ASSESSMENT OF INTRAINDIVIDUAL VARIABILITY IN POSITIVE AND NEGATIVE AFFECT USING LATENT STATE-TRAIT MODEL ANALYSES

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Intraindividual variability in positive and negative affect was assessed by the positive affect (Contentment, Joy, Vigor, Love, and Excitement) and negative affect (Depression, Hostility, Anxiety, Agitation, and Social Anxiety) subscales of the state version of the Comprehensive Personality and Affect Scales (COPAS) during a 3-week period. Using the latent state-trait model analysis, which takes both intraindividual variability and interindividual difference into account by controlling measurement error, it was shown that the variability could be measured reliably by the scores of the COPAS. In particular, a total of 56.9% to 63.5% and 48.2% to 60.6% of the reliable interindividual difference in positive and negative affect, respectively, was attributed to the intraindividual variability.

Keywords: *positive affect; negative affect; COPAS; intraindividual variability; state-trait theory*

State-trait theory (e.g., Cattell, 1963; Mischel & Shoda, 1995; Nesselroade, 1988; Singer & Singer, 1972; Spielberger, 1972; Zuckerman,

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1976) has emphasized both variability and stability of human affect, arguing that both temporal (i.e., state) and dispositional (i.e., trait) features are fundamental to individuals' emotional lives (Spielberger, 1972). Trait-like emotion is presumed to be persistent and stable, forming the bases of individuals' emotional lives. State-dependent affect, on the other hand, is subject to change according to individuals' immediate experiences and is assumed to fluctuate over time (Kraemer, Gullion, Rush, Frank, & Kupfer, 1994; Wessman & Ricks, 1966). Although the central focus of the literature has been on the individual difference origins of trait-like attributes, a series of studies within the framework of the latent state-trait model (LSTM) has investigated the intraindividual origins of state-dependent psychological phenomena (e.g., Deinzer et al., 1995; Eid & Diener, 1999; Nesselroade, 1991; Schmitt & Steyer, 1993; Steyer, Schmitt, & Eid, 1999). Use of the LSTM may further contribute to the building of analytical systems for assessing changeable, short-term emotional experience. Given that no studies to date have applied the LSTM on the instruments that systematically examine a broad spectrum of human affect, this study attempted to examine intraindividual variability in positive and negative affect using the LSTM approach. Toward this end, the state version of the Comprehensive Personality and Affect Scales (COPAS; Lubin & Whitlock, 2000, 2002), which simultaneously measures five positive and five negative affects, was used in the analyses.

Intraindividual variability in individuals' emotional experience is different from those dispositional or enduring aspects existing independently across time and situations (Wessman & Ricks, 1966). Intraindividual variability is characterized by short-term fluctuation or the "hum" of the living system (Nesselroade, 1988), which is different from the long-lasting emotional experience. Because state affect cannot be measured adequately at one point in time, it is a common practice to apply a measurement procedure entailing multiple occasions such as test-retest methods (Kraemer et al., 1994). Unlike trait affect, which is characterized by high test-retest correlations, state affect is optimal when low test-retest correlations are observed (see Spielberger, 1972).

Using a test-retest correlation to assess intraindividual variability, however, becomes problematic because it does not differentiate temporal variability from score unreliability (e.g., Nesselroade, 1988). As a result, low test-retest correlations may be found when intraindividual variability exhibits systematic variance but cannot be measured reliably. Alternatively, intraindividual variability may be measured reliably but is not stable across time or may be neither stable nor reliable (Eid & Diener, 1999). To evaluate the variability accurately, the measurement error originating from score unreliability needs to be separated from true variance. Furthermore, analyses taking into account both the state and the trait aspects warrant appropriate assessment of state affect given that how individuals feel on a given day can be dependent not only on how they feel that day (i.e., state) but also on how they generally feel (i.e., trait) (Spielberger, 1972).

The LSTM is designed to estimate the state- and trait-dependent phenomena by controlling measurement error. Fundamental assumptions underlying this model assert that individuals' psychological experience may be different at certain points in time (i.e., intraindividual variability) but also persist in different individuals across occasions (i.e., interindividual difference) (Schmitt & Steyer, 1993). As such, the variance originated not only from the stable individual differences in emotional experience (i.e., trait affect) but also from temporal emotional fluctuation (i.e., state affect) along with the measurement error are calculated using multiple indicators across multiple points in time. Structural equation modeling is applied to calculate a series of variance estimates (i.e., the state, trait, and error variance).

