprise that life satisfaction remained unaltered. Previous literature on the SWLS suggests it has a temporal reliability of up to four years (see Pavot and Diener, 1993) and that shifts in this measure of well-being over a short period would require substantial changes to an individual's outlook.

A future study should include secondary measures of persistent cognitive well-being to confirm the impact of savouring diversity beyond the FS and should also include a quantitative measure of users' savouring activities (e.g., Ways of Savouring Checklist; Bryant and Veroff, 2017) to compare groups directly. Furthermore, Quoidbach et al. (2010) recorded a medium effect size for savouring diversity as a predictor of subjective well-being; however their measure aggregated both emotional and cognitive well-being into one instrument and, as a result, they could only speculate as to whether cognitive or emotional well-being was more strongly moderated by savouring diversity. Our study suggests that cognitive well-being may show greater sensitivity to savouring diversity, although more research is needed to replicate these findings.

6.2 Emotional well-being and savouring diversity

Against our hypothesis, posttest measures of persistent positive emotion on the SPANE-P did not change between groups. We postulate that there would be two reasons for the lack of change in users' measured positive emotion. First, perhaps the dosage used in this study was insufficient to produce a measurable change in persistent positive emotion. Similar studies of savouring interventions have observed improvements in emotional well-being when the intervention lasted for longer periods of time; for example, five weeks with six positive activities per week, totalling 30 positive activities per user (Desmet and Sääksjärvi, 2016). In comparison, users of *Revealing Moments* only performed eight positive activities over eight days, totalling eight activities per user. It has been proposed that activity-based PPIs yield small effect sizes (see Brown and Rohrer, 2020; White et al., 2019); therefore, future research should increase the dosage of a savouring-based intervention beyond eight days (to improve the chances of measurable impact).

Second, the lack of between-group differences in post-test positive affect may relate to the nature of eudemonic well-being (Huta and Ryan, 2010; Bryant et al., 2011; Deci and Ryan, 2008; Ryff, 2018) which stems from meaningful experiences that are not always pleasant (e.g., sharing one's resources for the public good, being persistent to develop personal talents). We assert that self-selected positive activities may vary in their eudemonic qualities and, as such, mixed emotions may result. For example, one person in our study self-selected to reach out to a family member with whom they have a challenging relationship:

> "One of the prompts really tugged at me to send a text to my dad who I have had troubles with within our relationship. Even though it obviously didn't fix all the problems we have going on, I am glad that I was pushed to be honest, and really allowed me to clear my conscience of things I had been holding in for a while." (P9, low savouring diversity group)

7 General discussion and conclusion

7.1 Contributions and design implications

This study breaks new ground in several ways. First, where prior research on savouring diversity has been cross-sectional (i.e., no random assignment; e.g., Quoidbach et al., 2010), the current study provides the first RCT that examines savouring diversity as a predictor of subjective well-being. Our study also provides the first evidence that

savouring diversity may have a unique impact on cognitive well-being (over emotional well-being). Yet, in practice, PPIs that facilitate savouring tend to focus on only one technique (e.g., Costa et al., 2018; Yoon et al., 2022; Uhde and Hassenzahl, 2021) instead of facilitating multiple emotion regulation techniques through the same design, which has been recently suggested as a future research agenda for the development of emotion regulation technologies (Slovak et al., 2022). Based on our findings, we recommend that practitioners of Positive Design who seek to support cognitive well-being should consider scaffolding diverse savouring techniques into their designed interactions. In addition, future research into savouring may wish to include an instrument with granular differentiation between eudemonic (i.e., cognitive) and hedonic (i.e., emotional) savouring techniques such as the Savouring Configuration Inventory (SCI; Lauzon and Green-Demers, 2020), which measures savouring comprising seven dimensions: hedonic savouring, eudemonic savouring of life's meaning, spirituality, self-reflection, inspiration, appreciation, and gratitude.

