

RUNNING HEAD: Positive Emotion Variability

**Happiness is Best Kept Stable:
Positive Emotion Variability is Associated with Poorer Psychological Health**

June Gruber^{1*}, Aleksandr Kogan², Jordi Quoidbach³, & Iris B. Mauss⁴

¹Yale University

²University of Cambridge

³Harvard University

⁴University of California, Berkeley

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Corresponding Author:

June Gruber

Yale University

Department of Psychology

P.O. Box 208205

New Haven, CT 06520

june.gruber@yale.edu

(203) 432-4888

Abstract

Positive emotion has been shown to be associated with adaptive outcomes in a number of domains, including psychological health. However, research has largely focused on overall levels of positive emotion with less attention paid to how variable versus stable it is across time. We thus examined the psychological-health correlates of positive emotion variability versus stability across two distinct studies, populations, and scientifically validated approaches for quantifying variability in emotion across time. Study 1 utilized a daily-experience approach in a U.S. community sample ($N=244$) to examine positive emotion variability across two weeks (macro-level). Study 2 adopted a daily-reconstruction method in a French adult sample ($N=2,391$) to examine variability within one day (micro-level). Greater macro and micro-level variability in positive emotion was associated with worse psychological health, including lower well-being and life satisfaction and greater depression and anxiety (Study 1); and lower daily satisfaction, life satisfaction, and happiness (Study 2). Taken together, these findings support the notion that positive emotion variability plays an important and incremental role in psychological-health above and beyond overall levels of happiness, and that too much variability might be maladaptive.

Keywords: Positive Emotion; Variability; Fluctuation; Stability; Happiness

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Psychological research has established that high levels of positive emotion promote well-being (Seligman & Csikszentmihalyi, 2000). For example, increased positive emotion promotes creative thinking (Isen et al., 1987), social connection with others (Fredrickson, 1998), emotional resilience in the face of stressors (Folkman & Moskowitz, 2000), and better physical health (Tugade, Fredrickson, & Barrett, 2004). This research suggests that higher levels of positive feelings are of paramount importance for human flourishing, including psychological health.

However, a complete understanding of the correlates of positive emotion requires more than an understanding of its overall levels. As a process that varies, or fluctuates, dynamically over time (Davidson, 1998), positive emotion can only be fully understood if we understand its dynamics. For example, two people could be identical in terms of their overall positive emotion levels but quite different from one another in their variability, with one person fluctuating very little around his/her average level, while the other person fluctuates a great deal (See **Figure 1**). Prior work has demonstrated that variability in emotional states, frequently operationalized as the within-person standard deviation of emotions over time (e.g., Eaton & Funder, 2001), can be reliably measured (Trull et al., 2008), is stable within individuals (Eid & Diener, 1999), and is independent of overall emotion levels (Chow et al., 2005). Thus, examining variations in positive emotion is scientifically feasible.

While most research agrees that higher mean levels of positive emotion are associated with better psychological health, two different perspectives exist on whether

greater variability in positive emotion is adaptive. The first perspective suggests that greater variability is associated with worse psychological health. Indeed, early Buddhist texts underscored the importance of attaining greater emotional stability, rather than emotional variability, as an important component of well-being (Niramisa Sutta: Unworldly [SN 36.21], 2010). In Western psychology traditions, recent work indicates that excessive changes in negative emotions can signal psychological instability associated with distress and mental illness (Kashdan & Rottenberg, 2010; Waugh, Thompson, & Gotlib, 2011). Consistent with this notion, greater variability in negative emotion is associated with increased depressive symptoms (Peeters, Berkhof, Delespaul, Rottenberg, & Nicolson, 2003), borderline personality disorder (Trull et al., 2008), and neuroticism (Eid & Diener, 1999). Based on these findings, recent mindfulness-based treatments include a focus on decreasing variability in negative emotions (Linehan, Bohus, & Lynch, 2007). While much of this research has examined negative emotions, this work suggests that greater variability in positive emotions should also relate to worse psychological health.