The split-half method has usually been applied to form two parallel tests that illustrate a construct in the LSTM. Social desirability (Schmitt & Steyer, 1993), anxiety (Steyer, Majcen, Schwenkmezger, & Buchner, 1989), and various subconstructs of personality or human affect (Deinzer et al., 1995) have been examined using this method in the past. Modeling each component of positive and negative affect (e.g., Fear, Happiness, Love, and Sadness) separately using the split-half method, Eid and Diener (1999) showed that mood fluctuation had a high degree of stability across both types of affect. That is, intraindividual variability indeed could be thought of as individuals' distinct emotional experience rather than reflective of random fluctuation. Alternatively, construction of the LSTM has been based on the existing psychological measures. Dumenci and Windle (1996), for example, developed the LSTM with its model specification based on the factor structure underlying the Center for Epidemiologic Studies–Depression Scale (CES-D; Radloff, 1977). In particular, it was found that a larger amount of variance was explained by the stable individual difference than by the time-specific difference, being congruent with what the CES-D was claimed to measure (i.e., trait depression). The examination of intraindividual variability in individuals' positive and negative emotional experience can thus be done effectively by developing the LSTM according to the measurement structure underlying an instrument that purports to measure the state-dependent positive and negative affect.

In this study, we conducted LSTM analyses of the state affect across a 3-week period using the Negative and Positive Affect scales of the state COPAS (Lubin & Whitlock, 2000, 2002). The COPAS measured a broad range of positive affect (i.e., contentment, joy, vigor, love, and excitement) and negative affect (i.e., depression, hostility, anxiety, agitation, and social anxiety). Separate LSTMs were constructed for both positive and negative affect, and these models were examined under a series of restrictive assumptions (e.g., factorial invariance [FI] and equal variance) for the measurement of structural invariance across time (e.g., Meredith, 1993). Evidence of more stringent forms of the invariance can ascertain the stability of psychometric properties of the COPAS on which the present LSTMs are based, making a more accurate assessment of intraindividual variability possible. In particular, because the state COPAS was used, it was hypothesized that a large amount of reliable variability in positive and negative affect can be attributed to temporal variation (i.e., intraindividual variability).

Method

Participants and Procedures

Participants were 235 students recruited from introductory psychology classes at a suburban community college in the Midwest. There were 95 male and 140 female students, with the mean age being 20.91 (*SD* = 5.87) and 21.69 (*SD* = 6.48), respectively. Mean highest education levels completed were 12.38 grades (*SD* = 0.90) for female and 12.29 grades (*SD* = 0.80) for male students. About 96% of male and 86% of female students were single. Participants were told that the purpose of this study was to investigate the stability and variability of human emotional experience. They were made fully aware that participation in the study was voluntary and that they could withdraw their participation at any time during the course of the study. They were also informed that their responses would be kept strictly confidential. Those who volunteered to participate then completed the instruments at the end of the class period for 3 consecutive weeks. In particular, of 424 individuals who completed the first administration of the instrument at Week 1, 363 of them also completed the second administration (i.e., Week 2), and 235 individuals completed both the second and third administration (i.e., Weeks 2 and 3). Thus, the attrition rate between Weeks 1 and 2 was 14.39% and that between Weeks 2 and 3 was 35.26%. The method of listwise deletion was applied when missing data were encountered.

Measures

The state form of Negative and Positive Affect scales of COPAS (Lubin & Whitlock, 2000, 2002) was used. The state COPAS is composed of 78 adjectives that measure respondents' state positive and negative affect (e.g., how you feel today) with a 5-point Likert-type scale ranging from *not at all* to *very often*. The Positive Affect scale consists of the following five subscales: Contentment (11 adjectives), Joy (5), Vigor (9), Love (7), and Excitement (5). The Negative Affect scale is composed of the following five subscales: Depression (15 adjectives), Hostility (7), Anxiety (7), Agitation (7), and Social Anxiety (5).

