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RESEARCH PAPER

Momentary Happiness: The Role of Psychological Need Satisfaction

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Abstract Psychological well-being correlates positively with psychological need satisfaction—primarily the needs of autonomy, competence, and relatedness. The current study explores momentary happiness (defined as experienced enjoyment minus experienced stress over the course of an hour) as a function of momentary psychological need satisfaction. Results demonstrate that hour-by-hour ratings of psychological need satisfaction were correlated with momentary happiness, with individual differences in life satisfaction moderating this relationship. Ratings of autonomy and relatedness correlated positively with momentary happiness, while competence was negatively correlated with momentary happiness. Thus, engagement in competence-promoting behaviors may come at an affective cost, at least in the moment. When autonomy and relatedness needs were met, individuals with high levels of life satisfaction experienced greater increases in happiness than individuals with low levels of life satisfaction. This finding supports a sensitization model of well-being. Results are discussed with respect to their implications for self-determination theory (SDT).

Keywords Subjective well-being · Happiness · Self-determination theory · Psychological needs

Subjective well being (SWB) may be affected by multiple factors in an individual's experience. Previous research suggests that variance in SWB (which is defined in terms of affective and cognitive processes; see Arthaud-Day and Near 2005; Diener 2000; Diener et al. 1999; Ryan and Deci 2001) is mostly explained by temperament, rather than life

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circumstances (Schimmack et al. 2002; Vittersø and Nilsen 2002). However, there is also evidence that SWB varies as a function of individuals' life choices (Reis et al. 2000; Argyle 1999). If this is true, it is important to understand the types of behaviors associated with elevated SWB.

Self-determination theory (SDT; Deci and Ryan 1991) hypothesizes that SWB will be highest when individuals engage in behaviors that satisfy three universal psychological needs—autonomy, competence, and relatedness—which are necessary for growth, integration, and self-actualization (Deci and Ryan 1985; Ryan 1995; Ryan and Deci 2000). Therefore, just as fulfillment of physiological needs is essential for survival and increased happiness (Maslow 1954), SDT hypothesizes that psychological need satisfaction provides the necessary elements for SWB.

Past research using multilevel modeling has found that daily well-being tends to be highest on days when psychological need satisfaction exceeds one's own baseline level of daily need fulfillment (Reis et al. 2000; Sheldon et al. 1996). These studies relied on self-reports of overall daily need satisfaction and overall daily well-being. A full test of SDT requires more detailed reports of individuals' specific behaviors and the need satisfaction and SWB experienced during those behaviors (Deci and Ryan 1991). The current study aims to fill this gap in the SDT literature.

1 The Psychological Need Satisfaction and Well-Being Relation

SDT focuses on autonomy, competence, and relatedness—the three psychological needs required for optimal well-being (Ryan and Deci 2000). Individuals perceive their daily choices to be autonomous when their behaviors are freely selected and in line with a self-directed area of interest or value (Deci and Ryan 1985; Kasser and Ryan 1996). For instance, progress toward self-directed goals results in higher levels of well-being (Sheldon and Kasser 1998), while extrinsically motivated behaviors produce lower levels of well-being (Deci et al. 1999). Competence can be described as the need for challenges and experiences that produce increased self-efficacy—the sense that one has the capacity to bring about a desired outcome (Ryan and Deci 2000). Feelings of competence predict increased well-being across various outcomes, including physical health (Carver and Scheier 1990), vitality (Vansteenkiste et al. 2006), and self-esteem (Bandura 1977). Relatedness is the need to feel connection with others, to belong, and to form interpersonal bonds (Reis et al. 2000). Attachment to significant others and a sense of belongingness are fundamental to both mental and physical well-being (Baumeister and Leary 1995; Berscheid and Reis 1998). Past research repeatedly demonstrates that all three psychological needs are associated with higher well-being across age, cultural dimensions (Hahn and Oishi 2006), and longitudinally across the lifespan (Kasser and Ryan 1999).

An individual's level of psychological need fulfillment varies in both the short- and long terms. Thus, according to SDT, changes in psychological need satisfaction from either moment-to-moment (within the day) or day-to-day (between days) should impact momentary and daily well-being, respectively. Sheldon et al. (1996) demonstrated that when trait-level psychological need satisfaction was controlled, individuals experienced higher daily well-being on days when autonomy and competence needs were relatively more fulfilled. Reis et al. (2000) replicated these findings and further found that increased daily relatedness was also associated with increased daily well-being. The field has yet to study the moment-to-moment (within the day) need satisfaction-SWB relation in order to examine the real-time relationships hypothesized by SDT.