By contrast, a second perspective suggests that greater variability may be associated with improved psychological health. For example, emotional flexibility—defined as the ability to respond flexibly to changing circumstances—is a hallmark of psychological health and well-being (Kashdan & Rottenberg, 2010). Furthermore, greater variability in physiological stress levels (as measured by daily cortisol awakening responses) is associated with better psychological adjustment (Mikolajczak et al., 2010). In line with this idea, the ability to modify one's emotional responses depending on the current emotional context is predicted by greater resilience, a widely known index of

psychological adjustment (Waugh et al., 2011). Increased variability in self-reported positive and negative emotions is greater for individuals with high versus low self-esteem (Kuppens, Allen, & Sheeber, 2010). Finally, greater variability may render emotional experiences themselves in a more adaptive light. For example, periodic “breaks” in pleasant emotional experiences (e.g., listening to a favorite song) intensifies enjoyment of the subsequent experience (Nelson & Meyvis, 2008). Taken together, this work suggests that variation across time in emotional states, including positive ones, is part of a healthy mental life.

The Present Investigation

Theoretical considerations suggest that variability in positive emotion should matter for psychological health above and beyond overall mean levels. However, two competing perspectives exist about the psychological-health correlates of positive emotion variability. While research exists that informs each of these two perspectives, few studies have directly examined the psychological-health correlates (i.e., functioning, well-being, and symptoms of mental illness) of positive emotion variability. The present research thus examined this important question in large and diverse sample using a robust variety of measurement and sampling approaches. Specifically, we examined positive emotion variability across two studies, 2,635 participants drawn from two different countries, using a combination of diary and daily reconstruction methodologies, assessing both macro- and micro-level measures of variability, controlled for mean levels of affect when assessing variability, and utilized a wide range of psychological-health outcomes.

The present investigation expands upon extant work in positive emotion variability in several key ways. First, the present study is one of the first to

comprehensively link positive emotion variability with psychological health. This builds on prior work providing associations with more indirect or specific indices of psychological health, including associations with the personality trait of neuroticism (Eid & Diener, 1999; McConville & Cooper, 1999), non-clinical borderline personality features (e.g., Zeigler-Hill & Abraham, 2006). Second, we examined relatively fine-grained temporal variability in positive emotion within the course of a single day and across two weeks, which extends previous work linking variability in happiness across a one-year period with depression and anxiety symptoms in adolescents (e.g., Neuman, van Lier, & Frijns, 2011). Third, we examine whether associations between variability and ill health in specialized clinical populations (e.g., Kashdan et al., 2006; Newton & Ho, 2008) generalize to broader community samples and with more comprehensive measures of psychological health.

Methods

Study 1 included a sample of 244 adult participants from the Denver community (55% female; $M_{age}=40.69$ years). Participants were asked to rate their positive feelings each day before going to bed (between 7:00pm and 11:00pm) for 14 consecutive days ($M_{days}=12.60$, $SD=2.29$ days). Participants were asked to indicate how ‘happy’ and ‘excited’ they felt over the past 24 hours on a scale ranging from 1 (*very slightly/ not at all*) to 5 (*extremely*) that were combined into one positive emotion composite (See **Table 1**). Following established methods (Eid & Diener, 1999; Trull et al. 2008), two scores were calculated individually for each participant from these reports: Positive Emotion Variability (PE_{var}) as the standard deviation across 14 days and Overall Positive Emotion (PE_{mean}) as the average across 14 days. We controlled for effects of stressful events by

measuring the number of daily stressful events with the following daily diary item “In *total*, since this time yesterday, how many things happened to you that turned out to be stressful?” For each participant, the frequency of stressful events each day was averaged across the 14 days. Thus, both major stressors and daily hassles were accounted for.

Participants also completed four measures of psychological health, including life satisfaction, symptoms of depression, and symptoms of anxiety. Functioning was measured using a modified self-report version of the Global Assessment of Functioning Scale (Axis V, *DSM-IV*; American Psychiatric Association, 1994), consisting of 23 items rated individually on a 1 (not at all) to 9 (extremely) scale, with total functioning scores ranging from 23 (lowest functioning) to 207 (highest functioning). Life satisfaction was measured using the Satisfaction With Life Scale (Diener et al., 1985) rated on a 1 (strongly disagree) to 7 (strongly agree) scale. Depression symptoms were measured using the Beck Depression Inventory (Beck et al., 1984), rated on a 0 to 3 scale. Anxiety symptoms were measured using the Anxiety Screening Questionnaire (Wittchen & Boyer, 1998), which measures symptom counts (yes/no) of social anxiety, generalized anxiety, panic, and agoraphobia. Higher scores indicate greater depressive and anxiety symptom severity, respectively.