Lubin and Whitlock (2002) reported that the scores on the Positive Affect subscales had internal consistencies (Cronbach's αs) of .88 (Content), .94 (Joy), .81 (Vigor), .88 (Love), and .81 (Excitement), and the scores on the Negative Affect subscales had Cronbach's αs of .85 (Depression), .87 (Hostility), .90 (Anxiety), .79 (Agitation), and .61 (Social Anxiety). Test-retest reliability for a 1- to 3-week period was also reported, with the mean coefficient being .57 (range = .35 to .80) for the scores on the Positive Affect scales and .58 (range = .26 to .87) for scores on the Negative Affect scales (Lubin & Whitlock, 2002). Moreover, a series of Positive Affect scales had correlations that ranged from .27 to .49 with the Positive Affect scale of Youth Depression Adjective Check List (Carey, Lubin, & Brewer, 1992), indicating adequate convergent validity (Lubin & Whitlock, 2002). The COPAS Positive Affect scales also had a range of correlations from –.39 to –.56 with CES-D (Radloff, 1977) and from –.10 to –.43 with the Negative Affect scale of Youth Depression Adjective Check List, indicating good discriminant validity (Lubin & Whitlock, 2002). Convergent validity under the response to a series of the COPAS Negative Affect scales was indicated by adequate direction and magnitude of relationship with the CES-D (Radloff, 1977), the State-Trait Personality Inventory (Spielberger, 1995), the Shyness scale (Cheek & Buss, 1981), and the Youth Depression Adjective Check List (Carey et al., 1992), with the coefficients ranging from .39 to .56 (Lubin & Whitlock, 2002). Discriminant validity was also indicated by lower magnitude (range = .01 to .41) or negative direction (range = –.02 to –.30) of correlation coefficients with these scales.

Model Specification

Two LSTMs were constructed for positive and negative affect separately. The separate examination of the models of positive and negative affect was suggested by a body of literature that indicated the independence of positive and negative affect factors (e.g., Tellegen, Watson, & Clark, 1999). In each model, the following four latent constructs were created: w_1 to w_3 (week specific or state affect) and t (trait affect). All of the week-specific constructs represented a different measurement of the five COPAS subscales and were measured longitudinally. Thus, the three week-specific constructs were measured by a total of 15 observed variables as follows: y_{11} to y_{53} (see Figure 1).

A total of the four substantive models were tested for positive and negative affect, respectively, by fitting the three waves of data (i.e., Weeks 1, 2, and 3) simultaneously. The configural FI model (M_1) was first tested by relaxing all of the equality constraints (Hofer, 1999; Horn, McArdle, & Mason, 1983). A series of the constraints was then imposed on the other three models according to Meredith's (1993) formulation: weak FI (M_2), strong FI (M_3), and strict FI (M_4) (see Tables 4 and 5). First, in testing the weak FI model,

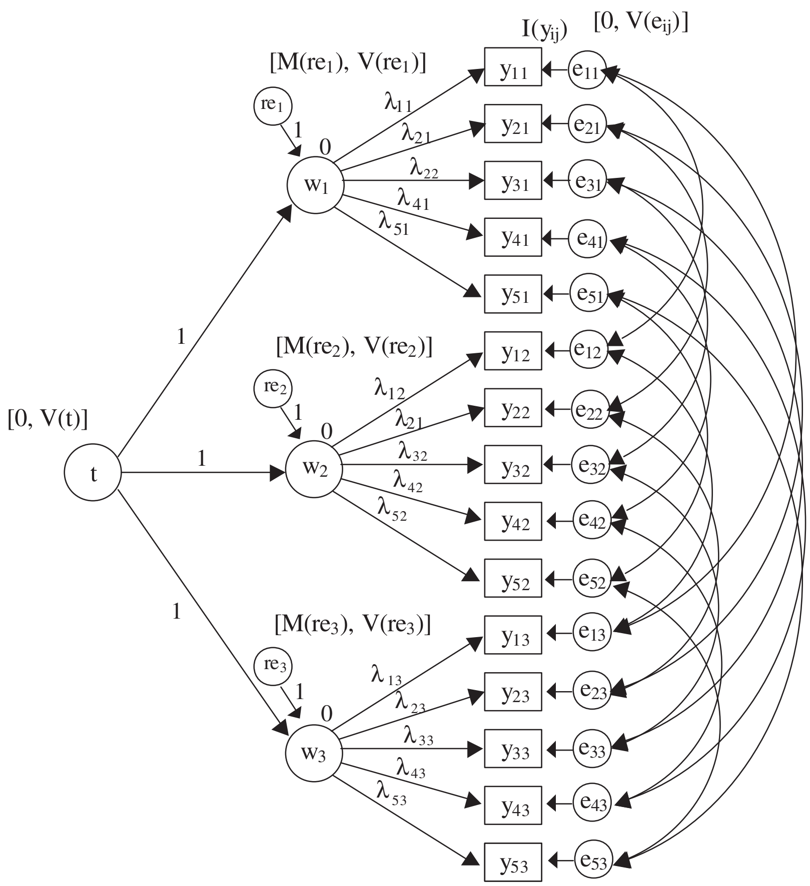

Figure 1. Latent state-trait model.

