



A multilevel perspective on self-determination theory: Predictors and correlates of autonomous and controlled motivation

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Abstract

Based on self-determination theory (SDT), we examined mediational models connecting autonomy support and self-criticism to negative affect (NA), positive affect (PA), and goal progress (GP) via autonomous and controlled motivation. Separate measures were obtained within eight domains (e.g., academic performance and intimate relationships) for 346 university students. Multilevel structural equation modeling was used to test whether, both between-persons and within-person, autonomy support and self-criticism predicted autonomous and controlled motivation, which in turn predicted NA, PA, and GP. In addition to several between-persons indirect effects, we found numerous significant within-person indirect effects, including: (1) in domains where they experienced greater autonomy support, people experienced greater PA and greater GP, mediated by greater autonomous motivation and (2) in domains where they experienced greater self-criticism, people experienced more NA mediated by greater controlled motivation, and less PA mediated by greater controlled motivation and lesser autonomous motivation. These results support systematically adopting a multilevel perspective in SDT research.

Keywords Autonomy support · Autonomous motivation · Controlled motivation · Self-criticism · Multilevel structural equation modeling

Self-determination theory (SDT) is a leading theory of human motivation that has been extensively applied across many settings (Ryan & Deci, 2017). Autonomous and controlled motivation are two core concepts in SDT. Autonomous motivation is defined as pursuing goals for reasons that are personally meaningful (identified), consistent with one's values and goals (integrated), or because pursuing the goals is enjoyable and satisfying (intrinsic) (Sheldon & Elliot, 1999). Controlled motivation is defined as pursuing one's goals in response to external or internal (introjected) pressures (Ryan & Deci, 2017).

Autonomous motivation benefits individuals in many ways (e.g., Deci & Ryan, 2008; Koestner et al., 2008; Levine et al., 2021a, 2021b; Ryan & Deci, 2017; Sheldon, 2014); conversely, controlled motivation has been linked to multiple negative outcomes. We studied three variables that have been robustly associated with the nature of people's motivation: positive affect (PA), negative affect (NA), and goal progress (GP). PA and NA are core components of subjective well-being (Diener, 1984). Persistence and success in goal attainment have been central concerns of SDT since its inception (Ryan & Deci, 2017) and remain active areas of research (Holding and Koestner, in press). Koestner et al.'s (2002) meta-analysis demonstrated that making progress towards one's goals is associated with both greater PA and lower NA.

There is widespread recognition in personality and social psychology that both individual differences (between-persons effects) and variation across contexts or occasions (within-person effects) are meaningful and warrant examination. Such effects can differ from one another and, moreover, within-person effects frequently correspond more closely to underlying theory and therefore provide stronger tests of

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theory (Preacher, 2011). While SDT researchers have extensively examined the between-persons effects of autonomous motivation, less research has addressed the implications of within-person variability across domains. For example, it is unlikely that one's motivation is the same for academic pursuits as it is for one's appearance or for one's intimate relationships. By averaging across an individual's domains of self, the ability to understand nuances in people's motivated behaviour may be reduced (Holding et al., 2017; Milyavskaya & Werner, 2018).

Autonomy support as a contextual predictor in SDT

Autonomy support is a contextual variable defined as the receipt of encouragement for self-endorsed choices and initiatives, and the acknowledgement of one's perspectives and feelings (Deci & Ryan, 1987; Koestner et al., 2012). Autonomy supportive teachers, parents, managers, peers, partners, and psychotherapists have been shown to enhance autonomous motivation in others (e.g., Levine et al., 2020; Ryan & Deci, 2017; Soenens & Vansteenkiste, 2005; Su & Reeves, 2011; Vasquez et al., 2016; Zuroff & Koestner, in press). For example, in a meta-analysis of 36 studies, parental autonomy support was related to greater autonomous motivation, academic achievement, and psychological health in children (Vasquez et al., 2016). Additionally, meta-analyses focusing on teacher-student and manager-employee autonomy support have confirmed a strong relation between autonomy support and autonomous motivation in over 80 studies (Slemp et al., 2018; Su & Reeves, 2011).

Most of this research has relied on between-persons designs examining one specific area of an individual's life or averaging across areas, and in so doing neglects possible within-person variability across life domains. Multiple studies have found that about 80% of the variance in motivation occurs across an individual's goals (Holding et al., 2017; Levine et al., 2017; Milyavskaya et al., 2014, 2015; Werner et al., 2016). For example, an individual may feel pressure rather than autonomy support from parents to achieve good grades but may receive considerable autonomy support from friends to pursue their music career. Although there have been some studies examining within-person variability in SDT processes (e.g., Laguardia et al., 2000; Werner et al., 2016), there is a pressing need for increased attention to the causes and consequences of within-person variability in motivational variables.

The first aim of the current research was therefore to examine core SDT findings concerning autonomy support and motivation using an analytical approach that permitted simultaneous testing of between- and within-person effects. We expected that across eight self-domains, higher average

and domain-specific levels of autonomy support would be associated with higher average and domain-specific levels of autonomous motivation and consequently, higher average and domain-specific levels of desirable outcomes.

Self-criticism as a personality predictor in SDT

SDT recognizes that motivational processes can be influenced by stable individual differences variables as well as by social contextual variables. Thus, the second aim of the current research was to examine the effects of self-criticism, a personality variable that has frequently been linked to motivational outcomes. Self-criticism has been described by several groups of researchers; in the present article, our frame of reference is Blatt's (2004, 2008) Two Polarities Theory, which integrates object relations theory and cognitive developmental theory. Blatt and Zuroff (1992) viewed self-criticism as a trait defined by constant and harsh self-scrutiny and evaluation, as well as a chronic fear of being disapproved and. Self-criticism has been found to contribute to high NA, low PA, disturbed interpersonal relationships, and depression (Blatt, 2004; Blatt & Zuroff, 1992; Shahar, 2015; Zuroff et al., 2004).

Shahar et al. (2003) were the first to suggest that Blatt's Two Polarities Theory could fruitfully be integrated with SDT. In addition to proposing multiple personality variables related to psychopathology, Blatt developed a theory of the personality structures underlying and giving rise to such individual differences (Blatt et al., 1997). In particular, self-criticism was postulated to be a consequence of introjected mental representations of critical and controlling others, especially caregivers. These introjects generate inner dialog in which the self-critic is directed how to think, feel, and act, and is shamed and criticized for failing to meet the introjects' standards and expectations. Moreover, the introjected "oughts," "shoulds," and "musts" undermine the development of an authentic self (Shahar, 2015) and self-concordant feelings, values, and goals. Consequently, the self-critics' reasons for acting frequently reflect others' demands or wishes (controlled motivation) and seldom reflect their own authentic desires or preferences (autonomous motivation).

The relations between self-criticism—or the closely related variable of self-critical perfectionism—and autonomous and controlled motivation have been examined in several cross-domain studies (e.g., Moore et al., 2021; Shahar et al., 2003) as well as several single-domain studies (e.g., Madigan et al., 2016; Vansteenkiste et al., 2010). These studies differ considerably in design, the samples studied, and the measures employed. A frequent finding is that self-criticism is associated with higher controlled motivation, which in turn predicts negative outcomes such as poor GP (Powers et al., 2012) and burnout (Jowett et al., 2013). Consistent with Shahar's (2015) theoretical account of self-criticism,

there have also been several studies that found that the negative effects of self-criticism were mediated by lower autonomous motivation (e.g., Harvey et al., 2015; Shahar et al., 2003, 2006a, 2006b).

