# Affective Dynamics in Daily Life Are Differentially Expressed in Positive, Negative, and Disorganized Schizotypy

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## Abstract:

Schizotypy and schizophrenia are associated with disruptions in the experience of affect. Temporal patterns of affect, or affective dynamics, offer unique information about the expression of multidimensional schizophrenia-spectrum psychopathology. The present study employed experience sampling methodology to examine affective intensity, inertia, variability, reactivity, and instability in positive, negative, and disorganized schizotypy in nonclinically ascertained young adults (n = 275). As hypothesized, disorganized schizotypy demonstrated the most robust associations with affective dynamics and was characterized by elevated intensity, reactivity, and variability of negative affect. Disorganized schizotypy was also associated with instability of negative affect, but this relation was better accounted for by mean negative affect, which was elevated in disorganized schizotypy. Negative schizotypy was characterized by diminished intensity and variability of positive affect as expected, but was unassociated with affective inertia. Finally, as hypothesized, positive schizotypy was associated with elevated intensity and variability of negative affect at the bivariate level, but was unassociated with affective dynamics when including disorganized schizotypy in the model. These findings indicate that the schizotypy dimensions are differentiated by both mean levels and dynamics of affect, and that affective dynamics convey unique information about multidimensional schizotypy beyond mean levels of affect. The findings provide further support for the multidimensional model of schizotypy.

**Keywords:** affective dynamics | schizotypy | schizophrenia-spectrum | experience sampling

## Article:

Researchers have long recognized that disruptions in the experience of both positive and negative affect are central to schizophrenia (e.g., Bleuler, 1950; Meehl, 1962), and that affective disruptions may increase risk for psychosis (e.g., Myin-Germeys & van Os, 2007). Thus, affective dysregulation is a vital area of study regarding risk for psychosis and schizophrenia-spectrum disorders. Schizotypy provides a useful and unifying framework for understanding the etiology and expression of schizophrenia-spectrum disorders as it includes subclinical expressions, the psychosis prodrome, personality pathology, and full-blown psychosis (Kwapil & Barrantes-Vidal, 2015; Lenzenweger, 2010). In order to understand how distinct patterns of affective dysregulation are associated with the psychosis spectrum, we investigated the association of affective dynamics, the temporal patterns of affect experienced in daily life (e.g., Kuppens, 2015), with multidimensional facets of schizotypy.

## Multidimensional Schizotypy

Current models suggest that schizotypy, like schizophrenia, is multidimensional with positive, negative, and disorganized dimensions (e.g., Kwapil & Barrantes-Vidal, 2015; Tandon et al., 2009). Positive schizotypy entails psychotic-like experiences such as unusual beliefs and unusual perceptual experiences, as well as suspiciousness. Negative schizotypy includes deficit experiences such as affective flattening, alogia, avolition, and disinterest in social activities. Disorganized schizotypy represents a disruption in the organization and expression of thought, speech, and behavior. Schizotypy provides a useful overarching construct; however, studying positive, negative, and disorganized schizotypy as distinct dimensions provides unique information about the risk for and expression of schizophrenia-spectrum psychopathology. In fact, recent studies suggest that treating schizotypy as a homogenous construct loses information compared to examining the positive, negative, and disorganized schizotypy dimensions (e.g., Kemp, et al., 2021; Sahakyan et al., 2019).

Questionnaires have been widely used for identifying schizotypy and risk for related spectrum disorders (see reviews by Chapman et al., 1995; Kwapil & Chun, 2015; Mason, 2015). The Multidimensional Schizotypy Scale (MSS; Kwapil, Gross, Silvia et al., 2018) includes subscales assessing positive, negative, and disorganized schizotypy that have good psychometric properties (Kemp et al., 2020; Kwapil, Gross, Silvia et al., 2018). The construct validity of the MSS has been supported by questionnaire (e.g., Kwapil, Gross, Burgin et al., 2018), interview (e.g., Kemp et al., 2021), laboratory (e.g., Sahakyan et al., 2019), and ambulatory assessment (Kwapil et al., 2020) studies.