Note. t = trait affect (i.e., positive or negative affect); w_1 to w_3 = week-specific affect; re_1 to re_3 = residual factors; ε_{11} to ε_{53} = unique factors; $M(re_1)$ to $M(re_3)$ = factor means; $V(re_1)$ to $V(re_3)$ = week-specific variances; 0 = trait affect mean; $V(t)$ = trait affect variance; $V(\varepsilon_{11})$ to $V(\varepsilon_{53})$ = unique variances; λ_{11} to λ_{53} = factor pattern coefficients; $I(y_{11})$ to $I(y_{53})$ = intercepts; y_{11} to y_{53} = observed variables (i.e., state COPAS subscales).

equality constraints were imposed on the week-specific factor pattern coefficients across scales as follows: $\lambda_{i1} = \lambda_{ij}$ (e.g., $\lambda_{11} = \lambda_{12} = \lambda_{13}$). Additional constraints were imposed on the intercepts as follows: $I(y_{i1}) = I(y_{ij})$, for example, $I(y_{11}) = I(y_{12}) = I(y_{13})$, when testing the strong FI. For the test of the strict FI, the equality constraints were imposed on the unique variances as follows: $V(\varepsilon_{i1}) = V(\varepsilon_{ij})$, for example, $V(\varepsilon_{11}) = V(\varepsilon_{12}) = V(\varepsilon_{13})$, in addition to the intercepts (see Figure 1).

Results

Descriptive Statistics

Tables 1 and 2 report the interscale correlations among the state COPAS along with the means, standard deviations, and reliabilities (Cronbach's α). Medium to high interscale correlations were evidenced between the corresponding subscales of positive affect across weeks, with the coefficients ranging from .46 to.76, as well as between those of negative affect, with the coefficients ranging from .36 to .62. Moreover, the measures of the positive affect also had medium to high correlations within each week (*r*s range = .39 to .77). The results also indicated that the measures of the negative affect correlated highly with one another within each week (*r*s range = .53 to .83) except for the Social Anxiety scale, which had a range of correlations between .03 and .29. The mean scores for each corresponding scale across weeks along with standard deviations were comparable for both affects. Higher degrees of internal consistency were also found for most of the scores on the Positive and Negative Affect subscales (Cronbach's α = .80 to .96), whereas lower degrees of internal consistency were found for the scores on the Social Anxiety scales (Cronbach's α = .57 to .64).

Structural Equation Modeling

The EQS program (Bentler & Wu, 1998) was used to test the hypothesized LSTM. The robust maximum likelihood procedure in conjunction with traditional maximum likelihood procedure was used given that these data deviated from multivariate normality. In particular, Mardia's multivariate kurtosis was found to be 47.51 (positive affect) and 104.11 (negative affect). Given its robustness against the violations of multivariate normality, the Satorra-Bentler (1988) rescaled chi-square (S-B χ^2) was reported in addition to the normal theory maximum likelihood chi-square. Additional measures for assessing the model fit included the comparative fit index (CFI; Bentler, 1990), the Tucker-Lewis Index (TLI; Tucker & Lewis, 1973), the Relative Noncentrality Index (RNI; McDonald & Marsh, 1990), and the standardized root mean squared residual (SRMR; Bentler, 1995). Criteria employed to evaluate the model fit were based on combination rules proposed by Hu and Bentler (1999). They suggested that the combination rule of TLI < .95 and SRMR > .09 (or .10) represented adequate model fit in that it produces the least sum of Type I error (i.e., the overrejection rate) and Type II error (i.e., the underrejection rate). The combination rules of RNI or CFI < .95 and SRMR < .09 (or .10) are also noted to be appropriate in reducing Type I error (Hu & Bentler, 1999).