Recent research has found that, in addition to trait-like differences in self-criticism, self-criticism varies across domains (Levine & Milyavskaya, 2018; Zuroff et al., 2021a, 2021b). Moreover, domain-level variability in self-criticism predicted domain-level variability in other variables such as NA, PA, and stress. The between-persons influence of self-criticism on SDT variables has been well-documented, but it is likely that there are within-person relations as well. For example, if someone is highly self-critical in the academic domain, they may feel more internal pressure to succeed, resulting in increased controlled motivation, decreased autonomous motivation, and decreased well-being in the academic domain. We planned to extend the integration of Blatt's theory with SDT by examining the influence of self-criticism on motivation, GP, and affect, both between-persons and within-person.

Present study

Building on the methodology of Zuroff and colleagues (), we asked participants to rate their autonomy support, self-criticism, autonomous motivation, controlled motivation, NA, PA, and GP in each of eight domains of the self (e.g., academic performance, relationships with friends, managing one's finances, and romantic relationships). These data have a multilevel structure, with domains nested within persons.

We examined two mediational models, one focused on the contextual predictor of autonomy support and the other on the personality predictor of self-criticism. The first model tested whether autonomous and controlled motivation mediated the relations between autonomy support and NA, PA, and GP. The second model tested whether autonomous and controlled motivation mediated the relations between self-criticism and NA, PA, and GP. The hypothesized relations were examined both between-persons and within-person using multilevel structural equation modeling (MSEM).

MSEM is an integration of multilevel modeling (MLM) and structural equation modeling (SEM) which combines the key strengths of the two techniques in a single analytic framework (Preacher et al., 2010; Sadikaj et al., 2021). Like MLM, it permits the testing of hypotheses both between-persons and within-person. Like SEM, it permits the simultaneous examination of a set of regression pathways linking multiple latent variables. Latent variable modeling yields more accurate estimates of path coefficients by correcting for error in the measured variables. MSEM is especially well-suited for examining mediational processes theorized to operate between and within-person.

The output of MSEM includes tests of the paths (regression coefficients) from the distal predictor (autonomy support or self-criticism) to the mediators (autonomous and controlled motivation), as well as from the mediators to the outcomes (NA, PA, and GP). Moreover, the significance of the two-step mediational paths from predictors to mediators to outcomes, referred to as *indirect effects*, can be tested.

In the first MSEM, we hypothesized that, at both levels, autonomy support would be related to greater autonomous motivation and less controlled motivation, autonomous motivation would be related to lower NA, and higher PA, and more GP, and controlled motivation would be related to higher NA, and lower PA, and less GP.

In the second MSEM, we hypothesized that, at both levels, self-criticism would be related to higher controlled motivation and lower autonomous motivation, autonomous motivation would be related to lower NA, higher PA, and more GP, and controlled motivation would be related to higher NA, lower PA, and less GP.

Method

Participants

Sociodemographic characteristics of the sample can be found in Table 1; the sample consisted of university students ($M_{\text{age}} = 20.05$ years, $SD = 1.27$) who were primarily female (86%), but varied in ethnicity, relationship status, and university major.

Participants were recruited through a research pool in the psychology department of a mid-size Canadian university for an online study of, "how you respond in various life domains." Participants were required to be aged 18 to 25. The intended sample size was 350, which was constrained by the number of participants in the research pool, but was greater than those in our prior studies of domain specificity (Zuroff et al., 2021a, 2021b) and so was expected to provide improved power. The study was started by 381 students and completed by 367; the final sample size was 346, as 21 participants were excluded based on failed attention checks (i.e., "What year is it?", "Please select 7"). The study was approved by the university ethics board. Data is available upon request.

Procedure

Participants accessed the study and provided informed consent through an online research platform, after which they were directed to the Qualtrics website to complete the survey. After a brief demographics measure, participants responded to questionnaires which assessed variables across eight domains of the self, which are described below.

Table 1 Sociodemographic characteristics of participants

Characteristic	N = 346	
	N	%
Gender		
Female	299	86
Male	43	12
Other	2	1
Decline to answer	2	1
Ethnic background		
White	175	51
Chinese	64	18
South Asian	16	5
Black	6	2
Southeast Asian	6	2
Latin American	9	3
Arab	12	3
West Asian	3	1
Korean	6	2
Pacific Islander	1	—
Mixed	36	10
Other	11	3
Relationship status		
Single	180	52
Casual dating	32	9
In relationship, not cohabiting	99	29
Cohabiting/married	23	7
Separated/divorced	11	3
Year of University ^a		
U0	15	4
U1	147	43
U2	103	30
U3	69	20
U4 and up	11	3
Major		
Psychology	166	48
Other	179	52
Cognitive Science	37	11
Neuroscience	24	7
Occupational Therapy	12	3
Pharmacology & Therapeutics	11	3
Double Major ^b	10	3

Characteristics which were not endorsed by any participants (i.e., For ethnicity: Japanese) have been omitted from the table

^aDepending on where they completed their previous schooling, participants' first year of university is designated either U0 (out-of-province or international students) or U1 (Quebec students or students who previously completed IB or equivalent programs)

^bEight of the ten participants who declared a double major had Psychology as one of their majors

Following completion of the study, participants received one extra course credit as compensation.

Measures

Domains

We used the same eight self-domains previously employed by Zuroff et al., (2021a, 2021b). The domains were presented in a fixed order: Academic or Job Performance, Friendships, Physical Appearance, Family Relationships, Managing My Finances, Relationships at School or Workplace, Maintaining a Healthy Lifestyle, and Romantic (Intimate or Marital) Relationships.

Reliability

The reliability of the measures was assessed using McDonald's Omega statistic (1999), a factor-based estimate that overcomes limitations associated with Cronbach's alpha (Hayes & Coutts, 2020). Two-level confirmatory factor analyses were conducted for each variable with three or more items using MPlus Version 8.6 (Muthén & Muthén, 2017). Omega estimates for the between-persons and within-person levels were calculated from the standardized factor loadings and can be found in Table 2. Reliability was excellent for each of the variables of interest: $\omega_{\text{between}} \geq 0.98$; $\omega_{\text{within}} \geq 0.90$.

Domain-specific self-criticism

Self-criticism was measured in each domain using the six highest-loading items from the Inadequate Self subscale of Gilbert et al.s (2004) *Forms of Self-Criticizing/Attacking and Self-Reassuring Scale*. Participants rated, "how I typically act towards myself in difficult times involving my [domain]" on a 5-point Likert scale from 0—*Not at all like me* to 4—*Very like me*. Items included: "There is a part of me that feels I am not good enough" and "I remember and dwell on my failings."

Domain-specific autonomy support

Autonomy support was measured in each domain using four items written to reflect important aspects of the construct, such as the receipt of encouragement of self-endorsed choices and initiatives, and the acknowledgement of one's perspectives and feelings by valued others (Deci & Ryan, 1987; Koestner et al., 2002). Participants rated each item on a 7-point Likert scale from 1—*Strongly disagree* to 7—*Strongly agree*. The items included: "I feel that the people who are important to me accept my choices in this domain," and "I feel that the people who are important to me understand my feelings in this domain."