Second, the design approach of Directional Ambiguity permitted users to self-select positive activities in response to ambiguous prompts, thus promoting Person-Activity Fit (Lyubomirsky and Layous, 2013). Further, ambiguous prompts may help users to maintain their engagement (e.g., "*It gave me something fun to do in the background of my life*", P10, high savouring diversity group; "*It was amusing to be able to think of different things to do each time*", P10, high savouring diversity group), perhaps by increasing their sense of agency (e.g., "*I realized that I could control my life*", P11, low savouring diversity group) which enabled them to "*do something different or something that I normally wouldn't do during the day*" (P12, high savouring diversity group), ultimately serving to refresh their outlook. One user (P13, high savouring diversity group) shared that they sometimes did not focus on their own enjoyment when choosing actions, but instead focused on increasing the happiness of others, illustrating how the flexible instructions can lead to unique interpretations that suit users' interests and contexts. Given the encouraging response participants had to the interaction design (e.g., "*this was a beautiful experience and made me feel more thankful for my life*", P6, high savouring diversity group), we recommend that PPI designers continue to explore Directional Ambiguity as a method for assisting users to take ownership over their intervention experience (Faulk et al., 2022). To that end, we offer our list of the top 20 ambiguous prompts in the linked appendices (see online Appendix, linked at the end of this manuscript), which were rated as highly positive and feasible for users to interpret through self-selected positive activities.

Third, designers can increase user engagement in self-selected activities by considering the kind of support users may require. For example, in testing the ambiguous prompts on their ratings of perceived positivity and feasibility, we determined which prompts would send users in a generally 'positive' and 'feasible' direction in their self-directed search for positive activities. In contrast, earlier prototypes that lacked a systematic analysis of the prompts (Faulk et al., 2020) frustrated some prototype users in their attempts to self-select activities. Thus, we recommend that designers employing Directional Ambiguity consider the facets of users' self-selection process and then scaffold the experience based on the insights that are generated, shared, and checked with the intended users to increase the likelihood of successful outcomes for them. For a comprehensive discussion on related participatory design methods and tools, see Sanders and Stappers (2012). To assist designers using Directional Ambiguity in PPIs, we have

included a list of 20 positively rated ambiguous prompts in our Appendix for others to coopt (See online Appendix, linked at the end of this manuscript).

Fourth, the artefact *Revealing Moments* adds new knowledge to the field of Positive Design. As found by Desmet and Sääksjärvi (2016), a set of positive activities printed on a tangible artefact was more effective in aiding emerging adult users to perform positive activities than those printed on paper. Such a finding is valuable because PPIs outside of coaching relationships typically centre upon non-interactive printed materials or screen-based technologies (see, Parks et al., 2012; e.g., Howells et al., 2016; Riboldi et al., 2023). In our study, some participants provided feedback on the aesthetic qualities of the poster (e.g., "*I'll probably keep the poster as decoration*", P14, low savouring diversity group), suggesting the artefact's aesthetic quality may play a role in users' willingness to display the intervention in their environment, helping to overcome the "out of sight, out of mind" issue (e.g., Mittelman et al., 2020). As found by other tangible PPI designers (e.g., Bharmal et al., 2020), the physical placement of the artefact within the user's environment affected users' motivation, "*If I was to start this study over, I would have kept the poster in a separate area from where I usually do my work. I initially thought this would be a prominent spot, but I think it made me less motivated to fulfil the prompts*" (P8, high savouring diversity group). One participant (P15, high savouring diversity group) suggested that the form would be more engaging if the scratch-off prompts were made into stickers that could be placed anywhere. Future research may wish to explore the potential differences between tangible and screen-based PPIs that scaffold similar emotion regulation techniques. The qualitative differences for emerging adult users may be telling given that technology plays an increasingly central role in day-to-day life and some individuals seek to reduce their screen time to support their mental health (e.g., Schmuck, 2020).

Fifth, in scaffolding knowledge of how to apply PER techniques, we found it possible to rephrase the description of savouring techniques (Seligman, 2002) as brief instructions, thus creating two levels of directions:

1 how to identify a positive activity

2 how to savour the positive activity.