Table 1

Interscale Correlations of the State COPAS (positive affect) Across Time

	Week 1					Week 2					Week 3				
	C_N	J	V	L	E_x	C_N	J	V	L	E_x	C_N	J	V	L	E_x
Week 1															
C_N	(.91)														
J	.74	(.93)													
V	.52	.60	(.87)												
L	.68	.64	.58	(.85)											
E_x	.39	.50	.63	.45	(.81)										
Week 2															
C_N	.59	.48	.41	.47	.32	(.92)									
J	.38	.46	.36	.39	.31	.73	(.93)								
V	.26	.29	.61	.32	.40	.58	.69	(.90)							
L	.42	.37	.38	.60	.34	.72	.74	.58	(.88)						
E_x	.17	.25	.39	.17	.58	.45	.60	.69	.53	(.79)					
Week 3															
C_N	.52	.46	.37	.45	.26	.68	.52	.44	.54	.34	(.93)				
J	.35	.50	.30	.34	.25	.47	.54	.37	.47	.39	.76	(.93)			
V	.28	.34	.58	.35	.37	.43	.46	.67	.44	.49	.62	.67	(.89)		
L	.40	.43	.44	.61	.30	.55	.52	.48	.67	.39	.77	.74	.67	(.89)	
E_x	.18	.30	.35	.19	.58	.30	.37	.40	.38	.67	.47	.58	.67	.50	(.80)
M	33.54	15.21	19.62	28.09	12.17	33.08	15.97	20.38	27.24	12.61	33.36	15.70	20.28	26.94	12.36
SD	8.75	5.12	6.31	6.13	4.46	9.07	5.13	6.43	6.33	4.26	9.08	5.09	6.51	6.50	4.35

Note. COPAS = Comprehensive Personality and Affect Scales; C_N = contentment; J = joy; V = vigor; L = love; E_x = excitement. All *r*s were statistically significant ($p < .01$). Numbers in parentheses are internal consistencies (Cronbach's α). $N = 235$.

Table 2
Interscale Correlations of the State COPAS (negative affect) Across Time

	Week 1					Week 2					Week 3				
	D	H	A_G	A_X	SA	D	H	A_G	A_X	SA	D	H	A_G	A_X	SA
Week 1															
D	(.93)														
H	.66	(.80)													
A_G	.66	.73	(.89)												
A_X	.71	.53	.64	(.86)											
SA	.16	.03	.08	.19	(.57)										
Week 2															
D	.45	.28	.32	.37	.18	(.94)									
H	.27	.36	.31	.27	.12	.75	(.82)								
A_G	.19	.23	.37	.23	.13	.72	.73	(.91)							
A_X	.37	.28	.35	.47	.13	.77	.61	.64	(.88)						
SA	.12	.00	.07	.14	.59	.29	.20	.25	.26	(.64)					
Week 3															
D	.40	.31	.32	.38	.13	.61	.49	.47	.51	.23	(.96)				
H	.31	.43	.34	.34	.05	.53	.52	.42	.48	.15	.80	(.91)			
A_G	.38	.43	.44	.37	.09	.54	.52	.54	.55	.19	.75	.83	(.93)		
A_X	.41	.37	.39	.51	.10	.60	.48	.50	.62	.17	.76	.70	.73	(.90)	
SA	.21	.14	.17	.28	.57	.24	.16	.14	.22	.47	.24	.18	.15	.23	(.59)
M	23.75	9.24	14.32	12.56	13.40	23.73	9.56	14.67	12.96	12.75	24.10	10.00	14.19	12.42	12.78
SD	9.94	3.28	6.07	5.38	3.49	9.94	3.43	6.03	5.54	3.54	11.56	4.76	6.59	5.66	3.46

Note. COPAS = Comprehensive Personality and Affect Scales; D = depression; H = hostility; A_G = agitation; A_X = anxiety; SA = social anxiety. $|rs| \geq .17$ and $.13 \leq |rs| < .17$ were statistically significant ($p < .01$ and $p < .05$, respectively). Numbers in parentheses are internal consistencies (Cronbach's α). $N = 235$.

Intraindividual Variability in Positive Affect

The test of the configural FI model showed an acceptable fit as indicated by S-B $\chi^2(74) = 220.81$, TLI = .92, RNI = .94, CFI = .94, and SRMR = .08 (see Table 3). The weak FI model was then examined by imposing equality constraints on week-specific factor pattern coefficients across weeks. The results suggested that placing the constraints on the factor pattern coefficients did not seem to reduce the model fit, with the differences in S-B rescaled chi-square not being statistically significant (ΔS-B $\chi^2 = 14.09$; $\Delta df = 8$; $p > .05$). The fit indices of the weak fit index (TLI = .93, RNI = .94, CFI = .94, and SRMR = .09) were also comparable to that of the configural FI. On the other hand, imposing additional constraints on intercepts in testing the next model, the strong FI model, resulted in reducing the model fit with the chi-square difference being statistically significant (ΔS-B$\chi^2 = .64.63$, $\Delta df = 8$, $p < .01$). As a result, the weak FI model was judged to approximate the data best and was selected as the final model.