We conducted Study 2 using a dataset that enabled us to examine whether our results would generalize to more micro-level (day-to-day) measures of variability, a larger and culturally distinct population, and when using distinct quantification methods to calculate variability across time. Study 2 consisted of 2,391 francophone adults (83% female, $M_{age}=37.1$ years, $SD=12.0$) recruited through a large online study mentioned during the French TV show “*Leurs Secrets du Bonheur*.” A website link to the

questionnaire was placed on the TV show website to complete on a voluntary basis. Participants were asked to report what they did on the previous day, episode-by-episode, following the validated Day Reconstruction Method (Kahneman et al., 2004). For each episode ($M_{episodes}=12.84$, $SD=4.68$), participants indicated whether they had experienced each of 9 positive emotions items (Yes/No) from the Differential Emotion Scale (Izard et al., 1974; French validation, Philippot, 1993), which included alertness, amusement, awe, contentment, joy, gratitude, hope, love, pride. Positive emotion items were summed for each episode, and similar to Study 1, two scores were calculated individually for each participant including: PE_{var} as the within-person standard deviation across episodes reported throughout the day, and PE_{mean} as the positive emotion average across episodes. After completing the DRM, participants were asked to report how satisfied they were with their day as a whole on a three 7-point items scale (*I am satisfied with how yesterday went; If I could start yesterday over, I wouldn't change anything; Yesterday was a bad day*—reversed scored); general life satisfaction using the same 5-item Satisfaction with Life Scale (Diener et al., 1985), and trait subjective happiness using the 4-item Subjective Happiness Scale (Lyubomirsky & Lepper, 1999). Higher scores on both scales signify greater life satisfaction and happiness, respectively.

Results

For both Study 1 and Study 2, both PE_{var} and PE_{mean} scores were entered as simultaneous predictors in regression models with the psychological-health outcome measures. The regression models were checked for multicollinearity using variance inflation factor, and all values were well below the maximum threshold level of 10. Means and standard deviations are reported in **Table 1**.

For Study 1, participants who experienced greater PE_{var} throughout the 14-day study period reported worse psychological-health outcomes, including decreased life satisfaction ($\beta=-0.16$), decreased functioning ($\beta=-0.15$), increased depression ($\beta=0.23$) and increased anxiety ($\beta=0.18$) ($ps < .05$). These associations held when controlling for life stressors, suggesting they were not driven merely by external life events (all $ps < .05$). It should be noted that life stressors predicted lower levels of life satisfaction ($\beta=-0.12$) and functioning ($\beta=-0.29$); and higher levels of anxiety ($\beta=0.19$) and depression ($\beta=0.23$). For Study 2, participants who reported greater PE_{var} throughout the previous day experienced worse psychological-health outcomes, including decreased daily satisfaction ($\beta=-0.38$), decreased life satisfaction ($\beta=-0.23$) and decreased subjective happiness ($\beta=-0.26$) (all $ps < .01$).

Across both studies, three facts suggest the results for PE_{var} held above and beyond overall mean positive emotion levels (i.e., PE_{mean}). First, all results were obtained when PE_{var} and PE_{mean} were entered simultaneously into our regression models. Second, even though PE_{var} and PE_{mean} were moderately positively correlated, PE_{mean} predicted all outcomes in an *opposite* manner. For Study 1, this included PE_{mean} predicting increased functioning ($\beta=0.31$), increased satisfaction ($\beta=0.43$), decreased depression ($\beta=-0.27$) and decreased anxiety ($\beta=-0.24$) ($ps < .05$). For Study 2, this included increased daily satisfaction ($\beta=0.64$), increased life satisfaction ($\beta=0.43$), and increased subjective happiness ($\beta=0.49$) ($ps < .01$). Third, we employed two additional measures of quantifying PE_{var} that produced identical results across both studies, including the probability of acute change (PAC; Trull et al., 2008) that calculates the proportion of large degrees of variability in positive emotion (e.g., Trull et al., 2008) and the mean