Table 2 Means, standard deviations, ICCs, reliability, and correlations

Measure	<i>M</i>	<i>SD_b</i>	<i>SD_w</i>	<i>ICC</i>	ω_b	ω_w	1	2	3	4	5	6	7
1. Self-criticism	2.29	0.68	0.75	0.45	0.99	0.91	—	-.30***	-.32***	.68***	.74***	-.26***	-.26***
2. Aut. Supp.	5.24	0.72	1.02	0.33	0.99	0.91	-.09**	—	.58***	-.37***	-.45***	.54***	.58***
3. Aut. Mot.	5.54	0.60	1.00	0.27	—	—	-.20***	.43***	—	-.41***	-.45***	.54***	.45***
4. Con. Mot.	2.64	0.94	1.33	0.33	—	—	.48***	-.31***	-.59***	—	.64***	-.34***	-.36***
5. NA	3.17	0.85	1.13	0.36	0.98	0.90	.50***	-.27***	-.38***	.66***	—	-.37***	-.35***
6. PA	4.73	0.68	1.29	0.22	1.00*	0.97	-.23***	.45***	.54***	-.50***	-.54***	—	.60***
7. Goal progress	4.89	0.70	1.24	0.24	—	—	-.02	.47***	.44***	-.18***	-.11***	.39***	—

Correlations are for the latent variables in a measurement model containing all 7 variables. Within-person correlations are presented below the diagonal and betweenpersons correlations are presented above the diagonal. As autonomy, control, and goal progress were each measured with 2 items, omega estimates were not calculated for these variables; the correlations between the item indicators for each variable were, respectively: $r_{\text{within}} = 0.51$, $r_{\text{between}} = 0.78$; $r_{\text{within}} = 0.42$, $r_{\text{between}} = 0.74$; $r_{\text{within}} = 0.71$, $r_{\text{between}} = 0.83$, all $p < .001$

Aut. Mot. autonomous motivation, *Con. Mot.* controlled motivation, *Aut. Supp.* autonomy support, *NA* negative affect, *PA* positive affect

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

*Value was rounded from 0.998

Domain-specific motivation

Motivation was measured in each domain using items that were developed to capture autonomous (i.e., identified or intrinsic) or controlled (i.e., extrinsic or introjected) motivation (Koestner et al., 2008; Ryan & Deci, 2000; Sheldon & Elliot, 1999). There were two autonomous motivation items (“My behavior usually reflects my own values” and “My behaviour usually reflects what interests me”) and two controlled motivation items (“My behavior usually reflects internal pressures like guilt or shame” and “My behaviour usually reflects external pressures like others’ demands or expectations”). Participants rated these items on a 7-point Likert scale from 1—*Strongly disagree* to 7—*Strongly agree*.

Domain-specific affect

Affect was measured in each domain using items developed through factor analytic work by Diener and Emmons (1985). Negative or unpleasant affect was measured using five items: unhappy, worried/anxious, frustrated, depressed, and angry/hostile. Positive or pleasant affect was measured using four items: happy, joyful, pleased, and enjoyment/fun. Participants rated the extent to which they tended to experience each affect on a scale from 1—*Not at all* to 7—*Extremely*.

Domain-specific goal progress

Goal progress was measured in each domain using two items similar to those used in previous research (e.g., Koestner et al., 2015). Using a 7-point Likert scale ranging from 1—*Not at all* to 7—*A great deal*, participants responded to: “When you set a goal in the domain of [domain], in general how much progress do you tend to make towards that goal?”

and “When you set a goal in the domain of [domain] and encounter setbacks or difficulties in achieving it, in general how much do you persist in trying to reach that goal?”.

Data analytic strategy

Variability over domains

We refer to the variability over domains that is displayed by a sample as a whole as the normative domain effect (Zuroff et al., 2021a). To characterize the normative domain effects in the study variables, we fit multilevel models using PROC MIXED with restricted maximum likelihood estimation and Kenward-Rogers degrees of freedom in SAS 9.4 (SAS Institute, 2013). These models were conceptually similar to repeated measures analyses of variance with domain as a within-person predictor. The dependent variables were the domain-level scores for each measure included in the study, obtained by taking the mean over the constituent items. Each model included domain as a fixed level-one predictor and a random intercept. We expected that domain would be a significant predictor of each measure, thereby demonstrating within-person variability over domains.

Parallel mediation models

To determine whether autonomy support and self-criticism predicted affect and GP via motivational processes, we fit two MSEMs, one with autonomy support and one with self-criticism as the distal predictor, using robust maximum likelihood estimation in MPlus Version 8.6 (Muthén & Muthén, 2017). Latent decomposition was used to estimate variance at both levels.

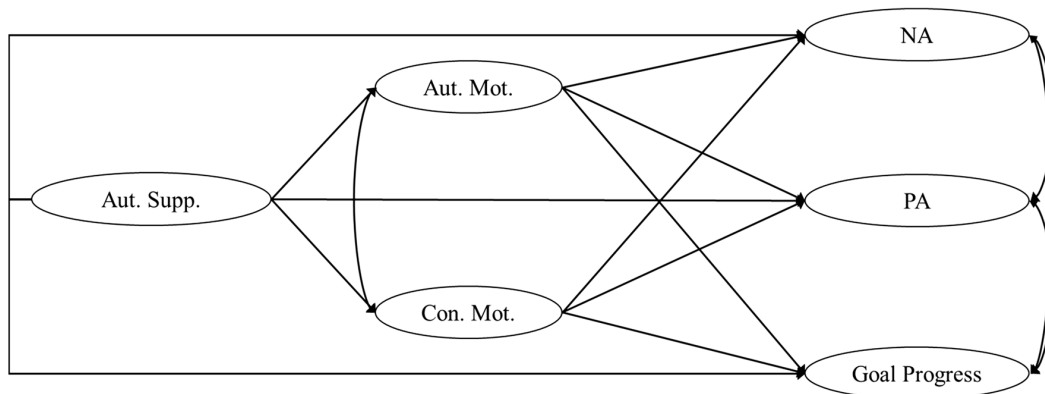
An initial measurement model consisted of seven latent variables: self-criticism (three indicators); autonomy support (four indicators); autonomous motivation (two indicators); controlled motivation (two indicators); NA (five indicators); PA (four indicators); and GP (two indicators). Indicators were the questionnaire items for each measure, except for self-criticism, for which the indicators were three parcels of two items each. Because an initial CFA found the six self-criticism items to be unidimensional at both levels, items were combined arbitrarily to create the parcels (Little et al., 2013). The same allocation of items to parcels was successfully employed in a previous study (Zuroff et al., 2021a). In order to achieve identifiability, the variance of each latent variable was set to 1. The residual error variance was set to zero at the between-persons level for two indicators, one each for PA and GP, as these were initially close to 0.0 but negative.

The structural model for autonomy support (See top panel of Fig. 1) included paths at both levels from autonomy

support to autonomous motivation and controlled motivation, and from each type of motivation to NA, PA, and GP. Covariances were included between autonomous and controlled motivation, and among NA, PA, and GP. Direct paths from autonomy support to each outcome were also included. The structural model for self-criticism (See bottom panel of Fig. 1) was the same except for the substitution of self-criticism for autonomy support. Model fit for each MSEM was evaluated according to Hu and Bentler's (1999) acceptable fit criteria of over .95 for CFI, less than .06 for RMSEA, and less than .08 for SRMR.

The product of a path from a predictor to a mediator and a subsequent path from a mediator to a dependent variable is referred to as an indirect effect and indexes the extent to which there is statistical mediation. Asymmetric confidence intervals for the unstandardized indirect effects were generated using the distribution of the product method in the PRODCLIN program for R (MacKinnon et al., 2007). Indirect effects were considered significant

Model 1: Autonomy Support as Predictor



Model 2: Self-Criticism as Predictor

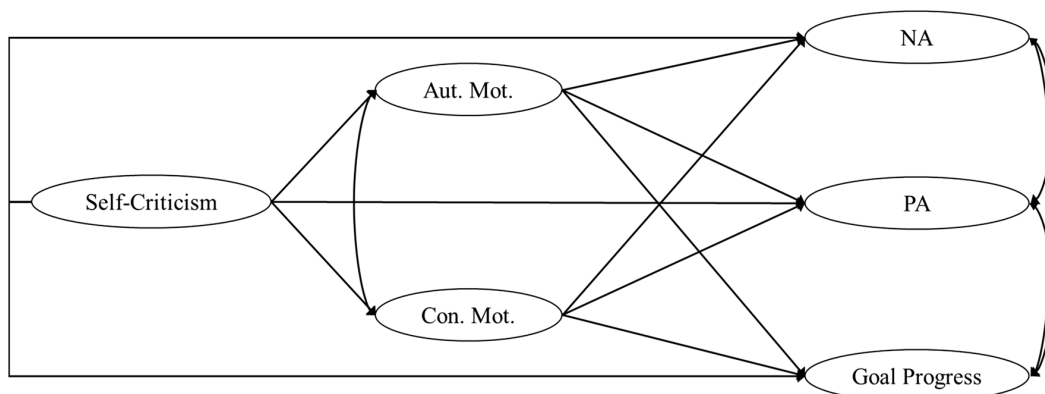


Fig. 1 Structural models. *Note.* Aut. Supp.=autonomy support, Aut. Mot.=autonomous motivation, Con. Mot.=controlled motivation, NA=negative affect, PA=positive affect. Models were tested at both the between-persons and within-person levels

when the confidence intervals did not contain zero. In addition to the standardized indirect effect estimates, the ratio of the indirect to total effect, or the proportion mediated P_M , was included as a measure of effect size (Alwin & Hauser, 1975).