The means of the residual week-specific factors in the weak FI model showed similar patterns across weeks (i.e., 33.54 for Week 1, 33.08 for Week 2, and 33.36 for Week 3). The residual week-specific factor variances for the 1st, 2nd, and 3rd week were, respectively, 22.46, 17.57, and 19.66 (*p*s < .01), and the trait variance was 29.77 ($p < .01$), which indicated that about 56.9%, 63.5%, and 60.6% of the higher order trait factor variance indicative of reliable interindividual differences in positive affect was explained by the variance specific to the 1st, 2nd, and 3rd weeks (i.e., intraindividual variability). A series of parameter estimates in this model are presented in Tables 5 and 6.

Intraindividual Variability in Negative Affect

The same process of testing invariance for positive affect was also adopted for evaluating invariance of negative affect. First of all, the test of the configural FI model showed an acceptable model fit as follows: S-B$\chi^2(74) = 147.22$, TLI = .94, RNI = .95, CFI = .96, SRMR = .11. The weak FI was then tested by placing the equality constraints on the factor pattern coefficients. Reduction in model fit resulted, however, as indicated by the statistically significant chi-square difference (ΔS-B$\chi^2 = 64.63$, $\Delta df = 8$, $p < .01$). The parameter estimates (e.g., variances and factor pattern coefficients) also changed between the configural and weak FI models. In particular, there was a substantial amount of increase in the residual Week 3–specific factor variance on the weak FI model compared with the configural FI model, with the difference in the variance being 11.01. At the same time, the factor pattern coefficient of the Hostility scale on that week-specific factor decreased from .45 in the configural FI to .35 in the weak FI, whereas the unique variance increased from 3.86 to 5.04. Given the substantial differences found between the configural and weak FI models, the configural model was chosen as the final

Table 3
Summary of Fit Indices Across Models of Positive Affect

Model	Constraint	S-Bχ^2	χ^2	*df*	TLI	RNI	CFI	SRMR
M_1: Configural FI		220.81	258.82	74	.92	.94	.94	.08
M_2: Weak FI	$\lambda_{i1} = \lambda_{ij}$	234.90	269.65	82	.93	.94	.94	.09
M_3: Strong FI	$I(y_{i1}) = I(y_{ij})$; $\lambda_{i1} = \lambda_{ij}$	299.53	329.27	90	.92	.93	.94	.09
M_4: Strict FI	$V(\varepsilon_{i1}) = V(\varepsilon_{ij})$; $I(y_{i1}) = I(y_{ij})$; $\lambda_{i1} = \lambda_{ij}$	318.83	346.77	100	.93	.92	.94	.09

Note. FI = factorial invariance; i = 1 to 5; j = 1 to 3; S-Bχ^2 = Satorra-Bentler rescaled chi-square; CFI = comparative fit index; TLI = Tucker-Lewis Index; RNI = Relative Noncentrality Index; SRMR = standardized root mean squared residual. All chi-squares were statistically significant ($p < .01$).

Table 4
Summary of Fit Indices Across Models of Negative Affect

Model	Constraint	S-Bχ^2	χ^2	*df*	TLI	RNI	CFI	SRMR
M_1: Configural FI		147.22	190.51	74	.94	.95	.96	.11
M_2: Weak FI	$\lambda_{i1} = \lambda_{ij}$	171.31	239.96	82	.92	.94	.94	.13
M_3: Strong FI	$I(y_{i1}) = I(y_{ij})$; $\lambda_{i1} = \lambda_{ij}$	215.24	279.07	90	.92	.93	.94	.13
M_4: Strict FI	$V(\varepsilon_{i1}) = V(\varepsilon_{ij})$; $I(y_{i1}) = I(y_{ij})$; $\lambda_{i1} = \lambda_{ij}$	226.23	301.08	100	.92	.92	.93	.13

Note. FI = factorial invariance; i = 1 to 5; j = 1 to 3; S-Bχ^2 = Satorra-Bentler rescaled chi-square; CFI = comparative fit index; TLI = Tucker-Lewis Index; RNI = Relative Noncentrality Index; SRMR = standardized root mean squared residual. All chi-squares were statistically significant ($p < .01$).