square of successive differences that incorporates the temporal sequence and magnitude of variations (MSSD; Jahng, Wood, & Trull, 2008). Specifically, for Study 1, participants who reported greater PE_{var} throughout the previous day experienced worse psychological-health outcomes, including decreased life satisfaction (PAC: $\beta=-1.80$; MSSD: $\beta=-0.37$), decreased global functioning (PAC: $\beta=-46.39$; MSSD: $\beta=-7.89$), elevated depression (PAC: $\beta=11.56$; MSSD: $\beta=-2.44$), and increased anxiety (PAC: $\beta=4.49$; MSSD: $\beta=0.73$) (all $ps < .017$). For Study 2, participants who reported greater PE_{var} throughout the previous day experienced worse psychological-health outcomes, including decreased daily satisfaction (PAC: $\beta=-0.09$; MSSD: $\beta=-0.11$), decreased life satisfaction (PAC: $\beta=-0.06$; MSSD: $\beta=-0.08$) and decreased subjective happiness (PAC: $\beta=-0.04$; MSSD: $\beta=-0.06$) (all $ps < .05$).

Discussion

The present results suggest that regardless of overall positive emotion levels, greater variability in positive emotion was linked to detrimental psychological-health outcomes, including decreased life satisfaction and global functioning and increased depression and anxiety (Study 1) and decreased daily satisfaction, life satisfaction, and subjective happiness (Study 2). These results were obtained in large and diverse international populations and with a wide range of indices of psychological health; qualitatively distinct measures of emotion (diary versus day reconstruction methods; intensity versus categorical ratings); different time frames (day-to-day versus moment-to-moment variation, reflecting macro- and micro-level variability); and different mathematical quantifications of variability (i.e., standard deviation, MSSD, PAC). This consistency of findings suggests that these results are robust and persist across distinct

populations, domains of psychological health, time frames, and measures of positive emotion variability. One important feature of the present study is that results held when controlling for mean affect levels, which is especially important in light of prior studies that have conflated true change across time with mean-level variance (Baird, Le, & Lucas, 2006).

Such findings support the examination of intraindividual variability in emotion across time, in addition to their overall level, to gain a more complete understanding of the dynamic nature of emotion (Davidson, 1998) and its relationship with psychological health (Eid & Diener, 1999). Specifically, the present findings suggest that too much variability within a relatively brief time interval is associated with decreased functioning and psychological health in a general community sample. Future work is needed to systematically probe whether different types of variability—such as frequent yet small oscillations versus infrequent but large oscillations—predict different psychological-health trajectories. This finding is consistent with the position that positive emotion serves an adaptive function if it is relatively stable over time. Unstable compared to stable positive emotion may be harmful because it involves extreme lows and highs, both of which have been shown to be maladaptive (Gruber, Mauss, & Tamir, 2011). Importantly, the fact that the present findings hold when controlling for mean levels of positive emotion suggests that it is not merely driven by extreme lows in positive emotions, but rather by the simultaneous experience of lows and highs across time. The present finding also has implications for interventions aimed at promoting well-being and psychological health. Specifically, it suggests that psychological interventions may be most successful when they reduce variability in positive states as opposed to solely

focusing on enhancing peak experiences and the frequency of positive emotion. Finally, it is striking that findings converged across different time scales, as variability in these time scales is likely driven by different processes. This convergence may indicate that effects on psychological health of affective processes at very different time scales are governed by similar rules, an idea that has yet to receive in-depth empirical scrutiny and is ripe for future inquiry.

The present findings suggest several directions for future research. First, it will be critical to parse apart which are the most detrimental aspects of variability (e.g., frequent dips down from positive peaks, or exhaustion experienced as a result of re-acclimating to a constantly changing internal emotional ecosystem). Second, it will be critical to examine whether positive emotion variability is always detrimental, or might it be adaptive when it is associated with flexibly and adaptively shifting one's emotion state to meet specific environmental changes or needs (Kashdan & Rottenberg 2010). Third, while identifying cross-sectional associations is an important step in developing a model of positive emotion variability, this feature limits our ability to inform causal claims. On the one hand, it is possible that variability in positive emotion causes decreased psychological health by creating instability in people's ability to function. On the other hand, reduced psychological health could lead to heightened variability because it leads to difficulty maintaining a stable emotional state. Ultimately, longitudinal and experimental designs are needed to examine the prospective and causal impact of positive emotion variability. Finally, it will be important to gain a better understanding of the mechanisms that link positive emotion variability to poorer psychological health.