## Affective Dysregulation in Schizotypy

Although schizotypy and schizophrenia are broadly associated with affective dysfunction (Horan et al., 2008; Najolia et al., 2011; Watson & Naragon-Gainey, 2010), the schizotypy dimensions involve differential patterns of the experience, expression, and regulation of emotion. For example, interview studies have found that positive, but not negative, schizotypy is associated with mood disorders (e.g., Barrantes-Vidal, Gross, et al., 2013). Furthermore, questionnaire (Brown et al., 2008; Lenzenweger & Loranger, 1989; Lewandowski et al., 2006) and ambulatory assessment (Kwapil et al., 2012) studies demonstrated that experiences characterized by elevated negative affect map onto positive schizotypy, and that diminished positive affect characterizes negative schizotypy. Similarly, positive schizotypy has been associated with increased attention to negative emotions, whereas negative schizotypy is associated with decreased attention to and experience of positive emotions (Martin et al., 2011). However, these studies were limited to assessing two dimensions of schizotypy, whereas current conceptualizations of schizotypy include a third, disorganized dimension.

When including disorganized schizotypy in studies of affect in multidimensional schizotypy, this dimension (compared to positive schizotypy) better accounts for elevated negative affect and mood disorders in questionnaire (Kemp et al., 2018), interview (Kemp et al., 2021), and ambulatory assessment (Kwapil et al., 2020) studies. Furthermore, Kerns (2006) found that disorganized, but not positive, schizotypy is associated with elevated affective intensity coupled with increased attention to emotions and poorer identification of emotions, which are correlated with difficulties coping with stress (e.g., Gohm & Clore, 2002). Disorganized schizotypy has also been associated with borderline personality traits (Kwapil et al., 2022), which include emotional lability and dysregulation. Thus, disorganized schizotypy appears to include not only disorganization of thought, speech, and behavior, but also affective regulation. Consistent with current conceptualizations, negative schizotypy appears robustly associated with diminished positive affect when disorganized schizotypy is included in the models. Given findings that disorganized schizotypy accounts for affective associations previously attributed to positive schizotypy (e.g., Kerns, 2006; Kwapil et al., 2020), further investigation of affective dysregulation in multidimensional schizotypy is needed. The differential expression of affect in positive, negative, and disorganized schizotypy may also help elucidate unique etiological pathways to schizophreniaspectrum disorders.

**Affective Dynamics in Schizophrenia-Spectrum Psychopathology**

Numerous questionnaire, laboratory, and ambulatory assessment studies have demonstrated that mean levels of affect are differentially expressed in multidimensional schizotypy (e.g., Gooding et al., 2010; Kemp et al., 2018; Kerns et al., 2008). However, examining time-dependent fluctuations of affect, named affective dynamics, may convey additional information about daily-life affective regulation beyond single measures of state or trait affect (Eaton & Funder, 2001; Kuppens et al., 2012). The DynAffect Model (Kuppens et al., 2010) of affective dynamics highlights that important individual differences exist in one's affective home base (mean-level affect), as well as one's fluctuations away from baseline (intraindividual variability). Furthermore, individuals differ in their attractor strength— the extent to which they return to their home base following external and internal perturbations. The temporal patterns related to shifts away from and toward home base can be captured in affective dynamic indices as described below. Following the differentiation of mean levels across dimensions, these indices may similarly capture differential affective experiences of positive, negative, and disorganized schizotypy.

Although affective scientists have outlined numerous ways to measure affect dynamics, the present study focused on the most commonly defined and examined affect dynamics which include intraindividual variability, reactivity, inertia, and instability. Reactivity refers to the intensity of affective responses following an emotion-inducing event (Thompson et al., 2012). Inertia indicates the extent to which changes in affect persist over time, or the extent to which affective states are resistant to change or insensitive to emotional stimuli (Suls et al., 1998; Thompson et al., 2012). Variability refers to the extent to which an individual deviates from one's mean level of affect (home base), and is often operationalized as the within person standard deviation (Eid & Diener, 1999). Finally, instability refers to moment-to-moment fluctuations in affect over time, combining aspects of variability (amplitude of the time series) and temporal dependency (successive differences from one moment to the next; Jahng et al., 2011; Koval et al., 2013; Trull et al., 2008). Note that both conceptually and statistically these dynamics incorporate unique and overlapping properties. The calculation of inertia, reactivity, and instability are all bound by an individual's mean levels of affect, and instability measures are bound by the variance or variability of such affect (Dejonckheere et al, 2019). However, inertia, reactivity, and instability are unique from mean levels and variability of affect in that their calculation takes into account time, which allows for the nuanced examination of emotional experiences with more granularity.

