Enacted Extraversion as a Well-Being Enhancing Strategy in Everyday Life: Testing Across Three Week-Long Interventions

Zachary M van Allen
Carleton University

Tamir Streiner
Carleton University

Deanna Walker
Carleton University

John M Zelenski
Carleton University

Lab-based experiments and observational data have consistently shown that extraverted behavior is associated with elevated levels of positive affect. This association typically holds regardless of one's dispositional level of trait extraversion, and individuals who enact extraverted behaviors in laboratory settings do not demonstrate costs associated with acting counter dispositionally. Inspired by these findings, we sought to test the efficacy of three week-long 'enacted extraversion' interventions. In each study, participants engaged in fifteen minutes of assigned behaviors in their daily life for five consecutive days. Studies 1 and 2 compared the effect of adding more introverted or extraverted behavior (or a control task). Study 3 compared the effect of adding social extraverted behavior or non-social extraverted behavior (or a control task). We assessed positive affect and several indicators of well-being during pretest (day 1) and post-test (day 7), as well as 'in-the-moment' (days 2-6). Participants who engaged in extraverted behavior reported greater levels of positive affect 'in the moment' when compared to introverted and control behaviors. We did not observe strong evidence to suggest that this effect was more pronounced for dispositional extraverts. The current research explores the effects of extraverted behavior on other indicators of well-being and examines the effectiveness of acting extraverted (both socially and non-socially) as a well-being strategy.

Data, analysis code, supplementary material:

https://osf.io/czauv/?view_only=daffcf8ad723495daf985609c35fdbd0

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Positive psychology seeks ways to increase people's well-being. Strategies are often based on the idea that people might increase their happiness by mimicking the behaviors of happy people. Empirical work suggests that some brief exercises can increase well-being, for example, counting one's blessings (Emmons & McCullough, 2003; Lyubomirsky et al., 2005), performing acts of kindness (Otake et al., 2006), meditation (Fredrickson et al., 2008), writing letters expressing gratitude (Boehm et al., 2011; Seligman et al., 2005), cultivating one's character strengths (Seligman et al., 2005), and visualizing one's best possible future self (Boehm et al., 2011).

Given the success of interventions based on mirroring the behaviors of happy people, a logical extension has been to explore the possibility of mimicking positive personality traits as a strategy for increasing well-being. Among the broad traits of major taxonomies (e.g., Big Five, HEXACO), trait extraversion has the most robust link with positive emotions (Anglim et al., 2020; Steel et al., 2008). In addition, momentarily acting in extraverted ways (i.e., being *talkative*, *assertive*,

adventurous) produces increases in positive emotions, and this effect typically occurs regardless of baseline personality (Fleeson et al., 2002; Sandstrom & Dunn, 2014; Zelenski et al., 2012). In other words, acting extraverted is enjoyable, regardless of whether a person is dispositionally introverted or extraverted. Moreover, there is little evidence of costs (e.g., such as stress or fatigue) for behaving in counter-dispositional ways (Zelenski et al., 2012). These findings suggest that enacted extraversion may be a viable strategy for promoting positive emotions in everyday life.

However, with two exceptions (Jacques-Hamilton et al., 2018; Margolis & Lyubomirsky, 2019), existing data are limited to either: 1) lab-based experiments - which have questionable generalizability to day-to-day life outside the lab, and; 2) correlational experience sampling studies - with weaker causal claims and limited relevance to *intentional* increases in extraverted behavior. The present research extends observational and laboratory-based work to test whether enacted extraversion promotes elevated levels of positive affect in

daily life. Further, we explore whether extraverted behavior may have an additional impact on indicators of well-being.

Trait Extraversion

Personality traits are consistent individual differences in patterns of thoughts, feelings, and behaviors that persist over time (McCrae & Costa, 2003). Broadly, extraversion describes the tendency to engage in behavior that is bold, assertive, energetic, talkative, and adventurous, and is conceptualized as a bipolar construct on a continuum with introversion, characterized by behavior that is reserved, quiet, modest, and passive (Fleeson et al., 2002; Goldberg, 1990). The exact make-up of extraversion (facets or narrower subtraits) varies among taxonomies, but all include elements beyond mere sociability, such as high activity, excitement seeking, and sometimes even positive affect (e.g., McCrae & Costa, 2003; Goldberg, 1990; Lee & Ashton, 2018; DeYoung et al., 2007).

The (sometimes definitional) link between extraversion and positive affect strongly suggests an association with well-being; moreover, the correlation extends across a wide variety of indicators (Zelenski et al., 2014). Beyond positive affect (Lucas & Fujita, 2000), positive associations have been observed between extraversion and the presence of meaning in life (Steger et al., 2006), subjective vitality (Ryan & Frederick, 1997), and satisfaction with life (DeNeve & Cooper, 1998; Steel et al., 2008). Additionally, extraversion has been positively associated with many aspects of psychological well-being, including self-acceptance, environmental mastery, purpose in life, and positive relations with others (Schmutte & Ryff, 1997; Cooper et al., 1995; Steel et al., 2008). For example, in a recent meta-analysis of 462 studies ($n = 334,567$) the mean correlations between nine indicators of subjective well-being and psychological well-being with trait extraversion, as measured using the 'big-five' and HEXACO approaches, were $r = .37$ and $r = .48$, respectively (Anglim et al., 2020).

Despite consensus about the descriptive link between extraversion and well-being, disagreement remains as to what may explain this relationship. Some draw on extraverts' tendencies to socialize, arguing that these behaviors, and the relationships they foster, produce happiness. Extraverts spend less time alone than introverts (Argyle & Lu, 1990; Leary et al., 2003), feel more socially connected to others (Lee et al., 2008), have a greater number of sexual partners throughout the lifetime (Heaven et al., 2000), and are perceived by their peers as being more competent and more likable (Ntalianis, 2010; Wortman & Wood, 2011). However,

it is possible that extraverts' tendencies to socialize are more a consequence of happiness than its cause, or at least that the causal link is bidirectional. That is, many see the core of extraversion as being a high baseline level of positive affect (Lucas & Baird, 2004), or as a general sensitivity to reward that then facilitates frequent positive affect (Lucas et al., 2000; Smillie et al., 2012; Zelenski & Larsen, 2000).

Socializing is one way to become happier (Sandstrom & Dunn, 2014), but positive affect also promotes a desire to socialize (Whelan & Zelenski, 2012). When socializing is dissociated from pleasantness in scenarios, extraverts prefer only the latter more strongly than introverts (Lucas & Diener, 2001). In day-to-day life, the amount of socializing only partially explains the link between extraversion and happiness (Lucas et al., 2008; Srivastava et al., 2008) and both extraverts and introverts report higher levels of positive affect when engaging in social situations (Lucas et al., 2008). As such, it seems likely that there are extraverted paths to happiness that occur independent of socializing.

State Extraversion

In contrast with personality traits, personality states are defined as momentary behaviors that can also characterize the same thoughts, feelings, and behaviors as the overall personality trait, but on a temporary basis (e.g., over the course of minutes or hours; Fleeson, 2001; Fleeson & Jayawickreme, 2015). In an experience sampling (ESM) study, Fleeson (2001) assessed the distribution of Big-Five personality states in daily life and found that although *average* behavioral tendencies are stable over time, people consistently manifest behaviors across the spectrum of the personality dimensions. For example, someone who is introverted will typically engage in behaviors along all levels of the introversion-extraversion spectrum in their daily routine, presumably in response to situational demands or goals.

Experience sampling studies have also observed that extraverted states correspond with higher levels of positive affect, irrespective of trait personality (Wilt et al., 2012). The phenomenon of traits and states being characterized by similar outcomes (e.g., state and trait extraversion correlated with positive affect) is referred to as the state-trait isomorphism hypothesis (Fleeson, 2001; van Allen & Zelenski, 2018). This isomorphic effect has also been observed in laboratory settings where researchers instruct people to behave in either an extraverted (e.g. acting *bold*, *assertive*, *adventurous*, *energetic*) or introverted manner (e.g. acting *reserved*, *quiet*, *passive*, *unadventurous*). When interacting in a

group discussion, people who acted extraverted reported significantly higher positive affect compared to those who acted introverted, regardless of their trait personality (Fleeson et al., 2002; Zelenski et al., 2012). In other words, acting extraverted is associated with increases in positive affect, regardless of whether people are dispositional introverts or extraverts (Fleeson et al., 2002; McNiel & Fleeson, 2006; McNiel et al., 2010; Zelenski et al., 2012; Zelenski et al., 2013).

Despite concerns that acting in a manner inconsistent with one's disposition may tax one's mental resources and be perceived as being inauthentic, research has shown that extraverted behavior is associated with elevated levels of subjective authenticity. Of particular note is that this effect holds irrespective of disposition (Fleeson & Wilt, 2010), and does not typically produce negative cognitive or affective consequences, nor is it perceived as more effortful, for introverts (Gallagher et al., 2010; Zelenski et al., 2012). Interestingly, introverts nonetheless underestimate the affective benefits, and overestimate the affective costs, of acting extraverted (Zelenski et al., 2013).

Based on these findings, researchers have suggested that acting extraverted may be an effective means of increasing the well-being of dispositional introverts (Fleeson et al., 2002; McNiel et al., 2010). However, to date, the strategy of enacted extraversion has largely been confined to short-term, controlled laboratory settings, and has focused on a narrow set of outcome variables (e.g., affect, cognitive fatigue). Outside the lab, experience sampling studies suggest that introverts experience more positive affect when behaving in extraverted ways, but results are correlational and ambiguous about whether additional, intentional, or instructed extraverted behaviors would have the same results as lab studies. To date, only a very limited set of (lab) contexts have been studied experimentally. Beyond the basic issue of generalizability, it is plausible that the clear instructions and pre-defined interaction partners in lab studies make it easier and more pleasant for introverts to behave in counter-dispositional ways. That is, pairing introverts with conversational partners in a contrived setting removes a natural barrier for introverts, namely, seeking out and establishing social contact. Our goal was to bridge the gap between the lab and the real world, testing whether instructions to act extraverted would increase positive affect, and possibly other aspects of well-being, in day-to-day life. The answer is an important step in determining the viability of an extraversion-based happiness exercise.

As we prepared this paper, we became aware of two recently published articles reporting on similar experiments. In one recent study Margolis and Lyubomirsky (2019) instructed participants to engage in extraverted behavior for one week followed by one week of introverted behavior (and vice versa; i.e., a within-person manipulation). Using structural equation models and second-order latent growth models in a sample of undergraduate students, results supported previous observational and experimental data in finding that extraverted behavior increased positive affect and that this effect was not moderated by trait levels of extraversion. Additionally, extraverted behavior also lead to increases in connectedness and autonomy (as assessed via the balances measure of psychological needs; Sheldon & Hilpert, 2012), and flow (Csikszentmihalyi, 1990). Weaker effects were observed on negative affect, subjective happiness, and life satisfaction. In this study, the behavior manipulation adjectives presented to participants were selected to minimize social desirability (e.g., talkative, assertive, spontaneous vs deliberate, quiet, reserved).