In addition to extending previous findings, Reis et al. demonstrated that individuals high on various trait-level well-being constructs (e.g., self-determination, effectance, connectedness) showed the strongest correlation between daily psychological need satisfaction and daily well-being. Specifically, (a) trait connectedness moderated the daily relatedness and well-being relation; and (b) trait self-determination moderated the autonomy and vitality relations. Those higher on connectedness and self-determination reported higher well-being and vitality when experiencing greater daily relatedness and autonomy, respectively. These results support a sensitization model (as opposed to a deprivation model) to describe the moderated relation between need satisfaction and SWB. The sensitization model predicts that if psychological needs are met (not met), individuals high on trait-level well-being will experience greater (lower) state-level SWB than those low on trait-level well-being. The deprivation model predicts the exact opposite. If psychological needs are met (not met) individuals *low* on trait-level well-being will experience greater (lower) state-level SWB than those high on trait-level well-being. To date, neither model has been tested with data related to momentary psychological need satisfaction or SWB.

2 Study Objectives

The current study pursues three major objectives: (1) Replicate the findings of Sheldon et al. (1996) and Reis et al. (2000) by demonstrating that daily reports of autonomy, competence, and relatedness are positively correlated with daily well-being (satisfaction with the day and positive affect) and negatively correlated with negative affect, when controlling for trait-level well-being measures (life satisfaction and subjective happiness); (2) Extend the work of Sheldon et al. and Reis et al. by examining within-person relations between momentary psychological need satisfaction (autonomy, competence, and relatedness) and momentary affect using hour-by-hour retrospective diaries; (3) Explore the cross-level effects of trait-level well-being (satisfaction with life) on the relation between momentary psychological need satisfaction and momentary happiness to determine whether a sensitization or deprivation model predicts the results.

3 Method

The study objectives are addressed with three sets of analyses and two samples of participants. To meet the first objective, participants in Sample 1 reported their overall daily well-being (satisfaction with the day, positive affect, and negative affect) as well as their overall daily psychological need satisfaction (autonomy, competence, and relatedness) for three consecutive days. The second and third objectives were met by having participants in Sample 2 retrospectively report their hourly behaviors, emotional experiences (overall enjoyment and stress for each hour), and psychological need satisfaction (autonomy, relatedness, and competence experienced during each hour) for 18 consecutive hours on two different days.

3.1 Participants

Sample 1 was composed of 144 undergraduate psychology students from a Southern California public university. Data from the 132 participants who correctly completed all three daily diaries are used in the analysis to address the first objective. Participants were

slightly older than the typical college student ($M = 25.03$ years, SD = 7.72 years) and were predominantly female (76.5% female). The sample was ethnically diverse, though largely Hispanic/Latino (47.7%) and Euro-American (37.9%), with fewer African-Americans (3.0%) and Asian-Americans (3.8%).

Participants in Sample 2 were 321 undergraduate psychology students from a different public university in Southern California. A total of 314 participants completed all necessary measures and their data are used in the analyses to address the second and third objectives. This sample was of typical college age ($M = 19.29$ years, SD = 2.73 years) and included more females than males (61.8% female). The sample was ethnically diverse, with 39.1% Asian-American, 24.2% Hispanic/Latino, 18.8% Euro-American, 7.3% African-American, 6.0% other, and 3.6% not reporting.

3.2 Measures and Procedure

3.2.1 Life Satisfaction

Participants in both samples completed the Satisfaction with Life Scale (SWLS; Diener et al. 1985), which is a 5-item measure of trait-level life satisfaction. The scale contains statements such as: "In most ways my life is close to my ideal," and "I am satisfied with my life." Participants rated the degree to which they agreed with each item (1 = strongly disagree; 7 = strongly agree). Life satisfaction scores are formed by computing the mean of the five items. Cronbach's α for Sample 1 was .82. Cronbach's α for Sample 2 was .83.

3.2.2 Happiness

Only Sample 1 completed the Subjective Happiness Scale (SHS; Lyubomirsky and Lepper 1999), which is a 4-item measure of trait-level happiness. The scale contains statements such as: "In general, I consider myself a very happy person," and "Compared to most of my peers, I consider myself more happy." Participants rated the degree to which they agreed with each item (1 = strongly disagree; 7 = strongly agree). Happiness scores are formed by computing the mean of the four items. Cronbach's α was .86.