The parallel mediation models were complex, with 11 paths and six indirect effects at each level, for a total of 34 estimated regression coefficients in each of our two MSEM models. Cribbie (2007) showed that Benjamini and Hochberg (1995)'s *false discovery rate* (FDR) procedure provided effective multiplicity control in SEMs by limiting inflated error rates while maintaining statistical power. We applied the Benjamini and Hochberg (1995) FDR correction and found that one path and one indirect effect that achieved conventional significance were declared non-significant by FDR. These instances are noted in the text.

Results

Descriptive statistics

Descriptive statistics for the observed variables (means over questionnaire items) at both levels can be found in Table 2. Out of a possible total of 2768 (346×8) observations, the maximum number of missing observations for any variable was nineteen. The ICCs are the ratio of between-person variance to the total variance. The moderate values suggest the presence of considerable within-person variance, i.e., variability across domains, in addition to considerable between-persons variance. The ICC was highest for self-criticism, which is consistent with its conceptualization as a relatively trait-like construct (Zuroff et al., 2016).

The between-persons correlations (upper panel of Table 2) were significant, in the expected directions, and generally moderate in size. Self-criticism and autonomy support were negatively related. Autonomy support was positively related to autonomous motivation and negatively related to controlled motivation; the reverse was true for self-criticism. Autonomous motivation was negatively related to NA and positively related to PA and GP; the reverse was true for controlled motivation.

The within-person correlations (lower panel of Table 2) were generally smaller in magnitude than the between-persons correlations, but followed the same pattern and were consistent with expectations. One exception was that self-criticism was not significantly correlated with GP at the within-person level.

Normative domain effects

The domain effect was significant for each of the seven multilevel models: self-criticism, $F(7, 2401) = 32.33, p < .001$;

autonomy support, $F(7, 2409) = 38.54, p < .001$; autonomous motivation, $F(7, 2406) = 18.10, p < .001$; controlled motivation, $F(7, 2405) = 50.01, p < .001$; NA, $F(7, 2401) = 107.49, p < .001$; PA, $F(7, 2401) = 156.23, p < .001$; and GP, $F(7, 2407) = 50.88, p < .001$. Thus, average scores for the sample as a whole varied across domains; see Fig. 2A–C for graphical depictions of the normative domain effects.

Parallel mediation models

The findings for the MSEM with autonomy support as the distal predictor are presented first, followed by the findings with self-criticism as the distal predictor. Within each section, we summarize the results for the between-persons part of the model and then the within-person part of the model. Standardized regression coefficients for each model are presented in Figs. 3 and 4, and indirect effect estimates are presented in Table 3.

Autonomy support as the distal predictor

The MSEM for autonomy support had adequate fit, $\chi^2(276) = 1407.81, p < .001$; CFI = .949, TLI = .936; RMSEA = .039; and SRMR (within/between) = .040/.055. The standardized factor loadings for all variables at both levels were significant, $p < .001$, and acceptably high, $> .50$ in all cases within-person and $> .70$ in all cases between-persons.

Between-persons effects The relations between autonomy support and the mediators in the between-persons portion of the model were as expected (See top panel of Fig. 3 and Table 3); autonomy support positively predicted autonomous motivation, $R^2 = 0.336, p < .001$, and negatively predicted controlled motivation, $R^2 = 0.133, p = .017$. The relations between the mediators and outcomes were in all cases in the expected direction, but only two reached statistical significance. Autonomous motivation positively predicted PA but was not significantly associated with NA or GP, while controlled motivation positively predicted NA but was not significantly associated with PA or GP. We have no specific interpretation of the non-significant between-persons effects beyond sampling vagaries.

Two of the six indirect effects were significant. Autonomy support was associated with lower NA via lower controlled motivation, and with higher PA via higher autonomous motivation. The indirect effects and direct effects together accounted for ~38% of the variance in PA, $R^2 = 0.377, p < .001$, ~46% of the variance in NA, $R^2 = 0.459, p < .001$, and ~38% of the variance in GP, $R^2 = 0.377, p < .001$.

Within-person effects The relations between autonomy support and the mediators in the within-person portion of

the MSEM were as expected (See bottom panel of Fig. 3 and Table 3); autonomy support positively predicted autonomous motivation, $R^2 = 0.181$, $p < .001$, and negatively predicted controlled motivation, $R^2 = 0.094$, $p < .001$. The relations between the mediators and outcomes were mostly consistent with expectations. Autonomous motivation was significantly associated with higher PA and higher GP, but not with NA. Controlled motivation was significantly associated with higher NA and lower PA. There was also an unexpected positive relation between controlled motivation and GP, which we interpret as a suppression effect resulting from the substantial negative correlation between autonomous and controlled motivation at the within-person level.

Five of the six indirect effects were significant. Autonomy support was associated with higher PA via both higher autonomous motivation and lower controlled motivation. Autonomy support was also associated with lower NA via lower controlled motivation. Lastly, autonomy support was associated with higher GP via both higher autonomous motivation and (unexpectedly) higher controlled motivation. The indirect effects and direct effects together accounted for $\sim 39\%$ of the variance in PA, $R^2 = 0.388$, $p < .001$, $\sim 44\%$ of the variance in NA, $R^2 = 0.438$, $p < .001$, and $\sim 30\%$ of the variance in GP, $R^2 = 0.303$, $p < .001$.