Table 5
Factor Pattern Coefficients for Positive Affect and Negative Affect

	C_N	J	V	L	E_x
Positive affect (weak FI model)					
Week 1	1.00 (.81)	.66 (.89)	.70 (.77)	.70 (.80)	.42 (.67)
Week 2	1.00 (.80)	.66 (.88)	.70 (.75)	.70 (.78)	.42 (.65)
Week 3	1.00 (.80)	.66 (.89)	.70 (.76)	.70 (.79)	.42 (.66)
	D	H	A_G	A_X	SA
Negative affect (configural FI model)					
Week 1	1.00 (.87)	.31 (.84)	.59 (.87)	.44 (.77)	.03 (.09)
Week 2	1.00 (.91)	.32 (.83)	.53 (.83)	.47 (.79)	.08 (.22)
Week 3	1.00 (.85)	.45 (.90)	.61 (.89)	.46 (.79)	.07 (.18)

Note. C_N = contentment; J = joy; V = vigor; L = love; E_x = excitement; D = depression; H = hostility; A_G = agitation; A_X = anxiety; SA = social anxiety. Numbers in parentheses are standardized factor pattern coefficients. All but one factor pattern coefficient (i.e., SA: $r = .03$; $p > .05$) were statistically significant ($p < .01$).

model for negative affect. In particular, most of the factor pattern coefficients in this model were high and showed similar patterns across weeks, although the magnitude of coefficients for social anxiety was small and varied across weeks (see Table 5). The results also revealed that the week-specific variances were 46.85 (Week 1), 32.69 (Week 2), and 36.13 (Week 3) and that the trait factor variance was 47.76. Thus, 51.3% (Week 1), 60.6% (Week 2), and 48.2% (Week 3) of the reliable interindividual differences in negative affect were explained by state-dependent fluctuation or intraindividual variability. Factor pattern coefficients and correlations among unique variances in the configural model are reported in Tables 5 and 6.

Discussion

The purpose of this study was to examine intraindividual variability in positive and negative affect using LSTM analyses. These analyses were different from the traditional methods (e.g., test-retest) in that measurement error originating from possible score unreliability was controlled. The analyses also took into account both state and trait aspects of emotional experience as articulated in state-trait theory; that is, how individuals feel on a given day can be dependent on both how they feel that day (i.e., state) and how they generally feel (i.e., trait) (Spielberger, 1972). The two LSTMs constructed in this study were derived from the measurement structures underlying the Positive and Negative Affect scales of the state version of the COPAS (Lubin & Whitlock, 2000, 2002).

Overall, the results revealed that positive and negative emotional experiences specific to a week were measured reliably by state COPAS scores. The

Table 6
Correlations Among Unique Factors for Positive and Negative Affect

	Week 1	Week 2	Week 3	Week 1	Week 2	Week 3	Week 1	Week 2	Week 3	Week 1	Week 2	Week 3	Week 1	Week 2	Week 3
	C_N			J			V			L			E_x		
Positive affect (weak FI model)															
Week 1															
Week 2	.48			.33			.68			.59			.64		
Week 3	.41	.56		.49	.31		.62	.69		.58	.51		.65	.68	
	D			H			A_G			A_X			SA		
Negative affect (configural FI model)															
Week 1															
Week 2	.58			.34			.40			.68			.59		
Week 3	.29	.32		.35	.23		.23	.30		.35	.29		.56	.44	

Note. C_N = contentment; J = joy; V = vigor; L = love; E_x = excitement; D = depression; H = hostility; A_G = agitation; A_X = anxiety; SA = social anxiety; $|rs| = .23$ ($p < .05$); other correlation coefficients ($p < .01$).

COPAS integrated subscales representative of a broad spectrum of positive and negative affect successfully detected the systematic variability in short-term, within-person fluctuation. These analyses made this explicit by the findings that a large amount of reliable variance in positive and negative affect was attributed to week-specific factors. It appears that the variability in human emotion exists separately from the trait-like, interindividual difference, which manifests itself over an extended period of time.