In another similar study (Jacques-Hamilton et al., 2018), participants ($n=147$) were randomly assigned to an enacted extraversion or 'sham' condition. A sample ($n=76$) from an unrelated study was also used as a no-contact control group. Importantly, in this experiment participants were instructed to act more "bold, talkative, outgoing, active and assertive" (extraverted condition) or "unassuming, sensitive, calm, modest, and quiet" (sham condition) in their 'interactions with other people across the next week'. Participants reported on behaviors, moods and authenticity six times daily, at the end of the week, and two weeks later. Overall, the instructions to act extraverted produced more positive affect and feelings of authenticity than the comparison condition in daily and end-of-week reports. The amount of time spent in social interactions did not mediate the relationship between positive affect and extraverted behavior, though all participants were asked to alter their behavior in the context of social interactions. Surprisingly, this study also suggested—for the first time—that benefits might depend on dispositional extraversion. The positive affect boost was not present for extremely introverted participants, who also reported some negative affect, tiredness, and inauthenticity when asked to act in more extraverted ways (Jacques-Hamilton et al., 2018). This new finding suggests some caution in recommending extraverted behavior. It also underscores the importance of testing whether patterns change when going from correlational and lab studies

to real world interventions, and the novel results require confirmation or refutation via replication.

Present Studies

The present research extends the methodology of previous enacted extraversion studies to the context of people's everyday lives via three week-long behavioral interventions. Specifically, our three studies assess whether engaging in an extra 15 minutes of extraverted behavior each day for five consecutive days is sufficient for increasing positive affect in the moment and producing lasting effects over time. In Studies 1 and 2, we compare the outcomes associated with engaging in daily extraverted behaviors to engaging in daily introverted behaviors (Study 1) and a control task (Study 2). In Study 3, we further extend the enacted extraversion paradigm to test whether engaging in social extraverted behavior produces different outcomes than non-social extraverted behavior or an inert control activity. Our studies were designed and conducted before Jacques-Hamilton et al. (2018) and Margolis et al. (2019), yet still differ in some useful ways: we had participants form implementation intentions (Gollwitzer, 1999), plan specific, concrete, short-term activities for each day (vs. general acting instructions for a week); we include different comparison (control) conditions; and we investigated extraverted behavior beyond socializing (especially Study 3). Based on the established finding that enacted extraversion leads to positive affect in laboratory settings, we propose the following hypotheses:

Hypothesis 1: Momentary Positive Affect

Extraverted behavior will result in greater feelings of positive affect 'in the moment' (i.e., via responses reported during daily reports), relative to introverted behavior and control groups.

Hypothesis 2: Positive Affect Across Time

Extraverted behavior will lead to increases in positive affect from the pre-test assessment to the post-test assessment.

Hypothesis 3: Dispositional Extraversion and Positive Affect

Despite recent findings to suggest the interaction between trait extraversion and extraverted behavior in predicting positive affect (Jacques-Hamilton et al., 2018), given many other null results, our a priori hy-

pothesis was that dispositional levels of trait extraversion would not influence the effect of extraverted behavior on positive affect.

As the majority of research in this area has focused on the relationship between positive affect and enacted extraversion, we focus our hypotheses on this association. However, we also present exploratory analysis examining potential outcomes of an 'acting extraverted intervention'. For example, we explore whether variables that have been studied in the enacted extraversion paradigm, such as authenticity (Whelan, 2014) and perceived effort (Gallagher et al., 2010) are influenced by the instructions. Additionally, we explore indicators of well-being that are traditionally not incorporated within enacted trait research—but that are more common among happiness exercises—such as meaning in life, subjective happiness, life satisfaction, depression, and vitality. Finally, we include a measure of serenity to assess the empirically dubious, but commonly asserted, suggestion that introversion might produce low-arousal pleasure (cf. Zelenski et al., 2014). As recommended by Simons and colleagues (2012), we report how we determined our sample sizes, all data exclusions, all manipulations, and all measures in the studies herein.

Study 1

Methods

Participants

Seventy-three undergraduate students participated in the study in exchange for course credit and entry into a cash draw. Our initial sample size target ($n=100$) was based on a 'rule of thumb' of 50 participants per condition. We did not stop/add participants based on results available during data collection; recruitment was limited by the end of the academic term. Data from 66 participants who completed a minimum of three out of five daily activities were included in the analysis. Thirty-five participants were randomly assigned to the enacted extraversion condition and 31 were randomly assigned to the enacted introversion condition. Participants were primarily female (71%), with ages ranging from 18 to 45 years old ($M = 20.69$, $SD = 6.45$). Sensitivity analysis, conducted in G*Power (Erdfelder et al., 1996), suggest that at 80% power our sample could detect effects sizes of $d = .90$ and $d = .41$.

for dependent and independent samples t-tests, respectively and $f = .24$ ($\eta^2 = .05$)¹ for a between-within ANOVA interaction. Lab studies have found large differences in positive affect between conditions instructed to act extraverted vs. introverted (e.g., $d = 1.30$, Zelenski et al., 2012).

Procedure

Participants registered for a study entitled “Examining the relationship between well-being and behavior”, which was advertised as consisting of an in-lab session (pretest), five daily activities and corresponding online surveys (daily logs 1-5), and a follow-up online survey (post-test) in exchange for course credit and the opportunity to be entered into a cash draw for completing assignments.

Participants were randomly assigned to one of two conditions (acting extraverted or acting introverted). During the in-lab pre-test, participants completed self-report questionnaires to assess personality, affect (including positive affect, negative affect, serenity, and fatigue), authenticity and effort, meaning in life, subjective happiness, satisfaction with life, depression symptoms, and subjective vitality. Following completion of the questionnaires, participants completed a written task that presented them with five behavior-related adjectives (either extraverted adjectives or introverted adjectives). Participants listed ten ways in which they could embody these characteristics in the context of their daily lives. Following verification of the content of the list by the researcher, participants then chose five activities to enact over the following five days and assigned each activity to a specific day of the week.

In the five days following the lab-session, participants were sent identical daily surveys. These surveys inquired about the extent to which participants engaged in their enacted activity. Those who indicated that they either completed, or somewhat completed, their daily activity were asked to respond to self-report assessments of their mood, vitality, and feelings of authenticity and effort while engaging in their assignment. Those who indicated that they did not complete their activity responded to an identical question set, but in the context of how they felt in the past day. These reports were excluded from analysis.

One week following the initial in-lab session (i.e., one day following the final daily activity), participants completed an online post-test questionnaire to assess their overall subjective well-being and affect.

Materials

Pre-Test and Post-Test Questionnaires

Personality. To assess personality during the pre-test questionnaire, we administered the Big Five Inventory (BFI), consisting of 44 items, that is designed to assess the five higher-order personality dimensions within the Five Factor Model: extraversion, agreeableness, openness, conscientiousness, and neuroticism (Costa & McCrae, 1992; Digman, 1990; Goldberg, 1990; John et al., 1991). Participants rated how much they agreed with statements such as “I see myself as someone who is talkative” or “I see myself as someone who can be reserved” as being characteristic of them on a scale of (1) *Disagree strongly* to (5) *Agree strongly*. Each personality dimension was scored through calculating the mean response across the items in each subscale.

Well-being Measures. To assess well-being during both the pre-test and post-test questionnaires, participants responded to several measures including the Positive and Negative Affect Schedule (PANAS), the Meaning in Life Questionnaire (MILQ), the Subjective Happiness Scale (SHS), the Satisfaction with Life Scale (SWLS), the Depression Scale (CESD), the Subjective Vitality Scale (SVS), and the Authenticity and Effort Scales (AES).

Positive and Negative Affect Schedule (PANAS). We used a 44-item version of the PANAS-X questionnaire to assess participants’ average weekly mood (Watson & Clark, 1994). Participants described the extent to which the mood adjectives described their feelings over the course of the previous week on a scale of (1) *I felt that way very slightly or not at all* to (5) *I extremely felt that way*. The full PANAS-X questionnaire contains 60 items. To suit the needs of our study, we omitted items from the ‘basic negative emotion scales’ and included items from the ‘general dimensions scales’ (measuring positive and negative affect), the ‘basic positive emotions scales’ (measuring joviality, self-assurance, and attentiveness), and the ‘other affective states’ scale (assessing shyness, fatigue, serenity, and surprise). However, only positive affect (PA), negative affect (NA), fatigue, and serenity were used in the present analysis. Example items include: “active”, “alert”, “enthusiastic” (PA); “ashamed”, “nervous”, “distressed” (NA); “tired”, “sluggish” (fatigue); and “relaxed”, “at ease” (serenity).

¹ All effect size conversions computed via https://www.psychometrica.de/effect_size.html

Meaning in Life Questionnaire (MILQ). The MILQ consists of ten items, with two subscales to assess both one's *presence of* and *search for* meaning in life (Steger et al., 2006). The 5-item *presence* subscale assesses the extent to which the respondent feels that they currently have a sense of meaning in their life, while the 5-item *search* subscale assesses the extent to which the respondent is actively seeking to obtain a sense of meaning in their life. Participants rated items including "I understand my life's meaning" (*presence*) and "I am looking for something that makes my life feel meaningful" (*search*) from (1) *Absolutely false* to (7) *Absolutely true*. The MILQ was scored through calculating the mean response across each item pertinent to its respective subscale.

Subjective Happiness Scale (SHS). The SHS consists of four short items to measure subjective happiness (Lyubomirsky & Lepper, 1999). Within this measure, participants responded to questions on a scale of 1-7 to describe the statement which they felt best described them. An example included participants rating to what extent they were (1) *Not a very happy person* or 7) *A very happy person*. The SHS was scored through calculating the mean response across all four items.

Satisfaction with Life Scale (SWLS). The SWLS consists of five items that assess global life satisfaction (Diener et al., 1985). Participants rated the extent to which they agreed with statements on a 1-7 scale, including "In most ways my life is close to ideal" and "The conditions of my life are excellent", whereby a rating of 1 indicated that they *strongly disagreed* with the statement and a rating of 7 indicated that they *strongly agreed*. The SWLS was scored through obtaining the sum of all five items.

Subjective Vitality Scale (SVS). The SVS consists of six items that measure subjective vitality, defined as the feeling of being alive and alert (Ryan & Frederick, 1997). Participants rated six statements based on how they applied to their life over the course of the past week, on a scale of (1) *Not at all true* to (7) *Very true*. The SVS was scored through calculating the mean of the six items.

Authenticity and Effort (AE). The AE questionnaire consists of two subscales that assess subjective feelings of authenticity and effort over the course of the past week (Fleeson et al., 2002; Whelan, 2014). A 15-item version of the scale was administered, instructing participants to indicate how they felt over the course of the past week. On a scale of 1-7, participants rated items including "It was very easy to behave the way I did" (*effort*) and "I was my true self" (*authenticity*),

whereby a rating of 1 indicated that they *strongly disagreed* and a rating of 7 indicated that they *strongly agreed*. Each AE subscale was scored through calculating the mean for each scale's respective items.

The Center for Epidemiologic Studies Depression Scale (CESD). The CESD (Radloff, 1977) is a short self-report measure designed to measure depressive symptoms in the general population. The scale presents 20 first person statements such as "I felt depressed", "I felt lonely" and "I thought my life had been a failure". For each item the respondent is asked to identify how often they have felt in a manner consistent with the statement presented over the period of the past week. The response options were rarely or none of the time (less than one day), some or a little of the time (one to two days), occasionally (three to four days) and most of the time (five to seven days). Scores on the CESD range from 0 (no depressive symptoms) to 60; a score of 16 or below is considered to indicate "no clinical significance". Following convention the CESD was calculated by using the sum of all 20 responses.