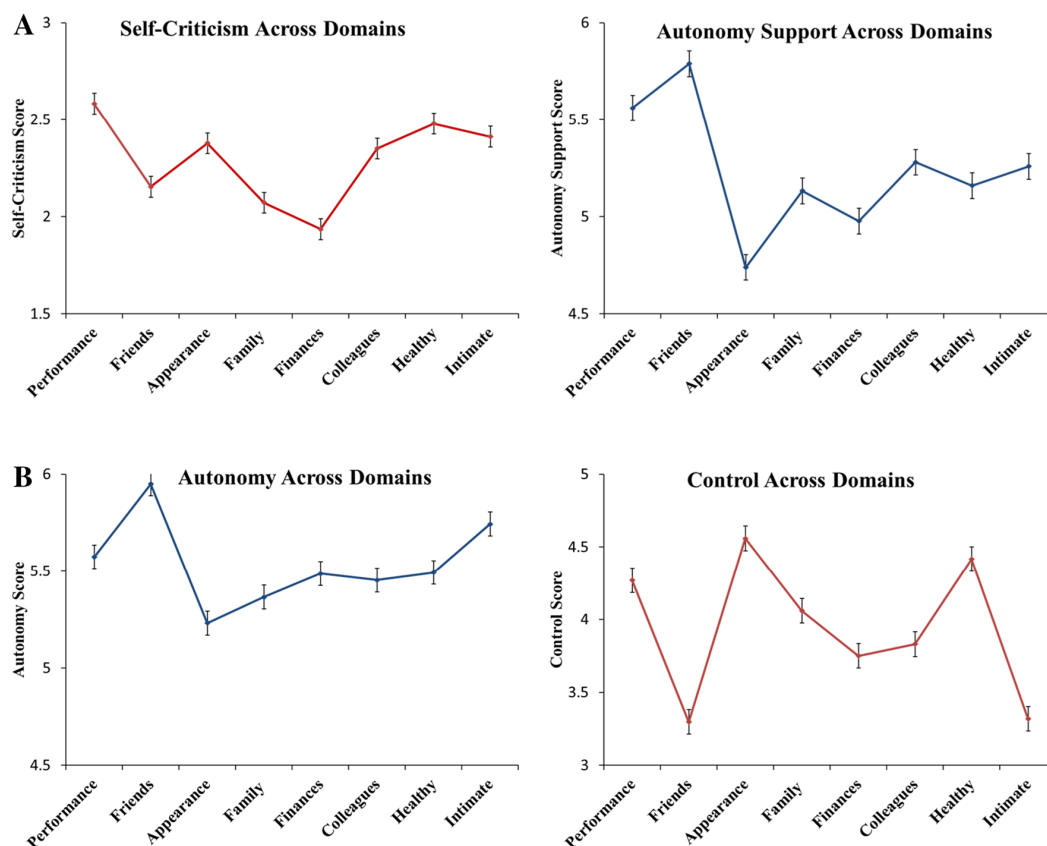


Fig. 2 **A** Normative domain effects for study variables: predictors. *Note.* Points represent the normative scores for each of the eight domains, which are presented in the following order: Academic or Job Performance, Friendships, Physical Appearance, Family Relationships, Managing My Finances, Relationships at School or Workplace, Maintaining a Healthy Lifestyle, and Romantic (Intimate or Marital) Relationships. Error bars are standard errors. **B** Normative domain effects for study variables: mediators. *Note.* Points represent the normative scores for each of the eight domains, which are presented in the following order: Academic or Job Performance, Friendships, Physical Appearance, Family Relationships, Managing

My Finances, Relationships at School or Workplace, Maintaining a Healthy Lifestyle, and Romantic (Intimate or Marital) Relationships. Error bars are standard errors. **C** Normative domain effects for study variables: dependent variables. *Note.* Points represent the normative scores for each of the eight domains, which are presented in the following order: Academic or Job Performance, Friendships, Physical Appearance, Family Relationships, Managing My Finances, Relationships at School or Workplace, Maintaining a Healthy Lifestyle, and Romantic (Intimate or Marital) Relationships. Error bars are standard errors

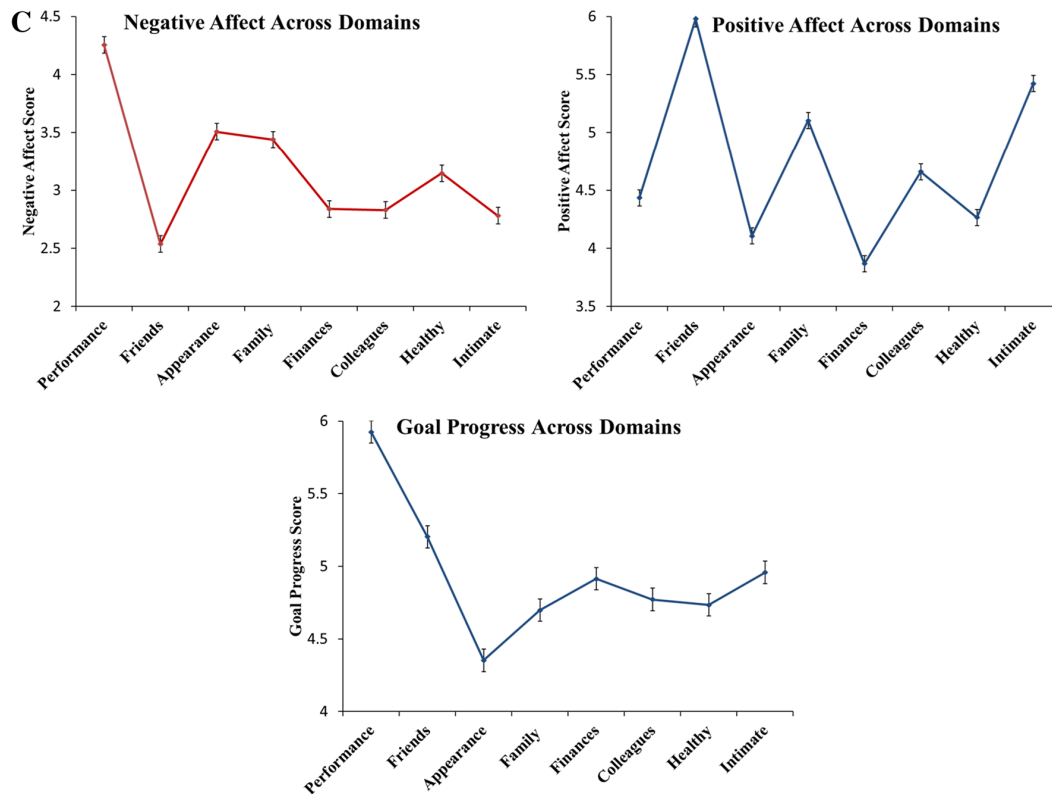


Fig. 2 (continued)

Self-criticism as the distal predictor

The MSEM for the self-criticism model had adequate fit, $\chi^2(242) = 1300.85$, $p < .001$; CFI = .951, TLI = .938; RMSEA = .040; and SRMR (within/between) = .042/.053. The standardized factor loadings for all variables at both levels were significant, $p < .001$, and acceptably high, $> .50$ in all cases within-person and $> .70$ in all cases between-persons.

Between-persons effects

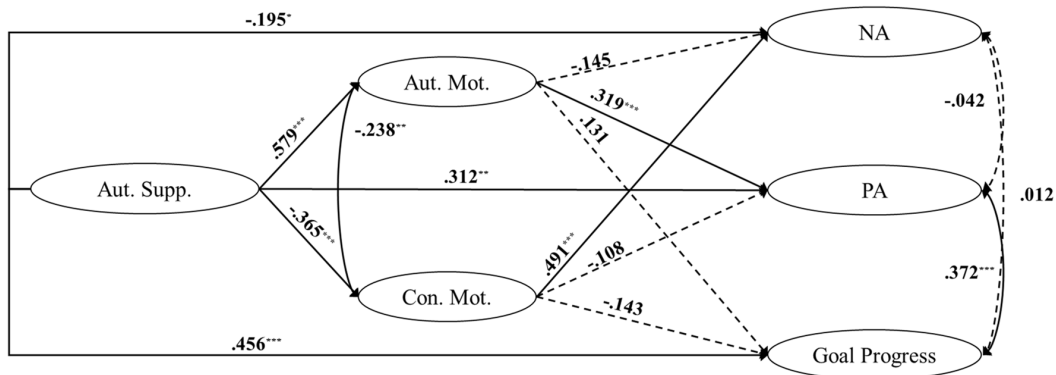
The relations between the predictors and mediators in the between-persons portion of the model were as expected (See top panel of Fig. 4 and Table 3); self-criticism positively predicted controlled motivation, $R^2 = 0.468$, $p < .001$, and negatively predicted autonomous motivation, $R^2 = 0.109$, $p = .032$. The relations between the mediators and outcomes were largely as expected. Autonomous motivation positively predicted PA, GP, and negatively predicted NA. Controlled motivation positively predicted NA but was not associated with PA or GP.