In sum, positive emotion variability appears to play an incremental and critical

role in psychological-health above and beyond overall levels of positive emotion.

Specifically, the present results provide evidence in support of the notion that how emotions unfold over time (in addition to their mean level) is involved in health.

Specifically, too much variability and not enough stability in one's positive feelings appear to co-occur with unhealthy psychological outcomes.

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Footnotes

¹ Of the 244 participants in Study 1, only seven (2.9%) completed less than 50% of the daily entries. Since the missing data rate was so low, we did not exclude any participants from analyses. For Study 2, we followed standard DRM convention and excluded participants who reported less than 5 episodes per day (5.3%; $n = 133$). Importantly, parallel results emerged when analyzing the data with and without the exclusion of these participants across both studies.

² One potential alternative explanation of our results is that our findings are not specific to variability of positive emotions--instead, there may be a similar pattern for negative emotions as well. We thus evaluated whether negative emotions variability predicted well-being in Studies 1 and 2, controlling for mean negative emotion levels. In Study 1, we did not find any evidence for an association between negative variability (measured as the mean across 11 items: irritable, sad, distressed, angry, ashamed, worried, nervous, guilty, hopeless, anxious, hostile) and well-being, and in Study 2, only 1 out of 3 tests (i.e., daily satisfaction, but not happiness or life satisfaction) yielded a significant negative relationship with negative emotion variability (measured as the mean across 9 items: anger, sadness, embarrassment, fear, disgust, guilt, shame, contempt, and anxiety). Thus, although some of these tests suggest that negative variability is linked to well-being, the strength of these associations does not parallel the effects observed for positive emotion variability in the present study. We therefore focus on the novel question of whether positive variability specifically is linked to psychological health.

Table 1. Means, Standard Deviations, Alphas, and Simple Correlations Among Measures in Study 1 and Study 2

Study 1	Mean	SD	α	Correlation Coefficients (r)						
				1	2	3	4	5	6	7
				PE _{var}	PE _{mean}	Functioning	Life Satisfaction	Depression	Anxiety	SLE
1. PE _{var}	0.75	0.27	--	--						
2. PE _{mean}	2.53	0.73	--	.19*	--					
3. Functioning	147.35	27.10	--	-.12	.26**	--				
4. Life Satisfaction	3.72	1.63	0.92	-.07	.43**	.65**	--			
5. Depression	10.44	9.88	0.93	.16*	-.24**	-.68**	-.65**	--		
6. Anxiety	16.21	3.44	0.95	.12	-.21**	-.66**	-.49**	.64**	--	
7. SLE	1.82	1.29	--	-.07	-.03	-.29**	-.12	.22**	.19**	--

Study 2	Mean	SD	α	Correlation Coefficients (r)				
				1	2	3	4	5
				PE _{var}	PE _{mean}	Life Satisfaction	Daily Satisfaction	Happiness
1. PE _{var}	1.46	0.78	--	--				
2. PE _{mean}	1.57	1.15	--	.54*	--			
3. Life Satisfaction	23.45	6.82	0.88	.01	.31*	--		
4. Daily Satisfaction	14.49	4.88	0.84	-.06*	.44*	.49*	--	
5. Happiness	18.71	4.93	0.85	.01	.35*	.68*	.49*	--

Note: PE_{var}=Positive emotion variability (ranged from 0.00-1.77 in Study 1; 0.00-5.64 for Study 2); PE_{mean}=Overall Positive emotion mean levels (ranged from 1.00-4.93 in Study 1; 0.00-8.91 in Study 2). SLE = Stressful life events. * $p < .05$

Figure Caption

Figure 1. Schematic to represent actual study participants with high PE_{var} and low PE_{var} .

Selected participants from Study 1 and Study 2 had identical PE_{mean} levels ($M_{Study\ 1}=3.43$ and $M_{Study\ 2}=3.85$).

Figure 1.