3.2.3 Daily Survey

After completing initial measures of SWLS and the SHS, participants in Sample 1 received three envelopes, each containing a daily survey to measure daily well-being (satisfaction with the day, positive affect, and negative affect) and daily psychological need satisfaction (autonomy, competence, and relatedness). Participants were instructed to fill out one survey after 9:00 p.m. for three consecutive nights. Participants returned 3 days later, turned in their daily surveys, and answered follow-up questions, including one about whether they had followed all instructions related to survey completion.

For the daily survey, participants received the following instructions: "Reflect on what you did today, who you were with, what you did, and how you felt during your day." Participants were then instructed to rate their level of agreement (1 = strongly disagree; 7 = strongly agree) with statements from six different constructs, each measured by two items: (a) satisfaction with the day (adapted from the SWLS): "Today was a very satisfying day" and "In most ways, today was close to an ideal day for me"; (b) positive affect (using two emotions from the PANAS-X; Watson and Clark 1994):

"I experienced a lot of joy today" and "Today was a fun day"; (c) negative affect (using two emotions from the PANAS-X): "Today was a very frustrating day" and "I experienced a lot of anxiety today"; (d) autonomy (adapting relevant questions from the Basic Need Satisfaction in Life Scale [BNSLS]; see Kashdan et al. 2006): "I was able to accomplish what I wanted to today" and "I made progress on my goals today"; (e) competence (adapting relevant questions from the BNSLS): "Some of my activities helped to increase my competence in some skill" and "Today helped me to master a new ability"; (f) relatedness (adapting relevant questions from the BNSLS): "Today I was able to develop closer relationships with my friends" and "Today I was able to develop closer relationships with my family."

Daily well-being and psychological need satisfaction scores were formed by computing the mean score for each construct (two items per construct) across the 3 days. Reliabilities were tested using Cronbach's α and were as follows: satisfaction with the day (.73); positive affect (.83); negative affect (.74); autonomy (.75); competence (.74); and relatedness (.67).

3.2.4 18-Hour Retrospective Diary

To measure momentary psychological need satisfaction and momentary affect participants in Sample 2 completed an 18-hour retrospective diary on two different days. The methodology was adapted from Hershey (1999).[1]

The retrospective diary required each participant to code their hourly behaviors (e.g., eating, doing chores, working, socializing) for an 18-hour period from the previous day (starting at 8:00 am and ending at 1:00 am). Participants then gave each hour a rating for enjoyment, stress, autonomy, competence, and relatedness. To assess hourly enjoyment, participants were asked, "Were you having fun?" The scale was anchored between 1 ("No. It was unpleasant.") and 4 ("Yes! It was very pleasurable."). To assess hourly stress, participants were asked, "Were you experiencing stress or anxiety?" The scale was anchored between 1 ("No. I was relaxed.") and 4 ("Yes! I was very stressed."). To assess autonomy, participants were asked, "Was this an activity that you really wanted to be doing, or something that you felt you 'ought' to do?" The scale was anchored between 1 ("I did it only because I felt I ought to.") and 4 ("I did it only because I wanted to."). To assess competence, participants were asked, "Did this activity help you increase your competence/mastery in some skill or ability?" The scale was anchored between 1 ("No. This activity hindered me in increasing my competence.") and 4 ("Yes! This activity increased my competence."). To assess relatedness, participants were asked, "Did this activity help you develop closer relationships with your friends/family?" The scale was anchored between 1 ("No. This activity hindered me from developing closer relationships.") and 4 ("Yes! This activity helped me develop closer relationships."). All items were designed to mirror those used in the daily survey given to Sample 1. Each of these constructs can be construed as a 36-item scale (18 hourly ratings across 2 days) for which a mean score was computed. Cronbach's α reliability coefficients of .87 (enjoyment); .88 (stress); .86 (autonomy); .87 (relatedness); and .88 (competence). To form the momentary

[1] This methodology is similar to the Day Reconstruction Method used by Kahneman et al. (2004). While both retrospective/reconstruction diary methods and experience sampling methods have advantages and disadvantages, Kahanmen et al. demonstrated that patterns of affect for experience sampling and retrospective/reconstruction diary methods are comparable.

happiness variable, stress was subtracted from enjoyment at each hour over the 2 day period.[2]

3.3 Analyses

Data provided by Sample 1 (for the first study objective) were analyzed using partial correlations to determine whether daily reports of autonomy, competence, and relatedness were associated with satisfaction with the day, positive affect, and negative affect, when controlling for satisfaction with life and subjective happiness.