Four of the six indirect effects were significant. Self-criticism was associated with higher NA via lower autonomous motivation and higher controlled motivation, with lower PA via lower autonomous motivation, and with lower GP via lower autonomous motivation. The indirect effects and direct effects together accounted for ~32% of the variance in PA, $R^2 = 0.321$, $p < .001$, ~62% of the variance in NA, $R^2 = 0.615$, $p < .001$, and ~25% of the variance in GP, $R^2 = 0.252$, $p < .001$.

Within-person effects

The relations between the predictors and mediators in the within-person portion of the model were again as expected (See bottom panel of Fig. 4 and Table 3). Self-criticism positively predicted controlled motivation, $R^2 = 0.231$, $p < .001$, and negatively predicted autonomous motivation, $R^2 = 0.039$, $p = .005$. The relations between the mediators and outcomes were largely as expected. Autonomous motivation positively predicted PA and GP but was not associated with NA, while controlled motivation positively predicted NA and negatively predicted PA. The unexpected positive relation between

BETWEEN



WITHIN

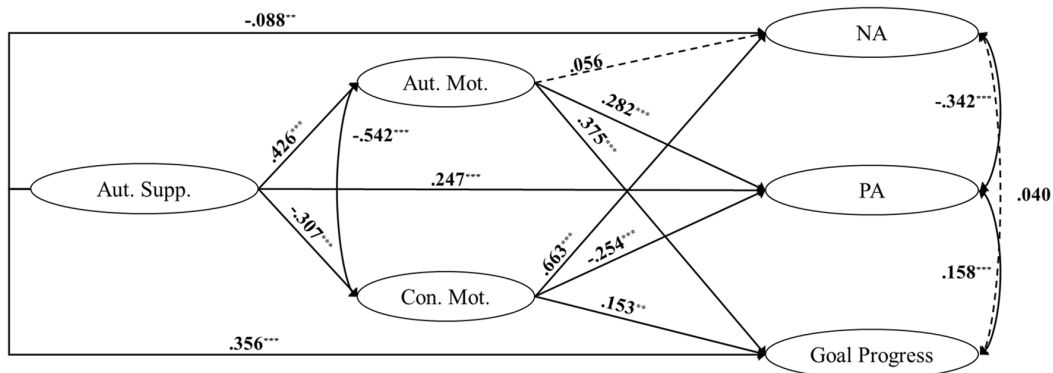


Fig. 3 Results for MSEM with autonomy support as predictor. *Note.* Values are standardized regression coefficients. Dashed lines indicate non-significant effects. Indirect effects are presented in Table 3.

Aut. Mot.=autonomous motivation, Con. Mot.=controlled motivation, NA=negative affect; PA=positive affect. * $p < .05$. ** $p < .01$. *** $p < .001$

controlled motivation and GP was significant at the 0.05 level, but it was deemed non-significant using the FDR procedure and therefore will not be interpreted.

Four of the six indirect effects were significant. A fifth from self-criticism to GP was eliminated by the FDR procedure. Self-criticism was associated with higher NA via higher controlled motivation, with lower PA via both lower autonomous motivation and higher controlled motivation, and with lower GP via lower autonomous motivation. The indirect effects and direct effects together accounted for ~34% of the variance in PA, $R^2 = 0.339$, $p < .001$, ~47% of the variance in NA, $R^2 = 0.473$, $p < .001$, and ~20% of the variance in GP, $R^2 = 0.202$, $p < .001$.

Combined model with both autonomy support and self-criticism as distal predictors

Autonomy support and self-criticism were significantly negatively correlated between-person ($r = -0.30$) and weakly but significantly negatively correlated within-person ($r = -0.09$). These relations are not surprising, as self-criticism is associated with impaired relationships and social support deficits (Moore et al., 2018; Zuroff et al., 2004). Nonetheless, because the two distal predictors were not fully independent, we conducted a highly conservative alternative MSEM including both self-criticism and autonomy support as distal predictors. The resulting model had adequate fit, $\chi^2(378) = 1739.49$, $p < .001$; CFI = .949, TLI = .938; RMSEA = .036; and SRMR (within/between) = .040/.054. The within-person effects remained

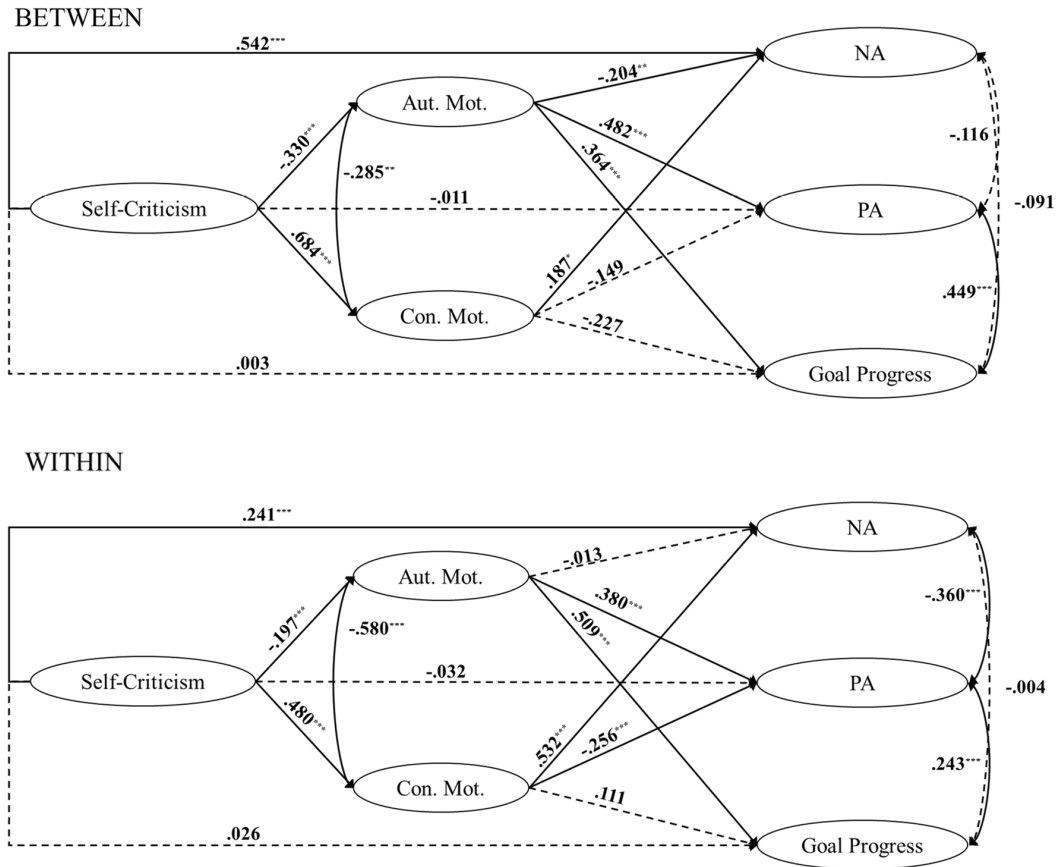


Fig. 4 Results for MSEM with self-criticism as predictor. *Note.* Values are standardized regression coefficients. Dashed lines indicate non-significant effects. Indirect effects are presented in Table 3. Aut. Mot.=autonomous motivation, Con. Mot.=controlled motivation,

NA=negative affect; PA=positive affect. The within-person path from Con. Mot. to Goal Progress was initially significant at the 0.05 level, but was no longer significant after applying the Benjamini and Hochberg (1995) correction. $*p < .05$. $**p < .01$. $***p < .001$

largely unchanged, with all nine of the previously reported indirect effects remaining significant. However, at the between-persons level, the predictors competed to explain variance in the mediators, resulting in only one of the six previously reported indirect effects remaining significant: autonomy support predicted higher PA, mediated by greater autonomous motivation. The indirect effect for self-criticism to predict lower PA, mediated by lesser autonomous motivation, failed to reach significance when the FDR correction was applied. A summary of the combined model, including standardized path estimates, indirect effects, and confidence intervals, can be found in the Online Supplementary Materials in Appendix A on the Open Science Framework (OSF).