Behavioral Instructions. During the pre-test, participants completed a short writing task to prepare for the activities that they would engage in during the following week. In the extraversion condition, participants were given a list of five trait descriptive adjectives coinciding with extraverted behaviors (*assertive, energetic, outgoing, sociable, and adventurous*), and in the introversion condition, participants were given introverted adjectives (*reserved, cool/aloof, quiet, modest, and passive*). Participants in both conditions were then instructed to "list 10 ways in which you could embody one or more of these adjectives for a 15-minute period in the context of your upcoming week."

After the list of potential activities was verified by the researcher, participants were given a blank five-day calendar and asked to assign one approved activity to each day. Additional instructions were given to indicate which time of day they intended to engage in the chosen activity. This aspect of the intervention was informed by research on the effectiveness of implementation intentions. Implementation intentions are thought to mediate the goal intention-behavior relationship, as they describe the process of how goal intentions are translated in behavior (Gollwitzer, 1993).

Daily Questionnaires

Activity Description. Each day, participants began by reporting the extent to which they completed their daily activity ("*did complete*", "*somewhat completed*", or "*did not complete*"). Participants who completed or somewhat completed their activity proceeded to provide a brief description of the activity that they engaged

in that day, including its time and duration. These participants were then shown the well-being measures and activity ratings and were asked to apply these measures to how they felt during their activity that day.

Participants who did not complete their activity were not prompted to describe their activity, but instead responded to the remainder of the questionnaire, with questions focused on their behaviors in the past week.

Well-being Measures. During the daily questionnaires, participants responded to three measures of well-being that were also included in the pre- and post-test questionnaires (vitality, PANAS, authenticity/effort), but adapted to refer to how they were feeling during their respective daily activity. To prevent daily fatigue within participants when completing each daily questionnaire, we used a revised 27-item version of the PANAS (containing only items assessing PA, NA, fatigue, and serenity) rather than the 44-item version used within the pre- and post-test questionnaires (Watson et al., 1988), and a 6-item adapted version of the Authenticity and Effort questionnaire rather than the 15-item version used in the pre- and post-test questionnaires. All measures were scored using the average ratings for items in a given scale.

Results

Hypothesis 1: Positive Affect

To test whether enacted extraversion was associated with elevated, ‘in the moment’, levels of positive affect (PA), relative to introverted behavior, we conducted an independent samples t-test (see Table 1 for means and standard deviations for all variables). Consistent with previous findings, participants in the enacted extraversion condition reported higher levels of daily positive affect than participants in the enacted introversion condition, $t(64) = 4.79, p < .001, d = 1.18$. Thus, Hypothesis 1 was supported.

Hypothesis 2: Positive Affect Across Time

To determine whether the intervention lead to changes in positive affect over time, A 2 x 2 mixed ANOVA on positive affect was conducted with condition (extraversion, introversion) as the between-subjects factor, and time (pretest, post-test) as the within-subjects factor. ANOVA results for all variables measured at pre- and post-test can be found in Table 2. Results revealed a significant time by condition interaction, $F(1, 54) = 8.56, p < .01$, partial $\eta^2 = .14$. Follow-up tests showed that positive affect increased in the extraversion condition, $t(28) = -2.31, p < .05$, 95% CI $[-.82, -.04]$, but not in the introversion condition, $t(26) = 1.84, p = .08$, 95%

CI $[-.04, .75]$. Neither the main effect of time, $F(1, 54) = .09, p = .76$, nor the main effect of condition, $F(1, 54) = 2.46, p = .12$, were statistically significant. Thus, Hypothesis 2 was supported in this sample.

Hypothesis 3: Dispositional Extraversion and Positive Affect

To determine whether trait extraversion moderated positive affect experienced during extraverted behavior, we ran a stepwise regression analysis with dispositional extraversion and condition predicting positive affect (step 1) and a trait extraversion by condition interaction (step 2). In the full model, condition significantly predicted PA ($\beta = -0.85, p < .001$), but trait extraversion ($\beta = -0.04, p = .80$) and the condition by trait extraversion interaction ($\beta = .11, p = .64$) did not. Thus, results failed to reject our null Hypothesis 3.

Exploratory Analyses

Exploratory analyses (refer to Tables 1-3) yielded several interesting findings. For example, participants in the extraversion condition reported feeling more authentic during their condition specific activities than did those in the introversion condition. These findings are consistent with experience sampling data (Fleeson & Wilt, 2010) and other experimental manipulations in a real-world setting (Jacques-Hamilton et al., 2018). Additionally, those who enacted extraverted behavior reported elevated levels of vitality relative to their counterparts in the introversion condition on daily reports and when comparing pre-post assessments. To our knowledge, this is the first reported instance of experimentally induced extraverted states producing increases in subjective vitality; however, that the association between trait extraversion and vitality (Ryan & Frederick, 1997) holds at the state level is consistent with the trait-state isomorphism hypothesis (Fleeson, 2001). Lastly, there were indications that extraverted behavior decreased symptoms of depression and fatigue over time compared to introverted behavior, but other comparisons did not yield significant differences (e.g., weekly changes in life satisfaction or subjective happiness). Finally, we did not observe any positive effects of introverted behavior in comparison to extraverted behavior (e.g., feelings of serenity).

Discussion

Study 1 sought to extend lab-based findings to participants’ daily lives and test the efficacy of a five-day en-

acted extraversion intervention as a strategy for increasing positive affect. Consistent with our hypotheses and previous experimental and observational findings, participants reported more positive affect after engaging in extraverted behaviors than introverted behaviors, and this effect was not dependent upon dispositional levels of extraversion (cf., Jacques-Hamilton et al., 2018). Further, and consistent with our second hypothesis, participants in the extraversion condition (vs. introversion condition) reported higher levels of positive affect after the week of the intervention compared to the before the intervention.

Study 1 was limited in part by a small sample size and the absence of a neutral control condition. To address these concerns, we conducted a second experiment (Study 2) with modifications to the experimental design and recruitment strategy. Specifically, we sought to deliver a similar intervention, with a non-introversion control condition, delivered solely online (cf., the in-person delivery of implementation intentions in Study 1).

Study 2

Method

Participants

Two hundred and seventeen undergraduate students participated in Study 2 in exchange for course credit and entry into a cash draw. Our initial target sample size was 200 (i.e., 50 per condition, plus expected attrition), however we continued to collect data until the end of the academic term. Nine participants failed at least six of eight attention checks and were removed from all analysis. Two hundred and eight participants completed the pre-test and at least three daily logs and were included in analysis of daily outcomes (randomly assigned to extraverted behavior [$n = 71$], introverted behavior [$n = 73$], or a control [$n = 64$]). One hundred and seventy-eight participants completed both the pre-test and posttest, as well as at least three daily logs, and were included in pre-post analysis ($ns = 58, 65, 55$ for extraverted, introverted, and control conditions, respectively). The full sample used in daily assessments ($n = 208$) was primarily female (72%), with ages ranging from 17 to 46 years old ($M = 21.96$; $SD = 5.34$). Sensitivity analysis suggest that in mixed ANOVAs our sample could detect effect sizes of $f = .27$ ($\eta^2 = .07$) for between subject tests, $f = .11$ ($\eta^2 = .01$), for within subject tests, $f = .12$ ($\eta^2 = .01$) for between-within interactions, and $f = .30$ ($\eta^2 = .08$) for a one-way ANOVA.

Procedure

In Study 2, participants began by completing an online pre-test questionnaire similar to Study 1 but delivered completely online (versus in lab). Participants were randomly assigned to either the acting extraverted, acting introverted, or control condition. Participants in both the extraverted and introverted conditions were presented with five behavior related adjectives, descriptive of either extraversion or introversion (mirroring Study 1) and were asked to write down five different ways which they could embody these characteristics for fifteen-minute periods each day for five consecutive days. Participants were instructed to choose activities or behaviors that they had not already planned to be part of their week. In the control condition, participants were asked to list five early childhood memories that they could write about each day for the following five days.

For the five days following the initial questionnaire, participants completed a brief daily questionnaire which assessed mood, vitality and authenticity during their assigned activity. In the experimental conditions, participants were asked to provide a brief summary of their daily assignment, while the control condition, participants were asked to write about an early childhood memory for approximately fifteen minutes.

One day following the final daily survey a follow-up (post-test) questionnaire was administered. This questionnaire contained the same measures as the initial questionnaire, and as the post-test questionnaire in Study 1. An additional set of questionnaires was administered two-weeks following the post-test assessment; due to high attrition rates these data are not reported here.

Materials

For Study 2, the materials used for the pre- and post-test questionnaires, and daily questionnaires, mirrored those used in Study 1, with the addition of modified behavioral instructions (adapted to the online context and adding control group) during the pre-test questionnaire.

Behavioral Instructions

During the pre-test, participants were randomly assigned to either one of the two experimental conditions similar to Study 1 (extraverted or introverted), or to a new control condition introduced within Study 2. Those in the experimental conditions completed a short writing task to prepare for the activities that they would engage in during the following week, mirroring the task in Study 1. In the new control condition, participants were instructed to write about an early childhood

Table 1*Means and Standard Deviations for All Study 1 Variables*

	Pre-test		Daily		Post-test	
	Extraversion (n=29)	Introversion (n=27)	Extraversion (n=35)	Introversion (n=31)	Extraversion (n=29)	Introversion (n=27)
MILQ (Presence)	4.81(1.63)	4.93(1.42)	-	-	5.23(1.45)	5.13(1.22)
MILQ (Search)	5.00(1.42)	5.33(1.34)	-	-	4.85(1.65)	5.30(1.20)
SHS	4.72(1.29)	5.18(1.21)	-	-	4.96(1.20)	5.21(1.13)
SWLS	22.90(6.49)	23.51(5.53)	-	-	24.45(5.93)	24.19(4.80)
CESD	18.14(13.55)	13.93(10.40)	-	-	17.48(7.99)	20.59(9.32)
PANAS PA	3.13(.93)	3.17(.78)	3.34(.68)	2.49(.75)	3.50(.81)	2.87(.82)
PANAS NA	2.19(.85)	2.05(.81)	1.45(.39)	1.37(.30)	1.80(.63)	1.94(.80)
PANAS Fatigue	2.86(.74)	2.56(.89)	1.59(.66)	1.93(.71)	2.02(.86)	2.45(.97)
PANAS Serenity	3.07(1.02)	3.20(.96)	2.94(.72)	3.07(.78)	3.43(.77)	3.23(.86)
Authenticity	4.64(1.65)	4.81(1.37)	5.49(.98)	4.16(1.45)	5.34(1.12)	4.52(1.24)
Effort	3.32(1.38)	3.26(1.23)	2.67(1.12)	3.38(1.25)	2.69(1.32)	3.32(1.11)
SVS	4.01(1.69)	4.25(1.25)	4.89(.98)	3.39(1.33)	4.82(1.38)	3.92(1.58)

Table 2*Comparisons for Daily Assessments Between Conditions in Study 1*

	Extravert (n=35)	Introvert (n=31)	<i>t</i>	95% CI [lower, upper]
PANAS PA	3.34(.68)	2.49(.75)	4.79***	[.49, 1.20]
PANAS NA	1.45(.39)	1.37(.30)	0.92	[-.09, .25]
PANAS Fatigue	1.59(.66)	1.93(.71)	-2.00*	[-.67, .00]
PANAS Serenity	2.94(.72)	3.01(.78)	-0.70	[-.50, .24]
Authenticity	5.49(.98)	4.16(1.45)	4.42***	[.73, 1.93]
Effort	2.67(1.12)	3.38(1.25)	-2.41**	[-1.29, -.12]
Subjective Vitality	4.89(.98)	3.39(1.33)	5.26***	[.93, 2.07]