A series of FI models was tested to obtain a model that can represent more stringent forms of invariance. Among all, the weak FI model was found to be the optimal measurement structure for the responses underlying the Positive Affect scale of the COPAS, which suggested that the magnitude of the relationship between Positive Affect scales and the corresponding week-specific factors stays the same across weeks. This form of invariance can support the notion that the degree to which individuals perceive each domain of their positive emotional experience does not change over time. More important, a large amount of the reliable interindividual difference in positive affect (i.e., approximately half to three quarters) was found to be due to state-dependent fluctuation (i.e., intraindividual variability), as hypothesized.

The test of the FI in negative affect revealed a lesser degree of invariance across occasions. The configural FI model was found to be most appropriate in characterizing intraindividual variability in this affect. Decrease in overall model fit along with changes in individual parameters were detected when the equality constraints were imposed on the week-specific factor pattern coefficients (i.e., the weak FI model). Thus, the relationships between the week-specific negative affect factors and the corresponding COPAS subscales changed over time. In particular, hostility seemed to have a stronger impact on negative affect due uniquely to Week 3 given that there was a sizeable decrease in the week-specific factor pattern coefficient on the Hostility scale (Week 3), yet there was an increase in the unique variance on this scale as well as in the residual variance on the Week 3 factor. Nevertheless, 48.2% to 60.6% of the reliable interindividual differences in negative affect were explained by state-dependent fluctuation or intraindividual variability.

On the other hand, smaller degrees of association were detected between the Social Anxiety scale and the week-specific factors as indicated by the low observed correlations of the Social Anxiety scale with other measures of negative affect (i.e., depression, hostility, anger, and anxiety) as well as by the low factor pattern coefficients on the week-specific negative affect in the LSTMs. Notably, the observed correlations between the Social Anxiety scales themselves across weeks were somewhat higher across time (see Table 2), as were the residual correlations between the unique variances associated with the Social Anxiety scales (see Table 6). Thus, social anxiety itself could have represented individuals' distinct emotional experience rather than being a marker of higher order state negative affect. It appears that the Social Anxiety scale, in its present form, does not measure a state phenomenon.

Different degrees of emotional fluctuation were found between positive and negative affect. More specifically, a larger amount of intraindividual variability existed in negative affect (i.e., 48.2% to 60.6%) than in positive affect (i.e., 56.9% to 63.5%). This finding is in line with Zevon and Tellegen (1982), who showed that as opposed to the positive affect dimension changing fairly consistently within individuals, the negative affect dimension was rather unique and was represented by the sharp elevations varying from one occasion to another. Eid and Diener (1999) also showed that the instabilities in intraindividual variability were relatively low for positive affect yet high for negative affect. Individuals' emotional experiences characterized by negative affect seemed to vary across time to a greater degree than did their positive emotional experience. Issues concerning different patterns of fluctuation in positive and negative affect should further be addressed in future investigations given the significance of understanding that positive and negative emotional experience can vary unequally and correlate differently with a variety of psychological adjustments (e.g., Watson, 1988; Watson, Clark, & Carey, 1988; Watson, Clark, McIntyre, & Hamaker, 1992).

Intraindividual variability was conceptualized as occasion-specific fluctuations from week to week. It can be argued, however, that variability is not only a function of the situational effect but also of the person-situation interaction (e.g., Eid & Langeheine, 1999). Diener and Larsen (1984) also discussed that the degree of stability varied depending on where people are and thus should not be treated in a global manner. We usually are not able to differentiate between the situational effect and the person-situation interaction under nonexperimental studies. In fact, this is the strength of assessing the state affect, where "individuals can be in different situations on an occasion of measurement and the situations have not to be known a priori" (Eid & Langeheine, 1999, p. 113). Nevertheless, specifying the situational effect would be helpful when examining samples that may have different emotional experiences depending on different circumstances (e.g., inpatient versus outpatient samples). At the same time, the measurement of more frequent time frames (e.g., day-to-day) can help uncover the patterns of shorter term emotional fluctuations. Furthermore, future LSTM analyses may be conducted for investigating enduring aspects of human emotion (i.e., interindividual differences) using the trait form of the COPAS (Lubin & Whitlock, 2002), which uses the same series of adjectives used in the state form of the COPAS.

In conclusion, this study clearly evidenced the state aspects of positive and negative affect as measured by the state COPAS. Use of LSTM analysis made it possible to assess these aspects often confounded with measurement error as well as trait affect. Furthermore, intraindividual variability explained a large amount of reliable variance, suggesting that state-dependent fluctuation in positive and negative affect can indeed be assessed adequately by the LSTM of the state COPAS.

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