Data provided by Sample 2 (for the second and third study objectives) were nested within the participants, as each participant retroactively described behaviors, affect, and need satisfaction for each of 36 hours (18 consecutive hours on two different days). The data were analyzed with a series of multilevel random coefficient models using the Hierarchical Linear Modeling (HLM) software program (Version 6; Raudenbush et al. 2005). Within-participant correlations between Level-1 predictors (hourly ratings of need satisfaction for autonomy, competence, and relatedness) and Level-1 outcomes (hourly ratings of enjoyment, stress, and momentary happiness) were computed. The Level-2 variable (life satisfaction) was used to explore the moderating effect of trait-level life satisfaction on the within-participant correlations. This analysis assesses the third study objective. For all analyses and explanations of the results, the detailed advice proffered by Nezlek (2001) was followed in this study.

4 Results

4.1 Examining the Daily Well-Being and Need Satisfaction Relation

To assess the first study objective, correlations between the daily well-being variables and the daily need satisfaction variables were explored with Sample 1. As expected, satisfaction with the day was strongly correlated with both daily positive affect ($r = .78$, $p < .001$) and daily negative affect ($r = -.60$, $p < .001$), and daily positive affect was negatively correlated with negative affect ($r = -.58$, $p < .001$).[3] Consistent with past research (Sheldon et al. 1996; Reis et al. 2000), there were strong correlations between daily psychological need variables (autonomy, competence, relatedness) and satisfaction with the day ($r = .65$, $p < .001$; $r = .44$, $p < .001$; $r = .59$, $p < .001$, respectively), positive emotions ($r = .50$, $p < .001$; $r = .42$, $p < .001$; $r = .53$, $p < .001$, respectively), and negative emotions ($r = -.37$, $p < .001$; $r = -.24$, $p < .005$; $r = -.29$, $p < .005$, respectively).

Daily psychological need variables were positively correlated with measures of trait-level SWB (life satisfaction and subjective happiness) as well as with the positive daily

[2] The definition of momentary happiness used with Sample 2 is consistent with past research describing happiness as affect balance (e.g., positive affect minus negative affect), as this emotional construct is marked by the experience of more positive affect and less negative affect (see Bradburn 1969; Diener et al. 1985; Diener et al. 1999; Lyubomirsky and Lepper 1999).

[3] Diener et al. (1985) found that timeframe greatly impacts the relation between PA and NA, with the strongest negative correlation occurring when the variables were measured as momentary affect. They found that PA and NA became less associated as timeframe increased.

Table 1 Correlations between daily well-being and daily psychological need satisfaction controlling for trait-level subjective well-being

	Daily psychological need satisfaction		
	Autonomy	Competence	Relatedness
Trait-level SWB			
Life satisfaction	.24**	.22*	.22*
Subjective happiness	.24**	.23**	.27**
Daily SWB—controlling for trait-level SWB			
Satisfaction with the day	.62**	.56**	.38**
Positive affect	.45**	.49**	.37**
Negative affect	−.32**	−.23*	−.18*

* $p < .05$ level; ** $p < .01$

well-being variables (satisfaction with the day and daily positive affect) after controlling for trait-level SWB (see Table 1). These findings corroborate past results (see Reis et al. 2000). Daily negative affect was negatively correlated with all psychological need variables after controlling for trait-level SWB.

4.2 The Relation Between Momentary Need Satisfaction and Momentary Happiness Within the Day

To assess the second study objective, with the nested data from Sample 2, Pearson correlation coefficients were computed between the hourly need satisfaction (autonomy, competence, and relatedness) and well-being (happiness, enjoyment, and stress) within each participant. These within-person correlations were then combined meta-analytically (see Rosenthal 1984) and tested for significance using the Fisher r-to-z transformation. These correlations are displayed in Table 2. The results demonstrate that, on average, increases in hourly autonomy and relatedness were associated with increased enjoyment and decreased stress, while increases in competence were associated with decreased enjoyment and increased stress.

To determine the relative independence of the three psychological needs, average within-person correlations were computed between the momentary ratings of autonomy, competence, and relatedness. First, the average within-person correlation between competence and relatedness ($r = .03$, ns) was small and non-significant. Also, though the average within-person correlation between autonomy and relatedness ($r = .16$, $p < .001$) and autonomy and competence ($r = -.31$, $p < .001$) were significant, these relations do indicate that there is substantial independence between the three psychological needs (as predicted by SDT).