Note. *** $p < .001$, ** $p < .01$, * $p < .05$

Table 3*Mixed Time (Pretest, Posttest) x Condition (Extraversion, Introversion) ANOVAs for Study 1*

Variable	Effect of time			Effect of time X condition			Effect of condition		
	<i>F</i>	<i>p</i>	η^2	<i>F</i>	<i>p</i>	η^2	<i>F</i>	<i>p</i>	η^2
PANAS PA	0.09	0.76	.00	8.56	.005	.14	2.46	.12	.04
PANAS NA	7.89	.007	.13	2.48	.12	.04	.00	.99	.00
PANAS Fatigue	24.76	<.001	.34	15.25	<.001	.22	.10	.78	.00
PANAS Serenity	3.80	.06	.07	2.51	.12	.04	.02	.89	.00
Meaning (Presence)	9.31	.004	.15	1.07	.31	.02	.00	.99	.00
Meaning (Searching)	0.53	.47	.01	.24	.63	.00	1.21	.28	.02
Subjective Happiness	2.34	.13	.04	1.23	.27	.02	1.29	.26	.02
SWLS	5.35	.03	.09	.85	.36	.02	.02	.90	.00
CESD	5.88	.02	.10	8.73	.004	.14	.05	.83	.00
Authenticity	1.05	.31	.02	6.31	.015	.11	1.11	.30	.02
Effort	2.68	.10	.05	3.78	.057	.07	.99	.32	.02
Subjective Vitality	1.31	.26	.02	7.36	.009	.12	.97	.33	.02

Table 4*Means and Standard Deviations for All Study 2 Variables*

	Pretest			Daily			Posttest		
	Extraversion (<i>n</i> = 58)	Introversion (<i>n</i> = 65)	Control (<i>n</i> = 55)	Extraversion (<i>n</i> = 71)	Introversion (<i>n</i> = 73)	Control (<i>n</i> = 64)	Extraversion (<i>n</i> = 58)	Introversion (<i>n</i> = 65)	Control (<i>n</i> = 55)
MILQ (Presence)	4.66 (1.37)	4.71 (1.38)	4.60 (1.46)				4.96 (1.33)	4.80 (1.48)	5.16 (1.24)
MILQ (Search)	4.77 (1.38)	4.78 (1.60)	4.85 (1.47)				4.61 (1.42)	4.85 (1.55)	4.88 (1.26)
SHS	4.68 (1.18)	4.93 (1.30)	4.70 (1.50)				4.88 (1.33)	4.95 (1.38)	4.91 (1.43)
SWLS	21.78 (7.43)	23.31 (7.30)	23.64 (6.40)				22.91 (7.54)	23.89 (7.33)	25.25 (5.83)
CESD	17.50 (12.44)	16.85 (11.24)	16.64 (12.13)				18.19 (7.21)	19.48 (6.51)	19.89 (9.64)
PANAS PA	3.00 (.89)	3.35 (.80)	3.21 (.71)	3.12 (.70)	2.70 (.71)	2.98 (.77)	3.00 (.83)	2.99 (.88)	3.08 (.79)
PANAS NA	2.18 (.78)	2.31 (.67)	2.35 (.82)	1.48 (.54)	1.56 (.56)	1.75 (.71)	1.74 (.63)	1.81 (.57)	1.99 (.82)
PANAS Fatigue	2.78 (.97)	2.92 (.86)	2.97 (.92)	1.82 (.74)	1.96 (.75)	1.82 (.77)	2.03 (.81)	2.30 (.84)	2.44 (.97)
PANAS Serenity	2.98 (.88)	3.26 (1.07)	3.22 (.89)	2.88 (.74)	3.15 (.76)	2.92 (.87)	2.97 (.97)	3.25 (.98)	3.10 (.83)
Authenticity	4.73 (1.14)	5.15 (1.24)	4.98 (1.01)	5.07 (1.04)	4.40 (1.32)	5.69 (1.04)	4.72 (1.18)	4.47 (1.17)	5.19 (1.03)
Effort	3.43(1.27)	3.17(1.13)	3.33(1.19)	2.79 (1.04)	3.15 (1.20)	2.32 (1.05)	3.18(1.21)	3.25(1.16)	2.96(1.26)
SVS	4.00 (1.26)	4.21 (1.55)	4.30 (1.35)	4.49 (1.08)	3.77 (1.11)	4.44 (1.23)	4.24 (1.38)	4.03 (1.26)	4.47 (1.41)

memory for fifteen minutes each day (Seligman et al., 2005).

Results

Hypothesis 1: Momentary Positive Affect

A one-way ANOVA on daily positive affect scores indicated differences between conditions, $F(2, 204) = 6.25, p = .002$. Follow-up tests showed that average positive affect during the condition-specific activities was significantly higher in the extraversion ($M = 3.12; SD = .70$) condition than the introversion ($M = 2.70; SD = 7.1$), $t(141) = -3.57, p = <.001, 95\% CI [-.65, -.19]$, but not the control ($M = 2.98; SD = .77$), $t(132) = -1.14, p = .26, 95\% CI [-.39, .11]$. Participants in the introversion condition also reported less positive affect than did those in the control condition, $t(135) = 2.19, p = .03, 95\% CI [.03, .53]$. Thus, Hypothesis 1 received only mixed support.

Hypothesis 2: Positive Affect Across Time

A 2 (time) $\times$ 3 (condition) mixed ANOVA was conducted on self-reported positive affect from pre- to post- assessment. Descriptive statistics and ANOVA results are presented in Tables 5 and 6, respectively. Results revealed a significant main effect of time, $F(1, 175) = 11.40, p < .001$, and a time by condition interaction $F(2, 175) = 5.05, p < .01$ (see Table 6). A series of repeated measures t-tests were employed to follow up on the observed interaction. Follow-up tests revealed that positive affect scores decreased in the introversion condition, $t(64) = 4.43, p = <.001, 95\% CI [.20, .52]$. No statistically significant differences were evident over time in the extraversion, $t(57) = -.04, p = .97, 95\% CI [-.16, .15]$, and control condition, $t(54) = 1.46, p = .15, 95\% CI [-.05, .31]$. Thus, Hypothesis 2 received only mixed, at best, support.

Hypothesis 3: Dispositional Extraversion and Positive Affect

Similar to Study 1, to determine whether trait extraversion influenced PA experienced during enacted behaviors, we ran a stepwise regression analysis with dispositional extraversion and condition (extraversion and introversion vs. control) predicting PA (step 1) and then adding trait extraversion by condition interactions (step 2). Results from the full model revealed that trait extraversion ($\beta = 0.22, p = .04$), and the introversion condition ($\beta = -.28, p = .02$) predicted positive affect significantly; however the extraversion condition (extraver-

sion: $\beta = .14, p = .26$) and key condition by trait interactions (extraversion condition $\beta = .12, p = .44$; introversion condition $\beta = -.16, p = .32$) were not statistically significant. Thus, results did not disconfirm the null Hypothesis 3.

Exploratory Analyses

Exploratory analyses suggested that, similar to Study 1, momentary extraverted behavior was associated with higher levels of subjective authenticity and vitality compared to introverted behavior (see Tables 4-6). However, extraverted behavior did not produce more vitality than in the control condition, and authenticity was highest in the control condition. Further, we observed that authenticity increased over time in the control condition, decreased over time in the introversion condition, and did not change significantly in the extraversion condition. Presence of meaning in life increased for both the extraversion and control conditions but not in the introversion condition. However, acting extraverted did not have a significant impact on many other well-being indicators (e.g., life satisfaction, subjective happiness, negative affect, etc.) over the course of the intervention.

Discussion

In Study 2, we sought to replicate our first experiment while strengthening our approach with the addition of a control condition and an increased sample size. In line with our first hypothesis, we found that participants reported more daily positive affect following extraverted behavior than introverted behavior. However, there were no statistically significant differences between positive affect levels reported in the extraverted behavior and control condition (i.e., reflecting on an early childhood memory). Moreover, the weekly assessment of positive affect was not significantly higher after a week of acting extraverted exercises, though positive affect in the introversion condition decreased to a statistically significant degree. Collectively, the results of Study 2 are more limited in suggesting well-being benefits of acting extraverted in day-to-day life when compared to Study 1. Some of the apparent benefits seem to depend on the particular comparison condition. Jacques-Hamilton et al. (2018) found somewhat similar patterns (i.e., differences depending on the particular control comparison).

The particular control task (i.e., writing about early childhood memories) is one of many possible reference groups against which the effects of enacted extraversion and introversion could be compared. Interestingly,

participants in the control condition reported increases in the presence of meaning in life over the course of the intervention, and they also reported elevated levels of authenticity ‘in the moment’. Although the early childhood memories writing task has been used in past research as an inert control (Seligman et al., 2005), real changes in authenticity and meaning following this nostalgia also seem plausible (e.g., Stephan et al., 2012), as do demand explanations. For these reasons, we opted to adjust the control condition in Study 3.

Study 3

In Study 3, we sought to replicate and extend our enacted extraversion intervention design by testing whether the effect of extraverted behavior on positive affect would vary as a function of whether the behavior was social or non-social in nature. The propensity for extraverts to engage in more social interactions has long been hypothesized to account for at least some of the discrepancy between positive affect levels experienced by introverts and extraverts (e.g., Eysenck, 1985; Pavot et al., 1990). However, this perspective has also been challenged (e.g., Lucas et al., 2008; Margolis et al., 2019). Indeed, this hypothesis was tested via a mediation model by Jacques-Hamilton et al. (2018) who found no association. We sought to experimentally test whether positive affect was differentially associated with positive affect for social vs. non-social extraverted behavior. We therefore omitted the introversion condition in this study to focus on the varieties of enacted extraverted behavior more closely, and included a new, less meaningful control condition: reporting on daily events.

Method

Participants

Two hundred and sixty-five undergraduate students participated in Study 3 in exchange for course credit and entry into a cash draw. Mirroring Study 2, we sought to obtain 200 participants, with the goal of obtaining 50 participants per condition after accounting for expected attrition; however, we continued to collect data until the end of the academic term. Eleven participants did not complete the pretest assessment, thirty-nine participants failed at least six of eight attention checks and were removed from all analysis. Two hundred and fifteen participants completed the pre-test and at least three daily logs and were included in analysis

of daily outcomes (randomly assigned to social extraverted behavior [$n = 68$], non-social extraverted behavior [$n = 69$], or a control [$n = 78$]).

One hundred and fifty-seven participants completed both the pretest and posttest, as well as at least three daily logs, and were included in pre-post analysis ($n_s = 50, 52, 55$ for social, non-social, and control conditions, respectively). The full sample used in daily assessments ($n = 215$) was primarily female (73%), with ages ranging from 17 to 53 years old ($M = 22.11$; $SD = 6.66$). Sensitivity analysis suggest that in mixed ANOVAs our sample could detect, with 80% power, effect sizes of $f = .29$ ($\eta^2 = .08$) for between groups, $f = .12$ ($\eta^2 = .01$) within subject tests, $f = .13$ ($\eta^2 = .02$) for between-within interactions, and $f = .32$ ($\eta^2 = .09$) for a one-way ANOVA.