Notably, these dynamics have been examined with respect to transdiagnostic risk for psychopathology, but appear to have distinct manifestations across disorders (Trull et al., 2015). Research using clinical and at-risk samples suggests that schizophrenia-spectrum patients show affective dynamic patterns indicative of emotional dysregulation, such as elevated NA variability (Hermans, MyinGermeys et al., 2020; Marwaha et al., 2014; Myin-Germeys et al., 2000, 2001; van der Steen et al., 2017). However, studies have produced contrasting results (e.g., Oorschot et al., 2013) or have relied on self-report at one-time point rather than repeated measurements (e.g., Marwaha et al., 2014), suggesting a need for further study of these dynamics. Furthermore, the heterogeneity of schizotypy and schizophrenia-spectrum disorders offers another promising area of study regarding affective dynamics, given that many previous studies simply examined categorical differences of healthy controls with patients or at-risk samples. For example, evidence suggests that affective dynamics are differentially associated with symptom dimensions in clinical populations (Nittel et al., 2018; Strauss et al., 2020; Westermann et al., 2017). These differential findings in clinical populations appear to extend to differences in temporal dynamics of affect across the schizotypy dimensions as well (Li et al., 2022) and schizotypic experiences in daily life (Nittel et al., 2019; Nowak & Lincoln, 2021). Furthermore, evidence that self reported stress in positive schizotypy is associated with subsequent increases in psychotic-like experiences in daily life may suggest increased affective reactivity in multidimensional schizotypy (Barrantes-Vidal, Chun, et al., 2013). Overall, these studies (see Table 1 in online supplemental materials for an overview of affective dynamics findings) provide initial evidence that affective dynamics are differentially associated with schizotypic experiences and schizophrenia-spectrum symptoms, but they either did not include examination of disorganized experiences or were largely limited to clinical samples. Examining differential associations between daily life affective dynamics in positive, negative, and disorganized schizotypy in a non-clinically ascertained sample may thereby provide additional evidence regarding distinct etiological pathways to clinical disorders.

## Experience Sampling Methodology

Affective dynamics can best be captured using sampling methods that provide time-series data, such as experience sampling methodology (ESM; also referred to as ecological momentary assessment). ESM is an ambulatory assessment method in which participants' experiences in their daily life environments are repeatedly assessed (e.g., Mehl & Conner, 2012). ESM offers advantages relative to traditional laboratory methods in that it enhances ecological validity by assessing participants in their real-world environments rather than in artificial laboratory or clinical settings. Furthermore, whereas traditional self-report measures typically ask participants to reflect on prior experiences, this method reduces retrospective bias by inquiring about participants' experiences at the time of the ESM signal (e.g., Mehl & Conner, 2012). ESM also allows for the examination of context in participants' self-reports. This is particularly relevant for the current study, as time-lagged analyses can be conducted in order to examine how self-reported experiences at one time-point influence subsequent affective expression.

## Goal and Hypotheses

This is the first study to our knowledge to examine the associations of positive, negative, and disorganized schizotypy with indices of affective dynamics in daily life. The goals of the study are to (a) replicate associations between schizotypy and mean levels of positive affect (PA) and negative affect (NA) and (b) examine the unique patterns of affective variability, reactivity, inertia, and instability in multidimensional schizotypy. Note that specific goals and hypotheses were preregistered at https://osf.io/by6eh/, and all hypotheses were investigated both at the bivariate level, and with positive, negative, and disorganized schizotypy as simultaneous predictors.