Discussion

The guiding assumption and primary motivation for this research was to demonstrate that SDT would be greatly enriched by a concerted focus on modeling within-person relations in addition to the more familiar probing of between-persons relations. As an initial test of this assumption, we examined the generalizability from the between-persons level to the within-person level of two well-established sets of findings concerning the predictors and correlates of autonomous and controlled motivation. One set of analyses focused on the contextual predictor of

Table 3 Standardized and unstandardized indirect effect estimates, confidence intervals, and P_M

Indirect effect	β	b	SE	95% CI	P_M
Autonomy support as predictor					
Between-persons					
Aut. Supp. \rightarrow Aut. Mot. \rightarrow NA	-.08	-.12	.08	[-.275, .030]	0.39
Aut. Supp. \rightarrow Con. Mot. \rightarrow NA	-.18	-.24	.07	[-.399, -.115]	
Aut. Supp. \rightarrow Aut. Mot. \rightarrow PA	.19	.23	.08	[.084, .413]	0.34
Aut. Supp. \rightarrow Con. Mot. \rightarrow PA	.04	.05	.03	[-.015, .130]	0.34
Aut. Supp. \rightarrow Aut. Mot. \rightarrow Prog.	.08	.10	.07	[-.043, .245]	
Aut. Supp. \rightarrow Con. Mot. \rightarrow Prog.	.05	.07	.04	[-.002, .152]	
Within-person					
Aut. Supp. \rightarrow Aut. Mot. \rightarrow NA	.02	.03	.03	[-.023, .089]	0.76
Aut. Supp. \rightarrow Con. Mot. \rightarrow NA	-.20	-.27	.04	[-.361, -.190]	
Aut. Supp. \rightarrow Aut. Mot. \rightarrow PA	.12	.15	.03	[.102, .211]	0.27
Aut. Supp. \rightarrow Con. Mot. \rightarrow PA	.08	.10	.02	[.062, .143]	0.17
Aut. Supp. \rightarrow Aut. Mot. \rightarrow Prog.	.16	.19	.03	[.131, .259]	0.34
Aut. Supp. \rightarrow Con. Mot. \rightarrow Prog.	-.05	-.06	.02	[-.094, -.022]	-
Self-criticism as predictor					
Between-persons					
SC \rightarrow Aut. Mot. \rightarrow NA	.07	.11	.05	[.021, .225]	0.09
SC \rightarrow Con. Mot. \rightarrow NA	.13	.21	.10	[.016, .422]	0.17
SC \rightarrow Aut. Mot. \rightarrow PA	-.16	-.19	.06	[-.330, -.082]	0.59
SC \rightarrow Con. Mot. \rightarrow PA	-.10	-.12	.08	[-.300, .036]	0.44
SC \rightarrow Aut. Mot. \rightarrow Prog.	-.12	-.14	.05	[-.255, -.049]	
SC \rightarrow Con. Mot. \rightarrow Prog.	-.16	-.18	.11	[-.397, .015]	
Within-person					
SC \rightarrow Aut. Mot. \rightarrow NA	.00	.00	.01	[-.020, .027]	0.51
SC \rightarrow Con. Mot. \rightarrow NA	.26	.35	.05	[.260, .453]	
SC \rightarrow Aut. Mot. \rightarrow PA	-.08	-.09	.02	[-.136, -.054]	0.33
SC \rightarrow Con. Mot. \rightarrow PA	-.12	-.15	.03	[-.220, -.088]	0.54
SC \rightarrow Aut. Mot. \rightarrow Prog.	-.10	-.11	.03	[-.163, -.067]	-
SC \rightarrow Con. Mot. \rightarrow Prog.	.05	.06	.03	[.001, .121]	-

SE s and CI s reported for bs . Bolded CI s do not contain zero, indicating significance at $p < .05$. The CI for the within-person SC \rightarrow Con. Mot. \rightarrow Prog. effect is not bolded, as this effect is non-significant when the Benjamini and Hochberg (1995) correction for multiplicity is applied. P_M = proportion mediated, ratio of the indirect effect to the total effect (Alwin & Hauser, 1975; MacKinnon, 2008); note that this effect size measure tends to fluctuate among studies when sample sizes < 500 (Miočević et al., 2018). P_M was not calculated for the within paths from self-criticism to goal progress, as the total effect was n.s., because of the presence of a suppression effect. Similarly, the P_M for the path from autonomy support to goal progress through control was not calculated.

SC self-criticism, Aut. Mot. autonomous motivation, Con. Mot. controlled motivation, Aut. Supp. autonomy support, NA negative affect, PA positive affect, Prog. goal progress

autonomy support and the other on the personality predictor of self-criticism. Because there is a risk of becoming lost in a forest of specific findings, we will begin by highlighting two broad patterns in the results, and only then move on to examine the results in more detail.

The first of these broad patterns is that, as expected, all variables displayed considerable within-person variance. Even self-criticism, the most trait-like of the variable studied, had less than 50% of its variance between-persons. Thus, people's experiences of autonomy support, self-criticism, autonomous and controlled motivation, and

the outcomes varied substantially across self-domains; trait-level descriptions that ignore this variability by averaging over domains are over-simplifications. In some contexts, this loss of nuance may be acceptable, even useful, but in others it may come at too great a cost (Moskowitz & Fournier, 2015). The existence of this within-person variability both justifies and motivates the search for mediational processes at the within-person level.

The second broad pattern emerges when comparing the between-persons and within-person indirect effects that test the hypothesized mediational pathways. In each of the two

MSEMs, there were six such indirect effects at the between-persons level and a corresponding six at the within-person level. Considering first the between-persons effects, we found that two of the indirect effects were significant in the autonomy support model, four were significant in the self-criticism model, and one of these six remained significant in the combined model. Thus, partial support was found for the models between-subjects, but the results were less consistent and robust than expected, especially for autonomy support. Considering next the within-person effects, we found that five of the six indirect effects were significant in the autonomy support model, four were significant in the self-criticism model, and all nine remained significant in the combined model. The second broad pattern therefore was that the within-person effects were not a weak echo of the between-persons effects, but were actually more plentiful and more robust. To some degree this reflects the greater power of within-person analyses, which are based on many more observations, but some of the within-person paths from the mediators to the outcomes were actually larger than the corresponding between-person paths. We consider these broad patterns to provide strong support for our guiding assumption. We next consider the results at a more fine-grained level of analysis.

Autonomy support as the distal predictor

Paths from autonomy support to mediators

Both between-persons and within-person, autonomy support predicted greater autonomous motivation and lesser controlled motivation, with the effects on autonomous motivation appearing to be somewhat stronger. The between-persons effects are familiar in SDT research (e.g., Slemp et al., 2018; Su & Reeves, 2011). More novel are the within-person findings that in domains in which people experienced greater autonomy support, they also experienced more autonomous and less controlled motivation. For example, if a person experienced considerable autonomy support in the domain of maintaining a healthy lifestyle and relatively little in the academic domain, their motivation in the former would be expected to be more autonomous.

Paths from mediators to outcomes

Both between-persons and within-person, we found that autonomous motivation predicted greater PA and that greater controlled motivation predicted greater NA. Two additional predicted paths were found within-person: greater autonomous motivation predicted greater GP and greater controlled motivation predicted lesser PA. There was also an unexpected within-person path, possibly attributable to suppression, from controlled motivation to greater GP.