Procedure

Similar to Study 2, participants began by completing an online pre-test questionnaire with measures to assess baseline personality and well-being, before being randomly assigned to one of three conditions. More specifically, participants were assigned to either the social extraverted, non-social (independent) extraverted, or control condition. Participants in the experimental conditions were asked to plan five days of activities according to the trait descriptive adjectives provided (i.e. either social or non-social adjectives associated with extraversion), and either in the context of others (social), or independent of others (non-social). Participants in the control condition were instructed to reflect on the time period between 12 and 12:15 pm each day for the following week. This control condition differed from Study 2 to better mirror the activity reflection sessions within the experimental conditions, but with no additional behavioral intervention.

For the five days following the pre-test questionnaire, participants completed daily online questionnaires similar to those used in Studies 1 and 2. On the final day of the experiment (one week after the pre-test), participants completed a post-test questionnaire with questions mirroring the pre-test session. An identical questionnaire was administered two weeks following the post-test assessment; however, data from this response set is not presented due to low response rates.

Table 5*Mixed Time (Pretest, Posttest) x Condition (Extravert, Introvert) ANOVAs for Study 2*

Variable	Effect of time			Effect of time X condition			Effect of con- dition		
	<i>F</i>	<i>p</i>	η^2	<i>F</i>	<i>p</i>	η^2	<i>F</i>	<i>p</i>	η^2
PANAS PA	11.40	<.01	.06	5.05	<.01	.06	0.85	.43	.01
PANAS NA	95.17	<.001	.35	0.83	.44	.01	1.44	.24	.02
PANAS Fatigue	115.52	<.001	.40	1.20	.30	.01	2.07	.13	.02
PANAS Serenity	0.45	.50	.00	0.32	.73	.00	1.82	.17	.02
MILQ (Presence)	29.74	<.001	.15	5.48	<.01	.06	0.13	.88	.00
MILQ (Search)	0.06	.81	.00	.72	.49	.01	0.26	.77	.00
SHS	8.18	<.01	.05	1.72	.18	.02	0.27	.76	.00
SWLS	11.91	<.001	.06	0.87	.42	.01	1.42	.25	.02
CESD	10.15	<.01	.06	1.23	.30	.01	0.03	.97	.00
Authenticity	3.66	.06	.02	10.46	<.001	.11	2.10	.13	.02
Effort	3.90	.05	.02	2.36	.10	.03	0.36	.70	.00
SVS	0.67	.41	.00	1.91	.15	.02	0.88	.42	.01

Note. *** $p < .001$, ** $p < .01$, * $p < .05$

Table 6*Pairwise Comparisons for Daily Logs with 95% Confidence Intervals for Mean Differences*

Comparisons		Positive Affect		Negative Affect		Fatigue		Serenity		Authenticity		Effort		Subjective Vitality	
		<i>t</i>	CI	<i>t</i>	CI	<i>t</i>	CI	<i>t</i>	CI	<i>t</i>	CI	<i>t</i>	CI	<i>t</i>	CI
Extravert	Introvert	-3.57***	[-.65, -.19]	0.90	[-.10, .27]	1.17	[-.10, .39]	2.18	[.03, .52]	-3.37**	[-1.06, -.28]	-1.92	[-.73, .01]	-3.92***	[-1.08, -.36]
	Control	-1.14	[-.39, .11]	2.52*	[.06, .49]	-0.02	[.26, -.26]	0.26	[-.24, .31]	3.42***	[.26, .91]	-2.57*	[-.82, -.11]	-0.23	[-.44, .35]
Introvert	Control	2.19*	[.03, .53]	1.74	[-.03, .40]	-1.14	[-.41, .11]	-1.70	[-.51, .04]	6.26***	[.88, 1.69]	-4.25***	[-1.21, -.44]	3.37***	[.28, 1.07]

Table 7
Means and Standard Deviations for All Study 3 Variables

	Pre-test			Daily			Post-test		
	Social (n=50)	Non-Social (n=52)	Control (n=55)	Social (n=68)	Non-Social (n=69)	Control (n=78)	Social (n=50)	Non-Social (n=52)	Control (n=55)
MILQ (Presence)	4.71 (1.41)	4.66 (1.43)	4.87 (.91)	-	-	-	4.77 (1.50)	4.82 (1.38)	5.09 (1.13)
MILQ (Search)	5.17 (1.35)	5.13 (1.51)	5.01 (.98)	-	-	-	4.83 (1.51)	4.98 (1.36)	4.93 (1.29)
SHS	4.56 (1.40)	4.75 (1.33)	4.86 (.99)	-	-	-	4.71 (1.34)	4.66 (1.30)	4.89 (1.10)
SWLS	23.44 (6.43)	23.25 (6.93)	24.27 (6.29)	-	-	-	23.44 (6.70)	23.21 (6.70)	23.84 (5.62)
CESD	18.54 (12.40)	19.87(13.30)	17.16(10.93)	-	-	-	20.44(9.09)	21.02(9.58)	20.09(9.62)
SCS-R	83.27(19.23)	79.97(18.33)	84.46(16.54)	-	-	-	82.14(19.27)	81.21(18.25)	85.91(17.38)
IOS	2.87(1.27)	2.78(1.37)	2.92(1.09)	-	-	-	2.74(1.19)	2.89(1.48)	2.82(1.23)
PANAS PA	3.20(.80)	3.09(.94)	3.27(.83)	3.09(.70)	3.07(.71)	2.68(.76)	3.15(.85)	2.90(.86)	2.87(.91)
PANAS NA	2.35(.72)	2.33(.71)	2.40(.73)	1.61(.57)	1.60(.61)	1.74(.81)	2.06(.77)	1.92(.72)	1.98(.79)
PANAS Fatigue	2.92(.95)	3.11(.98)	3.06(.84)	1.85(.64)	1.90(.70)	2.34(.88)	2.34(.87)	2.16(.91)	2.59(.96)
PANAS Serenity	3.01(.99)	3.06(1.03)	3.27(.95)	3.02(.85)	3.00(.85)	3.05(.69)	3.18(.88)	2.90(.87)	3.22(.96)
Authenticity	4.81(1.09)	4.45(1.40)	4.64(1.00)	5.12(1.21)	5.19(1.03)	5.03(1.17)	5.08(1.09)	4.85(1.17)	4.91(1.06)
Effort	3.34(1.18)	3.61(1.25)	3.70(1.21)	2.89(1.02)	3.04(1.01)	2.84(1.07)	2.98(1.08)	3.03(1.27)	3.03(1.26)
SVS	3.97(1.51)	3.88(1.71)	3.97(1.44)	4.59(1.11)	4.57(1.06)	3.98(1.19)	4.29(1.30)	4.21(1.70)	3.97(1.51)
Sociability	-	-	-	4.45(0.87)	3.49(1.05)	3.30(1.21)	-	-	-
Novelty	-	-	-	3.90(0.81)	4.38(0.86)	2.69(0.89)	-	-	-

Materials

All questionnaires from the two previous studies were included in Study 3, with the addition of four scales to assess measures relating to sociability and novelty. Modifications were also made to the behavioral instructions to reflect the updated nature of the daily activities and control condition.

Pre-test and Post-test Questionnaires

In addition to the measures used in Studies 1 and 2, participants completed the *Social Connectedness Scale - Revised* (SCS-R; Lee et al., 2001) and the *Inclusion of Other in the Self Scale* (IOS; Aron et al., 1992). These scales were not included in the present analysis.

Daily Questionnaires

In addition to the daily measures used in Studies 1 and 2, participants completed daily ratings assessing novelty (adapted from Lee & Crampton, 1992) and sociability (adapted from Keyes, 1998). To assess daily novelty, participants responded to four items developed by the researchers based on adjectives representing novel behaviors, adapted from the four dimensions of novelty: thrill, alleviation of boredom, change from routine, and surprise (Lee & Crampton, 1992). Examples included “I experienced something that I never have before”, and “I did something that was out of the ordinary for me”. Participants responded to these questions based on how they felt during their daily activity on a scale of (1) *Strongly disagree* to (7) *Strongly agree*. Items were averaged into a ‘novelty’ score. To assess daily levels of sociability, participants responded to five items adapted from Keyes’ (1998) *Social Well-Being Scale* (SWBS), which was later used by Smillie et al. (2015) in the context of extraversion interventions. The SWBS is divided into five subscales, four of which were used within the context of the present study: social integration, social acceptance, social contribution, and social actualization. During the daily questionnaires, participants responded to four single item questions corresponding with each of the subscales, as well as one additional question to assess social context specifically (“There were many people around me”). Examples of items from the subscales included “I had meaningful interactions with others” (*social actualization*) and “I felt close to the other people around me” (*social integration*), with participants rating each question on a scale of (1) *Strongly disagree* to (7) *Strongly agree*. The five items were averaged for a ‘social’ score.

Behavioral Instructions

During the Study 3 pre-test, participants who were randomly assigned to one of the two experimental

conditions completed a short writing task to prepare for the activities that they would engage in during the following week. In the social condition, participants were given a list of five characteristics associated with extraversion involving social interaction (*talkative/outgoing, sociable, assertive, playful, dominant*), and were asked to “Plan five activities that they would engage in over the following five days *within the presence of other people*” (i.e., within a social context). In contrast, participants in the non-social condition were given a list of five adjectives related to characteristics of extraversion that *did not* involve social interaction (*energetic/lively, adventurous, spontaneous, confident, bold*), and were asked to “Plan five activities to engage in during the following five days *without the presence of other people*” (i.e., independently). Participants in both conditions were encouraged to choose activities that were outside of their everyday routine.

We changed the control condition in Study 3 (cf. Study 2) to instruct participants to reflect and report on what they were doing between 12-12:15 pm each day for the next five days. This reflection acted as a comparable daily ritual that mirrored the experimental conditions’ reflection on daily activities, but without introducing new daily behaviors into their day-to-day lives.

Results

Manipulation Check

To ensure that participants in the three separate conditions were engaging in the desired activity, manipulation checks confirmed that those in the social extraverted condition were indeed behaving significantly more social (daily ratings) than those in the control condition, $t(115) = 5.88, p < 0.01, d = 1.10$ and those in the non-social condition, $t(117) = 5.44, p < .001, d = 1.01$ (see Table 7 for descriptive statistics). No significant differences existed between social ratings for those in the non-social condition and the control condition. Moreover, participants in the non-social condition engaged in activities that were significantly more novel compared to those in the control condition, $t(122) = 10.76, p < 0.001, d = 1.93$, and those in the social condition, $t(117) = 3.11, p < 0.01, d = 0.57$. Surprisingly, participants in the social condition also reported engaging in more novel behaviors compared to those in the control condition, $t(115) = 7.65, p < 0.001, d = 1.42$.

Hypothesis 1: Momentary Positive Affect

A one-way ANOVA of positive affect reported during daily tasks suggested significant differences among

the experimental conditions, $F(2, 212) = 7.53, p < .001$. Follow-up tests showed that participants reported less positive affect in the control condition compared to both the social, $t(144) = -3.39, p < .001$, 95% CI [-.65, -.17], and non-social, $t(145) = -3.17, p < .01$, 95% CI [-.63, -.14] conditions. Social and non-social groups reported similar levels of positive affect, $t(135) = -.21, p = .83$, 95% CI [-.26, .21], supporting previous research suggesting that acting extraverted produces increased positive affect and Hypothesis 1.