We hypothesized that positive schizotypy would be associated with elevated NA intensity, reactivity, variability, and instability in daily life at the bivariate level; however, we expected that these relationships would be better accounted for by disorganized schizotypy when included as simultaneous predictors. We hypothesized that negative schizotypy would be characterized by affective flattening in terms of diminished mean levels of PA, reduced variability, and instability of PA and NA, and diminished affective reactivity to situations either appraised as stressful or positive. We also expected that negative schizotypy would demonstrate inertia in both PA and NA. That is, consistent with prior findings that negative symptoms were associated with increased regulatory tendency (Westermann et al., 2017) and persistence of baseline affect (Li et al., 2022), we expected that individuals high in negative schizotypy would remain close to baseline levels of both PA and NA. Given the conceptualization that disorganized schizotypy includes an inability to organize affective responses, and the association of disorganized schizotypy and borderline personality traits (Kwapil et al., 2022), we expected generalized dysregulated affect in disorganized schizotypy. In addition to our earlier hypothesis that disorganized schizotypy would better account for NA affective dynamics relative to positive schizotypy, we hypothesized that disorganized schizotypy would also be associated with diminished mean levels of PA, variability and instability of PA, and increased PA reactivity to situations appraised as positive.

# Method

## Participants

We determined power and sample size according to suggested practices (see Text 1 in the online supplemental material or https://osf.io/ by6eh/ for details) from simulation research (Maas & Hox, 2005) and multilevel model researchers (e.g., Heck & Thomas, 2015; Hox, 2002). This study used a nonclinically ascertained sample of young adults ($n = 295$) recruited from a university psychology subject pool via two methods. First, any eligible (at least 18 years of age) participant was invited to sign up, resulting in a broad range of scores on the three schizotypy subscales. Second, we oversampled for elevated schizotypy by inviting all participants who scored at least 1.5 SDs above the mean on the Multidimensional Schizotypy Scale-Brief (Gross et al., 2018) positive, negative, or disorganized schizotypy subscales taken during a departmental prescreening. This enrichment procedure was used to ensure that we enrolled participants who scored across the full range of the three schizotypy dimensions and that we had adequate representation of elevated scores on the schizotypy subscales. Note that when using this sampling method, interview studies with nonclinically ascertained samples (e.g., Kemp et al., 2021; Kwapil et al., 2022) demonstrated that elevated scores on the MSS subscales are associated with heightened rates of schizophrenia-spectrum personality disorders, schizophrenia-spectrum symptoms, and impaired functioning (on the order of medium to large effect sizes). Consistent with our previous studies (e.g., Kemp et al., 2022; Kwapil et al., 2020), participants were dropped from the analyses for having elevated scores on an infrequency measure as defined below (n = 3) or completing fewer than 20 valid ESM surveys (n = 17), resulting in a final sample of 275 participants with usable data.

## Materials and Procedures

Participants completed a demographic questionnaire and the MSS prior to the start of ESM data collection. The MSS contains 77 truefalse items assessing positive, negative, and disorganized schizotypy. The MSS items were intermixed with a 13-item infrequency scale (Chapman & Chapman, 1983) to identify invalid protocols. Participants endorsing more than three infrequency items were omitted from the analyses.

The ESM questionnaire included 29 items assessing a variety of daily life experiences, including positive affect (PA), negative affect (NA), and appraisals of the current situation ("My current situation is positive," "My current situation is stressful"). All items, indices, and reliabilities are presented in Table 2 in the online supplemental materials. The chosen items were drawn from prior ESM studies in our lab (e.g., Barrantes-Vidal, Chun, et al., 2013; Kwapil et al., 2012; Sperry & Kwapil, 2017), and the items assessing affect covered the affective circumplex (Russell, 1980) in terms of valence and arousal.

Participants attended a 1-h information session in which they downloaded the ExpiWell smartphone application, completed self-report questionnaires of demographics, personality, and affective functioning, and were trained on ESM procedures. Participants were signaled eight times daily between noon and midnight for 7 days to complete ESM surveys on their personal smartphones. Initial notifications were sent at random times within the first 80 min of each 90-min time block. Consecutive survey notifications could then range from being 10 min apart to 170 min apart. Participants had 10 min to complete each survey from the initial notification, after which the survey expired so that participants could not complete them at a later time. Participants returned to the lab for one follow-up session 2–3 days after their information session in order to encourage compliance and troubleshoot technical problems.