Table 2 Meta-analytically averaged within-person correlations between momentary need satisfaction and momentary affect

Momentary affect	Momentary psychological need satisfaction		
	Autonomy	Competence	Relatedness
Happiness	.49***	−.33***	.23***
Enjoyment	.47***	−.23***	.30***
Stress	−.41***	.38***	−.08***

Note: All significant tests are random effects models (see Rosenthal 1984)

*** $p < .001$

Random coefficient models predicted the unique within-person relations between momentary psychological need variables (autonomy, competence, and relatedness) and momentary affect (happiness, enjoyment, and stress). The basic within-person model was as follows:

$$y_{ij} = \beta_{0j} + \beta_{1j}\text{Autonomy} + \beta_{2j}\text{Competence} + \beta_{3j}\text{Relatedness} + r_{ij}$$

in which y_{ij} is momentary affect (happiness, enjoyment, or stress) for person j at hour i; β_{0j} is a random coefficient representing the intercept for person j; β_{1j}Autonomy, β_{2j}Competance, and β_{3j}Relatedness are random coefficients (slopes) for the direct relations between ratings of autonomy, relatedness, and competence on momentary affect (happiness, enjoyment, or stress), and r_{ij} represents error. The three momentary psychological need variables are group-mean centered. (The group, in this case, is the person). This eliminates the influence of individual differences in hourly ratings on the parameter estimates. Each slope describes how deviations from one's mean psychological need satisfaction rating are related to deviations from one's average momentary affect rating.

To determine whether within-person relations between reports of momentary affect (happiness, enjoyment, or stress) and psychological need satisfaction were significant, the random coefficients for autonomy, relatedness, and competence were analyzed at the person level:

$$\begin{aligned}
&\text{Intercept} && \beta_{0j} = \gamma_{00} + u_{0j}\\
&\text{Autonomy} && \beta_{1j} = \gamma_{10} + u_{1j}\\
&\text{Competence} && \beta_{2j} = \gamma_{20} + u_{2j}\\
&\text{Relatedness} && \beta_{3j} = \gamma_{30} + u_{3j}
\end{aligned}$$

In this model, γ_{00} represents the grand mean intercept for the emotional outcome (happiness, enjoyment, or stress). The random coefficients γ_{10}, γ_{20}, and γ_{30} represent the mean relations between emotional outcomes and psychological needs. The results of these within-person analyses are presented in Table 3. These coefficients can be interpreted as mean within-person unstandardized regression coefficients.

As expected, momentary affect was associated with psychological need satisfaction. The random coefficients γ_{00}, γ_{10}, γ_{20}, and γ_{30} were significantly different from zero in each of the analyses. The intercept (γ_{00}) is the predicted momentary affect rating for an

Table 3 Relations between level-1 predictors (psychological needs) and level-1 outcomes (momentary affect)

Outcome variable (momentary affect)	Intercept (γ_{00})	Autonomy (γ_{10})	Competence (γ_{20})	Relatedness (γ_{30})
Momentary happiness	1.13***	.65***	−.40***	.26***
Enjoyment	2.76***	.40***	−.14***	.23***
Stress	1.63***	−.26***	.26***	−.03*

Note: This significant positive intercept for momentary happiness predicts that individuals rated themselves as having more enjoyment than stress during hours in which they experienced their average level of psychological need satisfaction. The slope coefficients for autonomy, relatedness, and competence can be interpreted as follows: if an individual selected a behavior that increased autonomy and relatedness by 1.0, and simultaneously lowered competence by 1.0, then predicted momentary happiness would be 2.44. However, if the individual engaged in a behavior that decreased autonomy and relatedness by 1.0, and simultaneously increased competence by 1.0, then predicted happiness would be −.18 (or more stress than enjoyment)

* $p < .05$ level; *** $p < .001$

individual experiencing their own personal average rating for all three psychological needs. Within-person average intercepts revealed that when individuals experienced their personal average levels of psychological need satisfaction, they reported more enjoyment, less stress and, thus, more momentary happiness. The mean autonomy (γ_{10}) and relatedness (γ_{30}) slopes positively predicted the momentary happiness and enjoyment outcomes, and negatively predicted the stress outcome. These two results are consistent with past research using daily diaries (Reis et al. 2000; Sheldon et al. 1996). Yet contrary to previous findings, competence (γ_{20}) negatively predicted momentary happiness in this study, a result most likely due to competence-producing behaviors being associated with less enjoyment and more stress.