Hypothesis 2: Positive Affect Across Time

A 2 (time) $\times$ 3 (condition) mixed ANOVA revealed a main effect of time on positive affect, $F(1, 155) = 13.79, p < .001$, partial $\eta^2 = .08$, with positive affect decreasing on average during the study period. A significant interaction effect was also observed, $F(2, 155) = 3.21, p = .04$, partial $\eta^2 = .04$. Follow-up t -tests showed that positive affect scores decreased over time in the control, $t(55) = 3.56, p = .001$, and non-social conditions, $t(51) = 2.12, p = .04$, but did not significantly change in the social condition, $t(49) = .55, p = .59$. The results did not support Hypothesis 2, but the relatively more positive trajectory for social

extraversion might suggest some incremental benefit to these behaviors.

Hypothesis 3: Dispositional Extraversion and Positive Affect

A regression analysis similar to the model used in Study 2 was used to test the impact of dispositional extraversion on PA experienced 'in the moment' in each of the three conditions. Results from the full model revealed that while the social ($\beta = .40, p < .001$) and non-social ($\beta = .35, p < .001$) extraversion conditions predicted PA, trait extraversion ($\beta = .06, p = .65$), and interactions between trait extraversion and both the social ($\beta = .29, p = .09$) and non-social ($\beta = .21, p = .23$) conditions were not statistically significant predictors. Dispositional extraversion did not significantly moderate the effect of acting extraverted (social and non-social) on positive affect. Results were thus generally consistent with Hypothesis 3.

Exploratory Analyses

Exploratory analyses suggested that extraverted behavior was associated with elevated levels of daily subjective vitality compared to the control condition. Subjective vitality experienced during the daily tasks was significantly lower in the control condition compared to both the social and non-social extraverted condi-

tions. Subjective vitality did not significantly differ between extraverted conditions. Interestingly, participants did not report any significant differences in daily subjective authenticity or feelings of serenity between conditions. When examining changes from pre- to post-test well-being, there were several effects of time, but there were minimal significant differences when considering the more interesting interactions between time and condition.

Discussion

In Study 3, we found that participants in both extraverted conditions (social and non-social) experienced higher positive affect than in the control condition. Moreover, there were no significant differences between the different extraverted conditions on level of daily positive affect. These results suggest that the hedonic benefits of behaving extraverted do not necessarily depend on interpersonal factors (Cooper et al., 1992; Lee et al., 2008). In possible contrast to this conclusion, positive affect did decrease less over time (pre to post) in the social extraversion condition, compared to both the non-social and control conditions. It is possible to see this as a beneficial buffering effect of social extraversion. That is, while daily non-social extraverted behaviors seem effective in increasing daily positive affect, daily social behaviors may have a longer lasting effect that persists over time. On the other hand, given the generally null pattern of condition by time effects on well-being, our manipulation seems to impact daily outcomes more so than weekly, longer-term, outcomes. Positive affect decreasing over time in all conditions also seems to suggest against the effectiveness of acting extraverted exercises on weekly positive affect. As such, we put somewhat more stock in the daily results which suggest similar short-term affective benefits for both social and non-social extraverted behavior. Finally, consistent with our original hypothesis, and the results of Studies 1 and 2, dispositional levels of trait extraversion did not significantly moderate the extent to which those in either the social or non-social extraversion conditions reported elevated levels of positive affect.

Additional Analyses

Although we focused our analysis on primary hypotheses relating to positive affect, here we briefly summarize intervention effects across our three studies on both positive affect and additional outcome measures of well-being. For these exploratory analyses,

we use statistical significance to flag potentially interesting findings; however, our studies were not powered to test so many hypotheses, and we do not correct for multiple comparisons. Appropriate caution is warranted. Table 10 summarizes results for between-group comparisons of how participants felt ‘in the moment’, and within-subject effects from pre-test to post-test assessments. Notably, momentary effects show greater positive affect and subjective vitality in extraversion conditions compared to both introversion (Studies 1 and 2) and control (Study 3) conditions and show greater feelings of authenticity when participants acted extraverted rather than introverted (Studies 1 and 2). Effects observed over pre and post-test assessments were generally weak and inconsistent. Except for Study 1, enacted extraversion did not increase positive affect over time. Across conditions and studies, negative affect decreased over time. Counterintuitively, depressive symptoms tended to increase over time while participants also tended to report more presence of meaning in their lives after completing the studies.

To explore possible trait by condition interactions for all measured indicators of well-being, we conducted a series of regression analyses, with the standardized beta coefficients (trait, condition, and interactions) reported in Table 11. For a more descriptive approach to exploring possible interactions, we also examined patterns in correlations between trait extraversion and each outcome variable, separately by condition (Table 12). The correlation comparisons across conditions can hint at interactive patterns (or lack thereof) similar to the way a table of means by conditions suggests similarities and differences beyond inferential tests.

In Studies 1 and 2, trait extraversion was negatively correlated with perceived behavioral effort for those who engaged in extraverted activities. Said another way, introverts were more likely to perceive extraverted behavior as requiring more effort, suggesting a potential cost to acting counter-dispositionally. Further, all studies found a positive correlation between authenticity and trait extraversion in the acting extraverted condition, and smaller or reversed correlations in the comparison conditions. This again suggests that introverts may experience costs when acting extraverted. However, correlations are inconsistent across studies, and the cross-product terms which test the patterns in regression are rarely significant.

Overall, despite correlational findings suggesting that acting counter dispositionally may incur some costs (i.e., feeling inauthentic, requiring greater effort), tests of interactions in regression models did not provide strong support in either direction.

General Discussion

This research further explores the robust link between extraversion and positive affect, with a more novel focus on intentionally adding extraverted behaviors. Consistent with observational data, laboratory-based experiments, and real-world interventions, across three studies, we observed that engaging in extraverted behavior was associated with elevated levels of in-the-moment positive affect compared to introverted behavior and/or other control behaviors (Hypothesis 1). However, general, retrospective reports suggested that participants did not consistently experience increased positive affect from extraverted behavior during the week of the intervention compared to the preceding week (Hypothesis 2). Further, we did not find clear support for the idea that dispositional extraverts might benefit more from engaging in more extraverted behavior compared to dispositional introverts (Hypothesis 3). These three studies suggest that average levels of momentary positive affect can be increased through the addition of extraverted behavior; however, these results do not support the idea that enacted extraversion interventions of 15-minutes daily behavior change are sufficient to produce lasting changes in well-being.

One strength of our experimental designs were our randomized controlled trial designs in Studies 2 and 3. Interestingly, the effect of extraverted behaviour on positive affect in our studies varied depending on the control group. We observed the strongest effect of extraverted behavior when compared to enacted introversion (Studies 1 and 2) or journaling about daily happenings (Study 3). In contrast, when compared to an arguably more ‘active’ control, reflecting on one’s childhood (Study 2), the relative benefits of extraverted behaviour were not clear. Taken together with conceptually similar experiments, increases in positive affect appear to be most consistent when compared to enacted introversion (present studies; Jacques-Hamilton et al., 2019) or tasks which contain several elements of introverted behaviour (i.e., a ‘sham’ condition which included instructions to act unassuming, sensitive, calm, modest, and quiet; Margolis et al., 2018).

When considered with the available observational (e.g., Fleeson, et al., 2002; McNiel & Fleeson, 2006; McNiel, et al., 2010) and experimental data collected both in laboratory (e.g., Zelenski et al., 2012; Zelenski et al., 2013) and naturalistic settings (e.g., Margolis et al., 2019; Jacques-Hamilton et al., 2019), our results

Table 8*Mixed Time (Pre-test, Post-test) X Condition (Social, Non-social) ANOVAs for Study 3*

Variable	Effect of time			Effect of time X condition			Effect of condition		
	<i>F</i>	<i>p</i>	η^2	<i>F</i>	<i>p</i>	η^2	<i>F</i>	<i>p</i>	η^2
PANAS PA	13.79	<.001	.08	3.21	.04	.04	.65	.52	.01
PANAS NA	38.26	<.001	.20	.49	.61	<.01	.22	.80	.00
PANAS Fatigue	86.34	<.001	.36	4.27	.02	.05	1.06	.35	.01
PANAS Serenity	.02	.90	.00	1.47	.23	.02	1.42	.24	.02
Meaning (Presence)	8.63	<.01	.05	.82	.44	.01	.66	.52	.01
Meaning (Searching)	4.85	.03	.03	.74	.48	.01	.06	.94	.00
Subjective Happiness	.31	.58	.00	1.43	.24	.02	.55	.58	.01
SWLS	.24	.62	.00	.19	.83	.00	.27	.77	.00
CESD	4.88	.03	.03	.34	.71	.00	.52	.60	.00
Authenticity	11.33	<.001	.07	.21	.81	.00	1.15	.32	.02
Effort	31.72	<.001	.17	.87	.42	.01	.54	.59	.01
Subjective Vitality	4.38	.04	.03	1.14	.32	.02	.18	.84	.00

Table 9

Pairwise Comparisons for Daily Assessments in Study 3

Comparisons		Positive Affect		Negative Affect		Fatigue		Serenity		Authenticity		Effort		Subjective Vitality	
		t	CI	t	CI	t	CI	t	CI	t	I	t	CI	t	CI
Social	Nonsocial	-.21	[-.26, .21]	-.10	[-.21, .19]	.44	[-.18, .28]	-.20	[-.32, .26]	.38	[-.31, .45]	.85	[-.20, .49]	-.10	[-.38, .35]
	Control	3.17**	[-.63, -.14]	1.07	[-.11, .36]	3.32**	[-.18, .71]	.40	[-.20, .30]	-.86	[-.52, .20]	-1.16	[-.54, .14]	-3.17**	[-.96, -.22]
Nonsocial	Control	-3.39**	[-.65, -.17]	1.14	[-.10, .37]	3.81***	[-.23, .75]	.17	[-.23, .27]	-.43	[-.47, .30]	-.30	[-.40, .29]	-3.18**	[-.99, -.23]

Note. *** $p < .001$, ** $p < .01$, * $p < .05$

Table 10*Summary of Statistically Significant Effects Across Three Experiments*

	Study 1	Study 2	Study 3	Study 1	Study 2	Study 3
	Daily	Daily	Daily	Over Time	Over Time	Over Time
Positive Affect	E>I	E>I C>I	S>C NS>C	E+	I-	NS- C-
Negative Affect		C>I>E		ME-	ME-	ME-
Fatigue	I>E		C>S C>NS	E-	ME-	S- NS- C-
Serenity						
Authenticity	E>I	C>E>I		E+	I- C+	ME+
Effort	I>E	E>C I>C			ME-	ME-
Subjective Vitality	E>I	E>I C>I	S>C NS>C	E+		ME+
Meaning (Presence)				ME+	E+ C+	ME+
Meaning (Search)						ME-
Subjective Happiness					ME+	
Satisfaction with Life				ME+	ME+	
Depression Inventory				I+	ME+	ME+

Note. ME=main effect of time; E = extraversion conditions; I = introversion condition; C = control condition; S = social condition; NS = non-social condition; +/- indicates direction of effect for within subject tests. > refers to statistically significant t-tests

Table 11

Standardized Beta Coefficients for Individual Regressions Predicting Well-Being Measures Assessed with Daily Reports