## Analytic Plan

In order to test our preregistered hypotheses for affective reactivity, inertia, and variability, we used Dynamic Structural Equation Modeling (DSEM; Hamaker et al., 2018). We fit bivariate multilevel first-order vector autoregressive (VAR[1]) models. Specifying 10,000 iterations, each model was estimated using Bayesian Markov Chain Monte Carlo estimation which imputes missing data. DSEM decomposes within- and between-person variance using latent mean centering and allows for multiple random effects and their covariances to be modeled simultaneously. Unconditional models (see Figure 1) were fit for each within-person variable of interest (NA with stress trigger, PA with positive trigger). These models result in eight random effects: mean intensity (2), autoregressive coefficients (2), cross-lagged regressions (2), and variability (2; as indicated by random logs of unique innovation variance). Following estimation of each unconditional model, we fit models that regressed all random effects at the between-person level on MSS positive, negative, and disorganized schizotypy (grand mean centered). We first ran models looking at each subscale's bivariate association with these effects, and then with each subscale entered simultaneously in order to examine the prediction of each subscale over and above the other two schizotypy subscales. All DSEM analyses were computed with MPlus 8.3 (Muthén & Muthén, 2010).

In order to test our hypotheses regarding affective instability, we ran multilevel models in R Studio Version 1.3.1073 that assessed the association of MSS positive, negative, and disorganized schizotypy subscales (Level 2 predictors) with instability of NA and PA, respectively (R code is provided on the study's OSF page). Instability was calculated following guidelines by Jahng et al. (2008) as the root mean square of successive differences adjusting for unequal spacing between prompts using the following formula:

$$\mathrm{RMSSD} = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N-1}\left(\frac{x_{i+1}-x_i}{\left[\frac{t_{i+1}-t_i}{\mathrm{Mdn}(t_{i+1}-t_i)}\right]^{\lambda}}\right)^2}.$$

Instability models predicted adjusted successive differences and were specified as follows:

$$\mathrm{NA\_RMSSD}\ ij = y00 + y01(\mathrm{Z} \cdot \mathrm{MSSP})j + y02(\mathrm{Z} \cdot \mathrm{MSSN})j + y03(\mathrm{Z} \cdot \mathrm{MSSD})j + y04(\mathrm{NA})j + \mathrm{U}0j + \mathrm{R}ij.$$

## Transparency and Openness Promotion

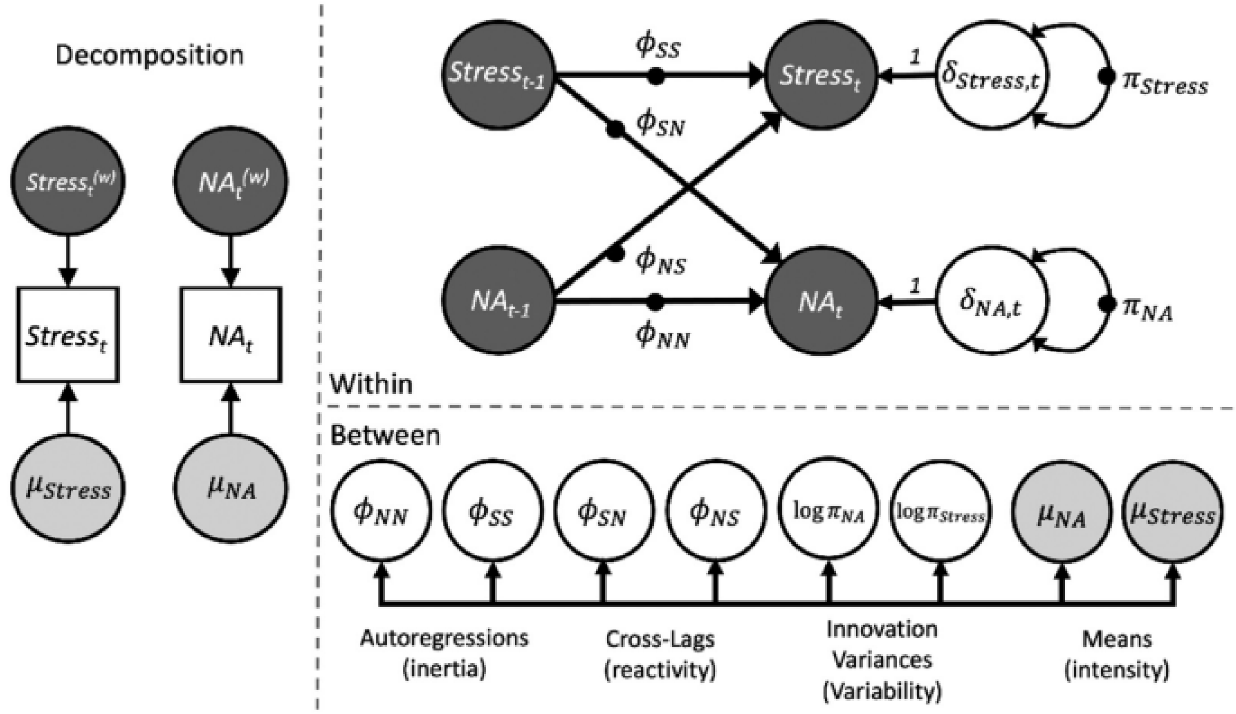
The specific goals, hypotheses, analytic plan, study materials, and power analysis for the study were pre-registered on Open Science Framework at https://osf.io/by6eh/. Data and analytic code for the study are available on Open Science Framework.