Indirect paths from autonomy support to outcomes

Considering the paths from autonomy support to the mediators and from the mediators to outcomes together, we found six significant indirect effects. The between-person paths in which autonomy support predicted greater PA via greater autonomous motivation and lower NA via lesser controlled motivation have been demonstrated in prior studies (e.g., Koestner et al., 2012; Levine et al., 2020). The within-person findings are novel, indicating that domain-level autonomy support leads to: (1) more PA through both increased autonomous motivation and decreased controlled motivation; (2) decreased NA through decreased controlled motivation; and (3) increased GP through increased autonomous motivation. Stated less abstractly, in domains in which people experienced greater autonomy support, they experienced more PA, less NA, and greater GP, and this could be explained by their greater autonomous motivation and lesser controlled motivation.

Also noteworthy was that all the direct effects from autonomy support to the outcomes were significant, indicating that the motivational consequences of autonomy support only partly explain its beneficial effects, and so there must be additional mediating variables that account for the downstream effects of autonomy support. One possibility is that autonomy support leads to greater basic need satisfaction, which in turn yields a range of positive outcomes.

Self-criticism as the distal predictor

Paths from self-criticism to mediators

Both between-persons and within-person, self-criticism predicted less autonomous motivation and more controlled motivation, with the effects for controlled motivation appearing to be somewhat stronger. This pattern stands in interesting contrast to that for autonomy support, which was especially predictive of autonomous motivation. The asymmetry in the antecedents of autonomous and controlled motivation is another illustration of why it is frequently preferable to consider them separately (Koestner et al., 2008). The within-person findings for self-criticism are again more novel, indicating that in domains in which people were more self-critical, they experienced less autonomous and more controlled motivation. For example, if a person were highly self-critical about their performance in the academic domain but relatively non-self-critical concerning their efforts to maintain a healthy lifestyle, their motivation in the latter domain would be expected to be more autonomous.

Paths from mediators to outcomes

The β s for the paths from the mediators to the outcomes in this model differ somewhat from those reported in the autonomy support MSEM. The reason is that in the first model, the direct effects from autonomy support to each outcome were controlled, while in the second model, the direct effects of self-criticism were controlled. Nonetheless, all of the significant mediator-to-outcomes paths in the autonomy support MSEM were also significant in the self-criticism MSEM.

Indirect paths from self-criticism to outcomes

Considering the paths from self-criticism to the mediators and from the mediators to outcomes together, we found four significant indirect effects at the between-persons level and four at the within-person level. Three mediational paths were found at both levels: self-criticism predicted greater controlled motivation which in turn predicted lower NA (1), and self-criticism predicted lesser autonomous motivation which predicted both lower PA (2) and lesser GP (3). The direct effects of self-criticism were generally small and non-significant, except for those for NA. The presence of the direct effects on NA indicates that autonomous and controlled motivation only partially mediated the relation of self-criticism to NA. Stress generation (Zuroff et al., 2021b) may also play a mediational role, and there are likely other mechanisms as well.

Viewed from the perspective of Blatt's Two Polarities Theory, the findings indicate that motivational deficits, specifically a surfeit of controlled motivation and a dearth of autonomous motivation, contribute to the pervasive dysfunction associated with self-criticism. The excessive controlled motivation likely reflects introjected demands and criticisms from significant others, while the deficits in autonomous motivation may reflect a failure to develop and act from an authentic self (Shahar, 2015). Viewed from the perspective of SDT, the findings indicate that individual differences as well as social contextual differences must be incorporated into the theory, and that self-criticism is a promising candidate. Thus, these two prominent, broad-scale theories can indeed be mutually informative.

Implications for future research

The present findings have both methodological and substantive implications. Personality psychology has long embraced the methodology of multilevel modelling to simultaneously examine person-level differences and variability across different situations or domains of the self (Moskowitz & Fournier, 2015). MSEM has recently emerged as a powerful extension of multilevel modeling that is well-suited for

examining mediational hypotheses (Sadikaj et al., 2021). SDT research has much to gain from adopting multilevel methodology, as research suggests that support for the three basic psychological needs, autonomous and controlled motivation, and basic psychological need satisfaction can vary greatly across an individual's goals or domains of interest (Levine et al., 2017; Milyavskaya et al., 2014, 2015). On the other hand, many research questions are intrinsically or by the investigator's choice domain-specific. In such cases, SDT researchers might wish to use domain-specific measures rather than more familiar, domain-general measures.

Although our method of examining variability across self-domains was fruitful, by no means is the strategy of multilevel analysis restricted to self-domains as the within-person variable. SDT researchers could also apply MSEM to examine consistency and variability across multiple goals nested within persons (e.g., Levine et al., 2017), multiple significant individuals within each person's life (e.g., Laguardia et al., 2000), multiple social roles occupied by each person (e.g., Moskowitz et al., 1994), or multiple kinds of external situations (e.g., Moskowitz, 1988).

Substantively, the present findings pertain primarily to three of the six SDT mini-theories: cognitive evaluation theory (intrinsic motivation and the social contexts that foster it), organismic integration theory (the continuum of internalization and the social contexts that impede or foster it), and causality orientations theory (individual differences in motivational orientations). However, our approach could readily be applied within the three other mini-theories: basic psychological needs theory, goal contents theory, and relationships motivation theory. For example, the links between need satisfaction and well-being or between need thwarting and maladjustment that have been demonstrated between-persons (Levine et al., 2021a, 2021b) would also be expected to hold within-person. Similarly, links between intrinsic and extrinsic goals and well-being and ill-being that have been demonstrated between-persons (Hope et al., 2019) would also be expected to hold within-person. As a third example illustrating the possible integration of the sixth SDT mini-theory and Blatt's theory, one could study self-criticism as a predictor of need satisfaction and relationship quality both at the trait level and varying over specific relationships.

Methodological limitations

Several limitations of the research should be noted. First, the participants were North American university students, aged 18–25, and predominantly female; research is needed to determine the generalizability of the findings over variables such as age, gender, class, nationality, and ethnicity. Further, the study relied exclusively on self-report, which may be limited by individuals' self-awareness, memory, and social desirability biases. Moving forward, research would be

strengthened by adding peer reports or other more objective measures of autonomy support, motivation, and personality.

Finally, the current research examined statistical mediation, but the data were cross-sectional and cannot support causal inferences. While past research and theory support the order of the variables in our mediational models (Levine et al., 2020; Ryan & Deci, 2017; Zuroff et al., 2004), the direction and causality of the effects remain to be more firmly established using longitudinal or experimental data.

Practical implications

Three implications of our findings may be pertinent in many of the contexts in which SDT has already been applied successfully, including clinical, health, organizational, and educational settings. First, autonomy support has broad-ranging positive effects, and self-criticism has broad-ranging negative effects; both should be prime targets for assessment and intervention. Second, practitioners may wish to supplement traditional trait measures with more differentiated measures that assess within self-domains or other within-person dimensions. Third, interventions may frequently be more effective if designed to target specific problem areas rather than global characteristics. To give one concrete example, troubled youth may experience deficits in autonomy support in some but not other life domains and with some but not other significant others. Targeted interventions are likely to be more efficient and more efficacious, although that remains to be studied empirically.

Summary and conclusion

We used MSEM to examine personality and motivational processes across individuals and domains of self. In the first model, at both levels, autonomy support led to increased PA via autonomous motivation, and reduced NA via increased controlled motivation. In the second model, at both levels, self-criticism was related to increased NA via controlled motivation, and decreased PA and less GP via reduced autonomous motivation. This research highlights the potential value of employing MSEM in SDT, as this technique facilitates more nuanced examination of motivational processes by permitting modeling of both between-persons and within-person effects. Moreover, the findings suggest potential value in closer integration of SDT with Blatt's Two Polarities Theory.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s11031-022-09995-6>.

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Declarations

Conflict of interest All authors report no conflicts of interest.

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