4.3 Examining Support for the Sensitization or Deprivation Model of Well-Being

To assess the third study objective, cross-level interactions were explored to extend work by Reis et al. (2000) on sensitization and deprivation models of well-being. An examination of the variance components (u_{0j}, u_{1j}, u_{2j}, and u_{3j}) demonstrated that significant within-person covariation for the intercepts and slopes existed ($p < .0001$ for each variance component), which allows for a test of moderation. Due to the similarities (near redundancy) between the outcome results for momentary happiness, enjoyment, and stress, only tests of the trait-level SWB moderator (satisfaction with life) with momentary happiness as the outcome are reported. For these analyses, satisfaction with life (a level-two variable) was standardized and moderation was tested using an intercepts-and-slopes-as-outcomes model (Raudenbush and Bryk 2002). Potential moderation by the Level-2 variable was examined using the following model:

$$\begin{aligned}
&\text{Intercept} && \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{SWL}) + u_{0j}\\
&\text{Autonomy} && \beta_{1j} = \gamma_{10} + \gamma_{11}(\text{SWL}) + u_{1j}\\
&\text{Competence} && \beta_{2j} = \gamma_{20} + \gamma_{21}(\text{SWL}) + u_{2j}\\
&\text{Relatedness} && \beta_{3j} = \gamma_{30} + \gamma_{31}\ (\text{SWL}) + u_{3j}
\end{aligned}$$

The cross-level (moderating) effects of satisfaction with life on the autonomy-happiness, competence-happiness, and relatedness-happiness slopes were tested by examining the significance of the γ_{11}, γ_{21}, and γ_{31} random coefficients, respectively (see Table 4). Robust standard errors were used for the findings produced by these analyses. Satisfaction with life moderated the happiness-autonomy and the happiness-relatedness relations. Compared to

Table 4 The moderating effect of life satisfaction on the happiness-psychological need satisfaction relations

Moderator	Momentary happiness			
	Intercept (γ_{01})	Autonomy (γ_{11})	Competence (γ_{21})	Relatedness (γ_{31})
Satisfaction with life	.03	.06†	−.00	.08*

Note: The significant cross-level interactions for autonomy and relatedness can be interpreted as follows: for every one standard deviation increase in life satisfaction, the autonomy-happiness slope increased .06, and the relatedness-happiness slope increased .08. These findings indicate that for an individual 2 SD above the mean on SWL, their predicted autonomy-happiness slope is .77 and for an individual 2 SD below the mean the predicted slope is .53. For an individual 2 SD above the mean on SWL, the predicted relatedness-happiness slope is .42 and for an individual 2 SD below the mean the predicted slope is .10

* $p < .05$, † $p < .10$

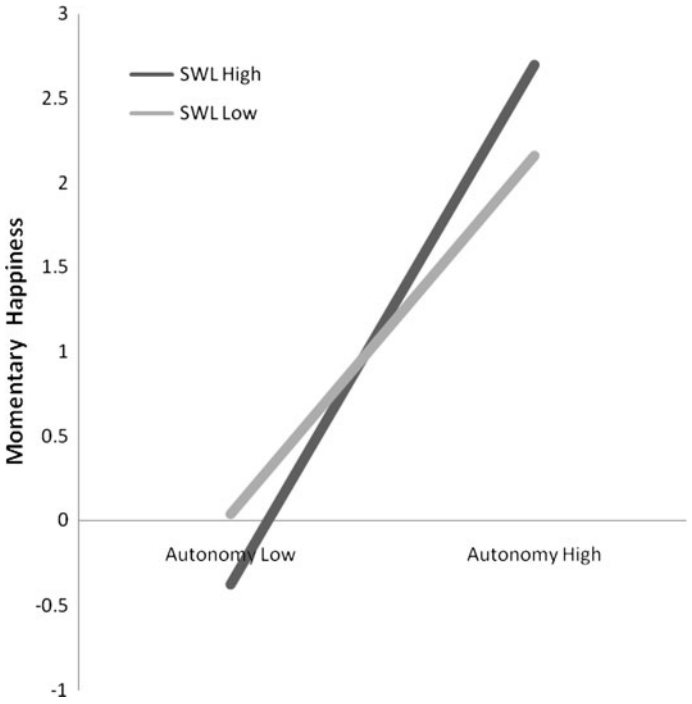

Fig. 1 The cross-level interaction between autonomy (x-axis) and happiness (y-axis) separately for participants with high scores on the SWLS and participants with low scores on the SWLS

participants with low satisfaction with life scores, participants with high satisfaction with life scores had stronger predictive relations between autonomy and momentary happiness (See Fig. 1), as well as between relatedness and momentary happiness (See Fig. 2).