## Results

Participants completed an average of 46.3 (SD = 10.5, range = 20–64) usable ESM surveys. Due to the COVID-19 pandemic shutdown, data collection was terminated one month prematurely in March 2020, resulting in fewer opportunities for oversampling higher scorers on the MSS. Despite this, the sample scored across a wide range of scores on the MSS positive, negative, and disorganized schizotypy subscales (Table 1). Note that consistent with previous interview (e.g., Kemp et al., 2021) and ESM (e.g., Kwapil et al., 2020) studies using this recruitment method, 20% of the sample (n = 54) had at least one MSS subscale score .1.5 SD above the mean and 36% (n = 98) had at least one subscale score .1.0 SD above the mean. In accordance with the study preregistration, α was set to .05 for all analyses. As seen in the values in Table 1, mean scores were lower for negative schizotypy than for positive and disorganized schizotypy, suggesting that overall we were not as successful recruiting participants with elevated negative schizotypy compared to the other two dimensions. Table 3 in the online supplemental materials presents the number and percentage of participants with elevated scores on each of the MSS subscales.

**Figure 1.**

*Example Dynamic Structural Equation Model (DSEM) with Situation Stressful and Negative Affect*




*Note.* Example path diagram for unconditional bivariate multilevel VAR(1) model. Eight random effects were specified: two individual differences each (stress and NA) for mean intensity, autoregressions, cross-lagged regressions, and innovation variances (variability). Adapted from "At the Frontiers of Modeling Intensive Longitudinal Data: Dynamic Structural Equation Models for the Affective Measurements From the COGITO Study," by E. L. Hamaker, T. Asparouhov, A. Brose, F. Schmiedek, and B. Muthén, 2018, Multivariate Behavioral Research, 53(6), p. 826. http://www.tandfonline.com/doi/full/10.1080/00273171.2018.1446819.
CC BY-NC-ND. Adapted with permission. Full model outputs are available in online supplemental materials. (w) = within-individual variables; NA = negative affect.

We examined associations between average levels and variability of affect with situation appraisals in daily life using unconditional DSEM models. For models evaluating situation stressful with NA and situation positive with PA, full correlation matrices between random effects at the between-person level and unstandardized point estimates are available in Tables 4–6 in the online supplemental materials. First, as expected, a person's average level of NA ($\mu_{NA}$) was associated with average levels of situation stressful ($\mu_{Stress}$), and average level of PA ($\mu_{PA}$) was associated with average levels of situation positive ($\mu_{SitPos}$). Greater variability of situation stressful, log($\pi_{Stress}$), was also associated with greater mean intensity ($\mu_{NA}$) and variability of NA, log($\pi_{NA}$). Variability of situation positive, log($\pi_{SitPos}$), was inversely associated with intensity of PA but directly associated with variability of PA, log(πPA). Note that there were significant individual differences in the pathways in the DSEM models, indicating that there is significant between-person heterogeneity in the within-person association between momentary reports of affect and situation appraisals.