Including a variety of savouring instructions (e.g., for self-congratulation: "Praise yourself for making it this far or for completing a task. Recall how long you have waited for this moment. Pause to express congratulations to yourself with today's action") effectively encouraged users to practice various savouring techniques in the high savouring diversity group. Others may wish to utilise the same two-level approach in PPI interventions to help facilitate a variety of emotion regulation techniques within the same intervention as suggested by Slovak et al. (2022).

Lastly, when we provided emerging adults with the ability to self-select positive activities, participants frequently chose to involve others (e.g., "*I really liked connecting with my friends through it*", P16, low savouring diversity group). Indeed, increasing the social support aspect of product interactions may tap into the Basic Psychological Need for relatedness, thereby possibly increasing engagement (Peters et al., 2018). Therefore, it may be helpful for PPI designers to consider how they may permit emerging adult users to involve others (i.e., to help them to maintain their engagement with the intervention experience; for an overview of relatedness-specific design strategies, see Peters, 2022).

7.2 Mental health and the COVID-19 pandemic

This study took place during the beginning weeks of the COVID-19 pandemic. Participants, along with the rest of us, lacked information about how the virus would impact daily life going forward. A loss of control often leads people to seek emotion management activities; however, some behavioural responses are healthier than others. For example, compulsive checking of online newsfeeds (i.e., "doomscrolling"; e.g., Watercutter, 2020) is a common, modern-day response to crisis; in related research, pandemic-focused news media exposure has been found to reliably predict psychological distress in many populations (Holman et al., 2020; Bendau et al., 2021; Lades et al., 2020), including in college students (Huckins et al., 2020). Supportive social connection, on the other hand, has been found to be an effective strategy for enhancing well-being during stressful periods (e.g., the 2008 economic crisis; Gonza and Burger, 2017). The qualitative data in our study suggest that *Revealing Moments* helped many users to maintain social connections during lockdown. One poster recipient, who had formed a "social pod" with their neighbours, said: "*The prompt* '*Going up*' *was nice, and I interpreted it literally by actually going upstairs to see my friends who I hadn't spent time with in a couple days*" (P17, high savouring diversity group).

Considering the external stressors associated with the pandemic, some participants expressed gratitude at having the occasion to reflect upon their experiences (e.g., "*With all the negativity and chaos going on in US, introspection is a calming and grounding task*", P7, high savouring diversity group). Interestingly, many participants reported certain positive activities (e.g., practicing hobbies, spending time in nature, and social engagement) that closely mirrored positive activities reported in another study (Lades et al., 2020). Yet, external stressors coinciding with the start of the COVID-19 pandemic, final examinations, and nationwide social justice protests (e.g., the Black Lives Matter movement) may have overshadowed any intervention-generated positive effects for some users:

> "I really did like this experiment, and I feel a bit bad because I don't feel the results of this survey will reflect the benefit I got out of it. Lately, obviously, there have been some big changes and uncertainty about the future as well as finals, which have all been upsetting me. So that may skew your results." (P18, high savouring diversity group)

Our study may highlight the significance of contextual factors in design for well-being as observed in Smits et al. (2022). While we could not have predicted the context-specific effects of the pandemic during the design phase for *Revealing Moments*, perhaps designers of future PPIs may benefit from showing a deliberate sensitivity to contextual factors (e.g., the need for physical distancing combined with the importance of social interaction) of their target populations within larger ecological trends (e.g., those who work from home are often isolated and need social interaction). Contextually derived user needs could be considered during the design process to increase the relevance of the intervention within a larger ecological framework.

7.3 Limitations

The central limitation of this study is the unusual time during which it was conducted. The onset of the COVID-19 pandemic led to unprecedented societal changes, including an unexpected shift toward remote learning in combination with 'stay-at-home' orders.

The compounding nature of these and other acute stressors was reflected in the written responses. Thus, the unusual time may limit the external validity of our findings to other times of societal unrest.

Self-report method could have inadvertently led to social desirability bias and other experimenter effects. Yet, the relatively consistent themes that appeared in the written data (e.g., a recurring theme of gratitude, "*Super glad I got to be a part of this experience. It was fun and something to look forward to every day!*" P19, high savouring diversity group) suggest that many participants felt some degree of enjoyment and relief from daily stressors because of the experiences facilitated by *Revealing Moments*. Therefore, *vis-à-vis* the potential for experimenter effects, we feel confident in the validity of these results.