5 Discussion

Results from this study partially support the hypothesized link between SWB and psychological need satisfaction, while also demonstrating that variability in trait-level life satisfaction moderates two of these relations within individuals. Replicating past research (Reis et al. 2000; Sheldon et al. 1996), results demonstrated that daily psychological need satisfaction was positively associated with daily well-being, as well as with trait-level SWB (life satisfaction and subjective happiness). To extend past research, within-person correlations and random coefficient models between hourly ratings of psychological need satisfaction and hourly ratings of affect were examined. However, while hourly behaviors associated with high autonomy and relatedness were associated with increased momentary happiness, hourly behaviors associated with increased competence were associated with *decreased* momentary happiness. Finally, by examining the cross-level (moderating) effects of satisfaction with life on the relation between psychological need satisfaction and momentary happiness it was demonstrated that trait-level life satisfaction influenced both the autonomy-happiness and relatedness-happiness relations. Specifically, people who reported higher levels of life satisfaction experienced greater increases in momentary

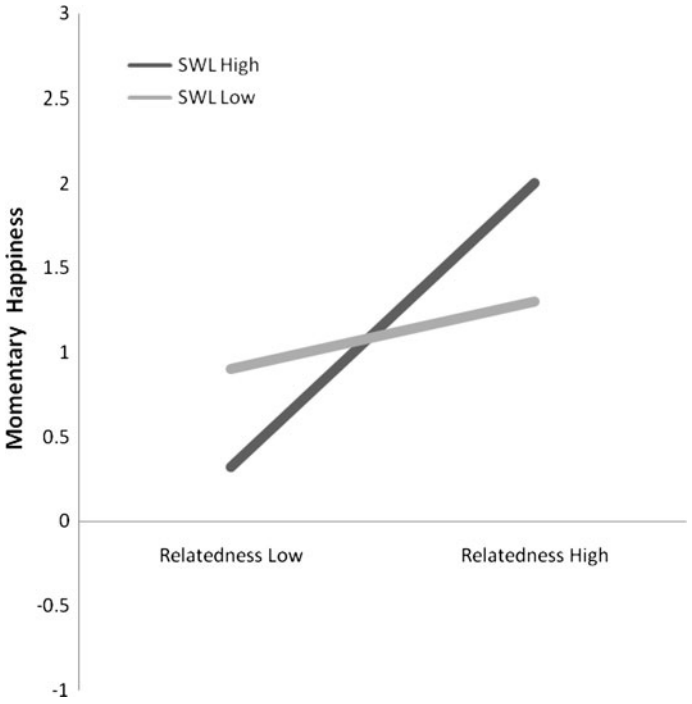

Fig. 2 The cross-level interaction between relatedness (x-axis) and happiness (y-axis) separately for participants with high scores on the SWLS and participants with low scores on the SWLS

happiness as need satisfaction increased for relatedness and autonomy than did people reporting lower levels of life satisfaction. This result supports the sensitization model of well-being within the day, and corroborates Reis et al.

5.1 Implications for Self-Determination Theory

The tenets of SDT are expanded by the results of this study. When the current study is combined with past work (Reis et al. 2000; Sheldon et al. 1996), it is demonstrated that: (a) increased autonomy is associated with increased hedonic well-being and decreased hedonic ill-being, regardless of how these needs are measured (hourly, daily, or trait-level); and (b) relatedness-promoting behaviors are strongly associated with increased enjoyment, but weakly (though significantly) related to decreased stress.[4]

In the current study, the most notable departure from past results concerns the negative relationship between momentary happiness and hourly ratings of competence, which was demonstrated by both the within-person bi-variate correlations as well as in the multilevel regression model, controlling for both autonomy and relatedness. Reis et al. (2000) found

[4] This weak inverse relation with negative affect is consistent with Reis et al. (2000), who found that relatedness was not an important predictor of decreased negative outcomes. Reis et al. suggest that relatedness-promoting behaviors are predictive of positive social activities as well as of increased arguments and conflicts. Thus, it appears that engaging in relatedness-producing (typically social) behaviors increases well-being through positive social interactions, but does not substantially decrease the number of negative emotions associated with negative social interactions.

that daily competence was positively correlated with general well-being, positive affect, and vitality, and negatively correlated with negative affect and physical health symptoms. However, the current study shows that behaviors associated with high levels of momentary competence were associated with *decreased* momentary happiness, *lower* levels of momentary enjoyment, and *higher* levels of momentary stress. Yet, these findings are not as startling as they may appear initially. Howell and Rodzon (2009) found that activities related to employment and academics can consume over 35% of students' daily lives, and "work activities typically provide many opportunities for [the manifestation of competence]" (Reis et al., p. 422). Yet, these competence-producing work activities appear to be, on average, among the least enjoyable and most stressful daily behaviors (Howell and Rodzon 2009). Thus, while competence-producing behaviors may produce greater well-being after reflection (demonstrated with Sample 1), these same behaviors appear to come at a momentary emotional cost (shown by Sample 2).