**Momentary Associations of Schizotypy Dimensions With Mean Affect and Affective Dynamics**

We examined models in which the MSS subscales were entered as between-subjects predictors of the eight random effects specified in each model (Table 2). As expected, the three schizotypy subscales were differentially associated with temporal dynamics of affect at the momentary level. First, we examined the associations of the MSS schizotypy subscales with mean intensity and variability of affect and situational appraisals. As hypothesized, positive schizotypy was associated with intensity ($\mu_{NA}$) and variability, log($\pi_{NA}$), of NA at the bivariate level. Negative schizotypy was also associated with NA mean intensity ($\mu_{NA}$) at the bivariate level. However, these relationships were better accounted for by disorganized schizotypy, which was associated with NA over-and-above the other two schizotypy dimensions. Relatedly, disorganized schizotypy was associated with intensity of situation stressful ($\mu_{Stress}$), and with variability of both NA, log($\pi_{NA}$), and situation stressful, log($\pi_{Stress}$).

As hypothesized, negative schizotypy was inversely associated with intensity of PA ($\mu_{PA}$) and situation positive ($\mu_{SitPos}$), and with reduced variability of PA, log($\pi_{PA}$), at both the bivariate level and over-and-above the other schizotypy dimensions. At the bivariate level, positive schizotypy was associated with variability of situation positive, log($\pi_{SitPos}$) but was no longer associated in analyses in which all three schizotypy subscales were entered as simultaneous predictors. Disorganized schizotypy was associated with diminished mean levels of PA ($\mu_{PA}$) at the bivariate level; in contrast to a priori hypotheses, disorganized schizotypy was not associated with either mean levels or variability of PA when all three subscales were entered as simultaneous between-subjects predictors. However, although this was not hypothesized, disorganized schizotypy was inversely associated with situation positive ($\mu_{SitPos}$), and was associated with increased variability of these appraisals, log ($\pi_{SitPos}$).

Next, we examined autoregressive relationships for affect (NA and PA) and situation appraisal (situation stressful and situation positive) at the momentary level (Figure 2). There were significant autoregressive relationships for all affect and appraisal items ($\varphi_{NN}$, $\varphi_{SS}$, $\varphi_{PP}$, $\varphi_{SPSP}$), indicating that the extent to which an individual deviated from their baseline at one moment was associated with the likelihood of continuing to deviate from their baseline at the next moment. When entering positive, negative, and disorganized schizotypy into the model, there were only two significant autoregressive relationships. Positive schizotypy was associated with a significant autoregressive relationship for situation stressful ($\varphi_{SS}$) in both bivariate and simultaneous regression analyses, suggesting that the within-person association for situation stressful was stronger for positive schizotypy. Disorganized schizotypy demonstrated a negative autoregressive relationship for positive appraisals of situations ($\varphi_{SPSP}$). That is, the association between situation positive at $t - 1$ and t was weaker for disorganized schizotypy.

We examined the cross-lagged relationships between affect and situation appraisals (Figure 2). Situation appraisal and momentary affect were associated in all cross-lagged relationships. That is, if a person appraised their situation as more stressful than their average self-report, they were more likely to experience heightened NA at the next moment. Furthermore, if a person appraised their situation as more positive than their average self-report, they were more likely to experience heightened PA at the next timepoint. There were significant cross-lagged relationships in the reverse direction as well (e.g., NA predicting situation stressful at the next time point). MSS scores predicted three cross-lagged effects. First, as expected, the within-person association between situation stressful and NA was stronger for those high in

**Table 1**

Descriptive Statistics for the Multidimensional Schizotypy Scale

| | | | | | Correlations | |
|---|---|---|---|---|---|---|
| MSS schizotypy subscales | *M* | *SD* | Range | Coefficient α | Negative schizotypy | Disorganized schizotypy |
| MSS positive schizotypy | 4.19 | 4.63 | 0–24 | .88 | .14* | .49* |
| MSS negative schizotypy | 2.94 | 3.85 | 0–24 | .86 | | .26* |
| MSS disorganized schizotypy | 4.12 | 5.49 | 0–25 | .93 | | |

*Note*. MSS = Multidimensional Schizotypy Scale. **p* > .001.