	PA	NA	Fatigue	Serenity	Effort	Vitality	Authenticity
Study 1							
Trait Extraversion	-.04	-.43*	-.15	.35	-.61***	.05	.23
Condition	-.51***	-.12	.24	.09	.28*	-.55***	-.48***
Trait Extraversion* Condition	.07	.22	.08	-.24	.51**	-.05	-.24
Study 2							
Trait Extraversion	.22*	-.13	-.16	.09	-.04	.21*	.09
Introversion Condition	-.18*	-.15	.10	.14	.34***	-.28***	-.49***
Extraversion Condition	.08	-.21*	.01	-.02	.20*	.01	-.24**
Trait Extraversion* Introversion Condition	-.09	.06	.09	.01	.17	-.05	-.07
Trait Extraversion* Extraversion Condition	.07	-.01	-.10	.07	-.21*	.07	.14
Study 3							
Trait Extraversion	.06	.00	.08	-.09	.22	.08	-.03
Social Condition	.25**	-.09	-.30***	-.01	.01	.24**	.03
Non-Social Condition	.22**	-.09	-.26***	-.03	.08	.22**	.06
Trait Extraversion* Social Condition	.17	.01	-.07	.21*	-.30**	.16	.25*
Trait Extraversion* Non-Social Condition	.12	-.06	-.10	.14	-.18	.10	.09

Note. ***p<.001, **p<.01, *p<.05

Table 12.*Correlations Between Trait Extraversion and Well-Being for Post-Test Assessment and Daily Reports*

Study	Condition	Time	PA	NA	Fatigue	Serenity	Effort	Authenticity	Vitality	SHS	Presence	Search	SWLS	CESD
1	Extraversion	post	.02	-.18	-.07	-.02	-.42*	.33	.16	.23	.06	-.26	.12	.06
		daily	-.05	-.36*	-.15	.34	-.63***	.30	.07					
	Introversion	post	.38*	-.14	-.10	-.12	-.11	.14	-.02	.38	.00	-.11	.06	.17
		daily	.07	-.16	-.04	.02	.09	-.11	-.03					
2	Extraversion	post	.33*	-.35**	-.24	.30	-.46***	.48***	.31*	.56***	.53***	-.22**	.42**	-.40**
		daily	.37**	-.20	-.33**	.21	-.47***	.42***	.35**					
	Introversion	post	.36**	-.11	-.27*	.22	-.11	.14*	.27	.54***	.29*	-.07	.39**	-.17
		daily	.06	-.03	.01	.08	.26*	-.04	.12					
	Control	post	.31*	-.21	-.23	.18	-.07	.20	.31*	.53***	.17	.03	.31*	-.17
		daily	.24	-.13	-.18	.09	-.05	.12	.23					
3	Social	post	.28*	-.08	-.18	.17	-.13	.22	.33*	.41***	.36**	-.10	.32**	-.08
		daily	.38***	-.01	-.05	.27**	-.29	.39***	.39***					
	Non-Social	post	.41**	-.05	-.26*	.22	-.14	.21	.42**	.48***	.42**	.07	.43***	.06
		daily	.28	-.10	-.16	.15	-.08	.15	.29*					
	Control	post	.07	-.14	-.02	.07	.11	-.02	.14	.28*	.03	-.09	.15	-.01
		daily	.05	.01	.06	-.09	.19	-.03	.07					

Note. *** p<.001, **p<.01, *p<.05

contribute to the confidence in a robust effect of state extraversion on positive affect. Although we did not find strong evidence that this effect varied as a function of trait extraversion (cf., Jacques-Hamilton et al., 2018), correlational evidence in the present studies did suggest that trait introverts perceived extraverted behavior to require more effort, and that trait extraversion was (inconsistently) related to feelings of authenticity when completing extraverted tasks. These interactions were generally non-significant in regression models, though even our larger studies may be underpowered to detect interactions reliably. Therefore, while we cannot rule out the possibility that the enacted extraversion-positive affect association depends on dispositional extraversion, we did not observe strong evidence for its influence.

It is possible that we did not observe strong evidence of ‘costs’ to acting counter-dispositionally (cf. Jacques-Hamilton et al., 2018) due to methodological differences between studies. For example, participants in our experiments were asked to engage in fifteen extra minutes of introverted or extraverted behavior each day (mirroring the length of time used in lab-based studies), whereas Jacques-Hamilton and colleagues (2018) asked participants to modify their behavior in interactions with others “as much as possible” for one week, and Margolis et al. (2019) likewise instructed participants to ‘be as introverted/extraverted as you can’. Although comparisons of the duration and intensity of extraverted behavior are not possible between studies, it is likely that people engaged in extraverted behavior less frequently in our studies.

Notably, no trait interactions have been observed when participants have been asked to report on specific instances of behavior, for example via experience sampling methods or questionnaires on one’s day. Specifically, the moderating effect of trait extraversion in the Jacques-Hamilton et al. (2018) study was observed in retrospective accounts but not in momentary data. The difference in task instruction within the present studies (i.e., 15 minutes) may make it more reasonable for introverts to introduce short bursts of extraverted behavior into their daily lives, rather than trying to adjust their general approach when interacting with other people (which would naturally be easier for dispositional extraverts). Therefore, dispositional levels of extraversion may influence the costs and/or benefits derived from extraverted behavior when such behavior is enacted more frequently and is sustained over longer durations of time. Further research is required to determine the trade-offs between short-term and long-term

counter-dispositional behavior and the hedonic benefits of sustained enacted extraversion.

Collectively, the accumulating evidence from observational and experimental data supports the trait-state isomorphism hypothesis (Fleeson, 2002). The trait-state isomorphism hypothesis also predicted the association between subjective vitality and state extraversion observed in each of our three experiments. Specifically, the association between trait extraversion and vitality (Ryan & Frederick, 1997) is predicted by the isomorphism hypothesis to hold at the state level, an association we observed consistently. However, given the strong correlations between measures of positive affect and subjective vitality, both measuring high-arousal and high-pleasantness constructs, the tendency for these outcomes to co-vary with state extraversion is perhaps not surprising.

Although consistently observed through a variety of methods, the mechanisms underlying the state extraversion/positive affect association are still not well-understood. One potential hypothesis for this association is that the relationship between extraversion and social interactions may partially explain this link. We attempted to dissociate social from non-social forms of extraversion in Study 3 with separate instructions. Participants who added socially motivated extraverted behavior to their daily lives (e.g., “*I made plans with a friend and consciously made the effort to be more talkative and outgoing...*”) did not report any more positive affect than did participants who engaged in non-social extraverted behavior (e.g., “*After finishing work, I took the bus down to the market and tried Ethiopian food, I went alone and made my way around the market until I found something that was new to me*”). This finding is consistent with mediation analysis (Jacques-Hamilton et al., 2018) which did not detect a mediating role of social activity frequency and the positive affect/state extraversion relationship. Taken together, these results suggest a possible ‘alternative path’ for dispositional introverts who wish to elevate their positive affect through primarily non-social activities or for situations in which social contact is not feasible.

Limitations and Future Research

Our three experiments provide experimental confirmation that intentionally incorporating more extraverted behavior into one’s daily life can increase momentary levels of positive affect. However, four main limitations should be noted. First, the studies are each

limited by low compliance rates, with many participants excluded from analysis for failing to complete a minimum number of daily activities or for non-compliance. This could be a result of the length of the study and/or loss of interest over the course of the week (Lefever et al., 2007). However, we cannot rule out the possibility that some degree of selective participation (i.e., person-activity fit) was present and may potentially bias the results, or limit generalizability in ways that would decrease the efficacy of a broad intervention. Additionally, although we attempted to assess participants two weeks following the post-test with the goal of assessing longer-term changes in well-being, significantly high attrition prevented analysis of these data.

Second, the experimental designs in Studies 2 and 3 were implemented entirely online, which we suspect resulted in lower task compliance and the selection of activities which may not be ideal for the purposes of the studies. In our first study, participants' activities were discussed and selected with the assistance of a researcher; however, the transition to an entirely online intervention (which facilitated scalability) resulted in a reduced capacity for quality control. Although it is tempting to attribute the stronger results observed in Study 1 to this characteristic of the experimental design, especially when identifying significant pre-post changes in well-being, the smaller sample size cannot be overlooked as being a limiting factor.

Third, the 'dosage' of the experimental manipulation may have been insufficient to produce detectable changes in affect and well-being over time. One tentatively supporting piece of evidence for this suggestion comes from a recent 15-week study where participants who engaged in more enacted extraversion tasks were more likely to report positive changes in trait extraversion over time (Hudson et al., 2019). Although this experiment focused on trait change rather than state outcomes, it highlights the possibility that a higher frequency of enacted extraversion may be required for sustained changes in trait-related outcomes (e.g., positive affect, well-being).

Fourth, although the promise of enacted extraversion as a well-being increasing strategy is to provide *individuals* with a simple behavioural tool to increase their mood and well-being, our experiments are conducted at the group level and results cannot be inferred to the individual level. The findings from our two randomized controlled trials provide some evidence that average levels of positive affect may be enhanced at the group level. However, without further researching us-

ing idiographic methods, we must refrain from committing an ecological fallacy (Robinson, 1950) by suggesting that our experiments support enacted extraversion as a strategy for any given individual. Moreover, across the recent acting extraverted studies, there appears a possible trade-off between the amount of activity needed for lasting change and the emergence of concurrent costs for dispositional introverts (cf., Jacques-Hamilton et al., 2018).

Conclusions

Multiple sources of data (e.g., observational, lab-based, randomized-controlled-trials) converge on the phenomenon that extraverted states produce elevated levels of positive affect as experienced in the moment. This effect was independent of dispositional levels of extraversion in three intervention studies and does not appear to be determined by the sociability of extraverted behavior (Study 3), suggesting an alternative 'non-social' route for introverts to increase positive affect. Further, in two of three experiments, extraverted behavior was reported as feeling more authentic than introverted behavior or control tasks. However, overall the addition of only 15 fifteen minutes of extraverted behavior did not produce enduring effects on positive affect or other indicators of well-being. We suspect that more frequent and sustained extraverted behavior may be required to elicit enduring effects, though more research is needed to confirm whether sustained counter-dispositional behavior can also be as beneficial for well-being as the momentary acts. Future research should address these questions, as well as work on implementation details, to capitalize on the thus far encouraging potential for an acting extraverted happiness exercise.