5.2 Sensitization Model of Well-Being

The cross-level interactions in this study supported the sensitization model of well-being and were consistent with Reis et al. (2000). People who were satisfied with their lives reported significantly more momentary happiness than non-satisfied individuals when they experienced increased autonomy and relatedness; on the other hand, satisfied individuals reported significantly less happiness than non-satisfied individuals when they experienced decreased fulfillment of these needs. Bem and Funder (1978) predict that one will only respond to those features of a situation that are important to one's disposition (e.g., "template matching"). It is possible that because satisfied individuals typically experience higher levels of need satisfaction (Ryan and Deci 2000), they're happiness is more dependent on those needs being met. Thus, a satisfied person may derive substantially more enjoyment from being with others than an unsatisfied person, but when it comes to being alone, that same satisfied person finds the situation much less enjoyable than an unsatisfied person.

Although compentence-producing behaviors were associated with lower levels of momentary happiness, the absence of an interaction with trait-level SWL indicates that satisfied individuals derived no more or less momentary happiness from competence-promoting activities than did unsatisfied individuals. The competence-promoting situations in this study likely involved work and school activities, which can be both stressful and unenjoyable in the moment. If competence-promoting situations are no more important to the disposition of satisfied individuals than to unsatisfied individuals, then we would not expect the momentary happiness of those high on life satisfaction to be more reactive to competence-promoting situations. However, because increased feelings of competence were associated with higher stress and lower enjoyment, the competence-promoting behaviors for participants in this study were not likely "selected" by the participants, but rather a natural result of engaging in necessary school and work-related activities. A study examining non-work and non-school related competency behaviors may show different results than were found here.

5.3 Limitations

As is somewhat typical in social and personality psychology, both sets of analyses relied on student samples and, thus, questions of generalizability should be addressed in future studies. For example, the counterintuitive negative relation found between momentary

happiness and ratings of competence likely emerged due to the types of competency-promoting behaviors reported by the student sample. Intellectually rigorous academic activities and working for pay may certainly be seen to increase mastery in a skill or ability (compared to watching television, for example), but are also likely to be more stressful and less enjoyable. A sample of non-students may produce different results, especially if they tend to engage in competence-promoting behaviors that are more enjoyable and less stressful.

One of the reasons for using the hour-by-hour retrospective diaries was to minimize the bias that comes from reporting affect and need satisfaction for the day as a whole. Current mood biases occur more often when making global judgments of well-being than when assessing specific events or circumstances (Reis and Gable 2000; Stone et al. 1999). Although the hour-by-hour recall allows for reflection on many behaviors and affective experiences throughout the day, these accounts are not pure measures of real-time affect or real-time psychological need satisfaction. While Kahneman et al. (2004) have demonstrated that retrospective diaries produce patterns of affective ratings that are similar to those of personal diary assistant (PDA) studies, a replication study using purer real-time experience-sampling techniques could be conducted to corroborate the current findings.

6 Conclusion

Maximization of well-being requires a balance of psychological need fulfillment (i.e., minimal variability in need satisfaction). The results of this study demonstrate that when individuals reflect on their need satisfaction at the end of the day, autonomy, competence, and relatedness are all associated with increased satisfaction with the day and happiness overall. However, when individuals reflect on their need satisfaction and happiness hour by hour of the day, only autonomy and relatedness are associated increased momentary happiness (increased enjoyment, less stress), while competence is associated with decreased momentary happiness (decreased enjoyment and more stress). Thus, much like the rule of 'no pain, no gain,' satisfying the need for competence may require individuals to delay positive affective experience (and perhaps even experience some negative affect) in order to gain the benefits of goal pursuit and attainment. The momentary stress and lack of enjoyment may explain why individuals do not always pursue those competence-promoting behaviors that will ultimately maximize well-being. Therefore, because optimal well-being cannot be attained if fulfillment of one psychological need is pursued at the expense of another need (Sheldon and Niemiec 2006), optimal well-being likely cannot be attained by only selecting enjoyable and stress-free behaviors.

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