Memory biases may have also affected participants' answers as they were asked to recall positive emotional experiences after the fact. Indeed, others have noted that memories can shift to align with beliefs about oneself, or about related events, instead of accurately depicting past emotions (Robinson and Clore, 2002), a phenomenon that has been measured within eight days of an event (e.g., Urban et al., 2018). Further, retrospectively recalled memories can change with a person's current emotional state (Karahanoğlu and Ludden, 2021). Thus, 'savouring' may have inadvertently occurred when participants imagined past positive events (Pennebaker, 2004), introducing an unintended boost to well-being. Yet, we endeavoured to minimise such an unintended boost in well-being by requesting all written responses at the end of the survey (i.e., the last day). To overcome potential memory biases in future emotion-based research, a concurrent self-report method, such as Ecological Momentary Assessment (EMA; Stone and Shiffman, 1994), could be introduced.

Although the Low Savouring Diversity group indicated lower emotional well-being during the start of the experiment (see Table 3), this group's baseline mean score would not be considered out-of-the-ordinary for individuals weathering the COVID-19 pandemic. Therefore, we consider our results to reflect an ecologically valid starting point for intergroup comparisons. Future research should consider increasing the sample size and omitting participants with outlying baseline values.

Prescribing four savouring techniques might have constrained our ability to evaluate potential ceiling effects of savouring diversity as a moderator of the relationship between positive activities and subjective well-being. While Quoidbach et al. (2010) – who also measured four savouring techniques – observed adaptive effects from increased savouring diversity, future research should extend beyond four techniques to test for ceiling effects. We suggest scaffolding six-to-ten savouring techniques while also testing a version of the intervention that scaffolds only four techniques.

Finally, this study was relatively short. To close the knowledge gap around the long-term impact of savouring (see Bryant, 2021), future studies should investigate the long-term benefits of engaging in design-mediated savouring practices. Such a longitudinal study could also benefit from increasing the number of participants, which is an enduring limitation among activity-focused studies of subjective well-being (see Brown and Rohrer, 2020).

7.4 Conclusion

Our study investigated if and how practising diverse savouring techniques impacts outcomes of subjective well-being. While cognitive well-being showed improvement

for participants who were assigned to the high savouring diversity condition, emotional well-being was not predicted by savouring diversity. Confirmatory research is needed with a larger sample size, over a longer period, and featuring concurrent self-report measures (e.g., EMA method).

From a design perspective, our results suggest that allowing people to self-select their own positive activities may have helped them to sustain their engagement while increasing their Person-Activity Fit. We thus encourage designers to continue exploring Directional Ambiguity as an interaction method. Furthermore, the tangible form factor of the intervention provided an engaging alternative to popular means of sharing evidence-based Positive Psychology practices with emerging adult users (e.g., books and screen-based technologies), reinforcing the efficacy of tangible interventions for this population. Lastly, most participants in the two experimental groups opted to involve other people in their self-selected positive activities, emphasising the suitability of PPIs that facilitate social connection for emerging adults. Design practitioners may wish to explicitly scaffold social affordances in future PPIs to meet the interests of emerging adult users in the general population.

By promoting a diversity of savouring techniques, designers can highlight the available richness of each moment in our day-to-day experiences. Whether we become lost in the moment or share good news with family and friends, we can prolong and amplify our positive emotions, thereby boosting our subjective well-being. As designers, we are uniquely equipped to scaffold emotion management techniques that help users to refresh their agency as caretakers of their own well-being. We hope that our description of developing *Revealing Moments* will inspire others to pursue this goal.

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https://mdtl.human.cornell.edu/faulk-2023-jdr-video

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Appendix

The online Appendix includes instructions that were mailed to poster users, a table of key variables with unadjusted pretest and post-test group means, and a list of 20 top-rated ambiguous prompts that resulted from the brainstorming and evaluation sessions.

http://mdtl.human.cornell.edu/faulk-2023-jdr-appendix