References

- Anglim, J., Horwood, S., Smillie, L. D., Marrero, R. J., & Wood, J. K. (2020). Predicting psychological and subjective well-being from personality: A meta-analysis. *Psychological Bulletin*, 146(2), 279-323.
- Argyle, M., & Lu, L. (1990). The happiness of extraverts. *Personality and Individual Differences*, 11, 1011-1017.
- Aron, A., Aron, E. N., & Smollan, D. (1992). Inclusion of other in the self scale and structure of interpersonal closeness. *Interpersonal Relations and Group Processes*, 63, 596-612.
- Boehm, J. K., Lyubomirsky, S., & Sheldon, K. M. (2011). A longitudinal experimental study comparing the effectiveness of happiness-enhancing strategies in

- Anglo Americans and Asian Americans. *Cognition & Emotion*, 25, 1263–1272.
- Cooper, H., Okamura, L., & Gurka, V. (1992). Social activity and subjective well-being. *Personality and Individual Differences*, 13, 573–583.
- Cooper, H., Okamura, L., & McNeil, P. (1995). Situation and personality correlates of psychological well-being: Social activity and personal control. *Journal of Research in Psychology*, 29, 395–417.
- Costa, P. T., & McCrae, R. R. (1992). *The revised NEO personality inventory (NEO-PI-R) and NEO five-factor inventory (NEO-FFI) professional manual*. Psychological Assessment Resources.
- DeNeve, K. M., & Cooper, H. (1998). The happy personality: A meta-analysis of 137 personality traits and subjective well being. *Psychological Bulletin*, 124, 197–229.
- DeYoung, C. G., Quilty, L. C., & Peterson, J. B. (2007). Between facets and domains: 10 aspects of the Big Five. *Journal of Personality and Social Psychology*, 93(5), 880.
- Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment*, 49, 71–75.
- Digman, J. (1990). Personality structure: Emergence of the five-factor model. *Annual Review of Psychology*, 41, 417–440.
- Emmons, R. A., & McCullough, M. E. (2003). Counting blessings versus burdens: An experimental investigation of gratitude and subjective well-being in daily life. *Journal of Personality and Social Psychology*, 84, 377–389.
- Erdfelder, E., Faul, F., & Buchner, A. (1996). GPOWER: A general power analysis program. *Behavior Research Methods, Instruments, and Computers*, 28(1), 1–11.
- Eysenck, H. J., & Eysenck, M. W. (1985). *Personality and individual differences: A natural science approach*. Plenum Press.
- Fleeson, W. (2001). Toward a structure - and process - integrated view of personality: Traits as density distributions of states. *Journal of Personality and Social Psychology*, 80, 1011–1027.
- Fleeson, W., & Jayawickreme, E. (2015). Whole trait theory. *Journal of Research in Personality*, 56, 82–92.
- Fleeson, W., & Wilt, J. (2010). The relevance of big five trait content in behavior to subjective authenticity: Do high levels of within-person behavioral variability undermine or enable authenticity achievement. *Journal of Personality*, 78, 1353–1382.
- Fleeson, W., Malanos, A. B., & Achille, N. M. (2002). An intraindividual process approach to the relationship between extraversion and positive affect: Is acting extraverted as "good" as being extraverted? *Journal of Personality and Social Psychology*, 83, 1409–1422.
- Fredrickson, B. L., Cohn, M. A., Coffey, K. A., Pek, J., & Finkel, S. M. (2008). Open hearts build lives: Positive emotions, induced through loving-kindness meditation, build consequential personal resources. *Journal of Personality and Social Psychology*, 95, 1045–1062.
- Gallagher, P., Fleeson, W., & Hoyle, R. H. (2010). A self-regulatory mechanism for personality trait stability: Contra-trait effort. *Social Psychological and Personality Science*, 1–8.
- Goldberg, L. R. (1990). An alternative 'description of personality': The big five factor structure. *Personality Processes and Individual Differences*, 59, 1216–1229.
- Gollwitzer, P. M. (1999). Implementation intentions: strong effects of simple plans. *American psychologist*, 54(7), 493.
- Gollwitzer, P. M. (1993). Goal achievement: The role of intentions. In W. Stroebe & M. Hewstone (Eds.), *European review of social psychology* (Vol. 4, pp. 141–185). John Wiley & Sons.
- Heaven, P. L., Fitzpatrick, J., Craig, F. L., Kelly, P., & Sebar, G. (2000). Five personality factors and sex: Preliminary findings. *Personality and Individual Differences*, 28, 1133–1141.
- Hudson, N. W., Briley, D. A., Chopik, W. J., & Derringer, J. (2019). You have to follow through: Attaining behavioral change goals predicts volitional personality change. *Journal of Personality and Social Psychology*, 117, 839–857. doi: 10.1037/pspp0000221
- Jacques-Hamilton, R., Sun, J., & Smillie, L. D. (2018, August 26). Costs and benefits of acting extraverted: A randomized controlled trial.
- John, O. P., Donahue, E. M., & Kentle, R. L. (1991). The big five inventory--Versions 4a and 54. University of California, Berkeley, Institute of Personality and Social Research.
- Keyes, C. L. M. (1998). Social well-being. *Social Psychology Quarterly*, 61, 121–140.
- Leary, M. R., Herbst, K. C., & McCrary, F. (2003). Finding pleasure in solitary activities: Desire for aloneness or disinterest in social contact? *Personality and Individual Differences*, 35, 59–68.
- Lee, K., & Ashton, M. C. (2018). Psychometric properties of the HEXACO-100. *Assessment*, 25, 543–556.
- Lee, R. M., Dean, B. L., & Jung, K. (2008). Social connectedness, extraversion, and subjective well-being: Testing a mediation model. *Personality and Individual Differences*, 45, 414–419.
- Lee, R. M., Draper, M., & Lee, S. (2001). Social connectedness, dysfunctional interpersonal behaviors, and psychological distress: Testing a mediator model. *Journal of Counseling Psychology*, 48, 310–318.
- Lee, T., & Crompton, J. (1992). Measuring novelty seeking in tourism. *Annals of Tourism Research*, 19, 732–751.

- Lucas, R. E., & Baird, B. M. (2004). Extraversion and emotional reactivity. *Journal of Personality and Social Psychology*, 86, 473.
- Lucas, R. E., & Diener, E. (2001). Understanding extraverts' enjoyment of social situations: The importance of pleasantness. *Journal of Personality and Social Psychology*, 81, 343-356.
- Lucas, R. E., Diener, E., Grob, A., Suh, E. M., & Shao, L. (2000). Cross-cultural evidence for the fundamental features of extraversion. *Journal of Personality and Social Psychology*, 79, 452-468.
- Lucas, R. E., & Fujita, F. (2000). Factors influencing the relation between extraversion and pleasant affect. *Journal of Personality and Social Psychology*, 79, 1039-1056.
- Lucas, R. E., Le, K., & Dyrenforth, P. (2008). Explaining the extraversion/positive affect relation: Sociability cannot account for extraverts' greater happiness. *Journal of Personality*, 76, 385-414.
- Lyubomirsky, S., & Lepper, H. A. (1999). A measure of subjective happiness: Preliminary reliability and construct validation. *Social Indicators Research*, 46, 137-155.
- Lyubomirsky, S., Sheldon, K. M., & Schkade, D. (2005). Pursuing happiness: The architecture of sustainable change. *Review of General Psychology*, 9, 111-131.
- McCrae, R. R., & Costa, P. T. (2003). *Personality in adulthood: A five-factor theory perspective* (2nd ed. ed.). Guilford Press.
- McNiel, J. M., Lowman, J. C., & Fleeson, W. (2010). The effect of state extraversion on four types of affect. *European Journal of Personality*, 24, 18-35.
- McNiel, J. M., & Fleeson, W. (2006). The causal effects of extraversion on positive affect and neuroticism on negative affect: Manipulating state extraversion and state neuroticism in an experimental approach. *Journal of Research in Personality*, 40, 529-550.
- Otake, K., Shimai, S., Tanaka-Matsumi, J., Otsui, K., & Fredrickson, B. L. (2006). Happy people become happier through kindness: A counting kindnesses intervention. *Journal of Happiness Studies*, 7(3), 361-375.
- Pavot, W., Diener, E., & Fujita, F. (1990). Extraversion and happiness. *Personality and Individual Differences*, 11, 1299-1306.
- Radloff, L. S. (1977). The CES-D scale a self-report depression scale for research in the general population. *Applied Psychological Measurement*, 1, 385-401.
- Robinson, W. S. (1950). Ecological correlations and the behavior of individuals. *American Sociological Review*, 15, 351-357.
- Ryan, R. M., & Frederick, C. (1997). On energy, personality, and health: Subjective vitality as a dynamic reflection of well-being. *Journal of Personality*, 65, 529-565.
- Sandstrom, G. M., & Dunn, E. W. (2014). Is efficiency overrated?: Minimal social interactions lead to belonging and positive affect. *Social Psychological and Personality Science*, 5, 437-442.
- Seligman, M. E. P., Steen, T. A., Park, N., & Peterson, C. (2005). Positive psychology progress: Empirical validation of interventions. *American Psychologist*, 60, 410-421.
- Sheldon, K. M., & Hilpert, J. C. (2012). The balanced measure of psychological needs (BMPN) scale: An alternative domain general measure of need satisfaction. *Motivation and Emotion*, 36(4), 439-451.
- Smillie, L. D., Cooper, A. J., Wilt, J., & Revelle, W. (2012). Do extraverts get more bang for the buck? Refining the affective-reactivity hypothesis of extraversion. *Journal of Personality and Social Psychology*, 103, 306-326.
- Smillie, L., Wilt, J., Kabbani, R., Garratt, C., & Revelle, W. (2015). Quality of social experience explains the relation between extraversion and positive affect. *Emotion*, 15, 339-349.
- Srivastava, S., Angelo, K. M., & Vallereux, S. R. (2008). Extraversion and positive affect: A day reconstruction study of person-environment transactions. *Journal of Research in Personality*, 42, 1613-1618.
- Steel, P., Schmidt, J., & Shultz, J. (2008). Refining the relationship between personality and subjective well-being. *Psychological Bulletin*, 134, 138-161.
- Stephan, E., Sedikides, C., & Wildschut, T. (2012). Mental travel into the past: Differentiating recollections of nostalgic, ordinary, and positive events. *European Journal of Social Psychology*, 42(3), 290-298.
- Steger, M. F., Frazier, P., Oishi, S., & Kaler, M. (2006). The meaning in life questionnaire: Assessing the presence of and search for meaning in life. *Journal of Counseling Psychology*, 53, 80-93.
- van Allen, Z. M., & Zelenski, J. M. (2018). Testing trait-state isomorphism in a new domain: An exploratory manipulation of openness to experience. *Frontiers in Psychology*, 9, 1964.
- Watson, D., & Clark, L. A. (1994). *The PANAS-X: Manual for the positive and negative affect schedule-expanded form*. The University of Iowa.
- Watson, D., & Clark, L. A. (1995). Depression and the melancholic temperament. *European Journal of Personality*, 9, 351-366.
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54, 1063-1070.
- Whelan, D. C. (2014). *Extraversion and counter-dispositional behaviour: Exploring consequences and the impact of situation-behaviour congruence*. [Doctoral dissertation, Carleton University].
- Wilt, J., Nofhle, E. E., Fleeson, W., & Spain, J. S. (2012). The dynamic role of personality states in mediating

the relationship between extraversion and positive affect. *Journal of Personality and Individual Differences*, 80, 1205-1236.

- Wortman, J., & Wood, D. (2011). The personality traits of liked people. *Journal of Research in Personality*, 45, 519-528.
- Zelenski, J. M., & Larsen, R. J. (2000). The distribution of basic emotions in everyday life: A state and trait perspective from experience sampling data. *Journal of Research in Personality*, 34, 178-197.
- Zelenski, J. M., Santoro, M. S., & Whelan, D. C. (2012). Would introverts be better off if they acted more like extraverts? Exploring emotional and cognitive consequences of counterdispositional behavior. *Emotion*, 12 (2), 290-303.
- Zelenski, J. M., Sobocko, K., & Whelan, D. C. (2014). Introversion, solitude, and subjective wellbeing. In R. J. Coplan & J. C. Bowker (Eds.), *The handbook of solitude: psychological perspectives on social isolation, social withdrawal, and being alone* (pp. 184-201). John Wiley & Sons, Inc.
- Zelenski, J. M., Whelan, D. C., Nealis, L. J., Besner, C. M., Santoro, M. S., & Wynn, J. E. (2013). Personality and affective forecasting: Trait introverts underpredict the hedonic benefits of acting extraverted. *Journal of Personality and Social Psychology*, 104, 1092-1108.