**Table 2**

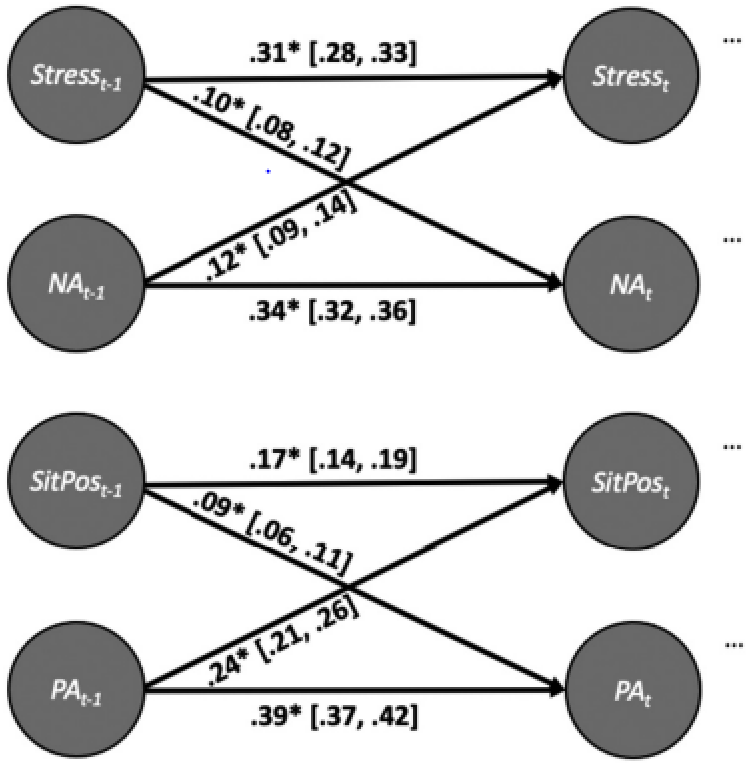
Momentary Conditional DSEM Model With MSS Subscales Predicting Random Effects (n = 275)

| | Bivariate associations | | | Simultaneous predictors | | |
|---|---|---|---|---|---|---|
| Criteria | MSS positive schizotypy Estimate [95% CI | MSS negative schizotypy Estimate [95% CI | MSS disorganized schizotypy Estimate [95% CI | MSS positive schizotypy Estimate [95% CI | MSS negative schizotypy Estimate [95% CI | MSS disorganized schizotypy Estimate [95% CI |
| NA and stress | **0.12 [0.03, 0.21]** | **0.09 [0.01, 0.17]** | **0.26 [0.17, 0.33]** | 0.01 [−0.08, 0.11] | 0.03 [−0.05, 0.12] | **0.25 [0.14, 0.33]** |
| NA mean intensity ($\mu_{NA}$) | 0.02 [−0.08, 0.10] | 0.09 [0.00, 0.17] | **0.15 [0.05, 0.23]** | −0.07 [−0.17, 0.04] | 0.06 [−0.03, 0.15] | **0.17 [0.06, 0.27]** |
| Stress mean intensity ($\mu_{Stress}$) | −0.06 [−0.19, 0.07] | −0.08 [−0.20, 0.04] | −0.08 [−0.21, 0.05] | −0.03 [−0.17, 0.11] | −0.06 [−0.19, 0.07] | −0.05 [−0.20, 0.09] |
| NA autoregression ($\varphi_{NN}$) | **0.14 [0.03, 0.24]** | −0.03 [−0.14, 0.07] | 0.05 [−0.07, 0.16] | **0.15 [0.03, 0.27]** | −0.04 [−0.15, 0.07] | −0.02 [−0.15, 0.11] |
| Stress Stress$_{t-1}$ → NAt cross-lag ($\varphi_{SN}$) | 0.09 [−0.05, 0.24] | 0.03 [−0.13, 0.17] | **0.23 [0.07, 0.38]** | 0.00 [−0.15, 0.16] | −0.03 [−0.18, 0.13] | **0.22 [0.06, 0.39]** |
| NA$_{t-1}$ → Stress$_t$ cross-lag ($\varphi_{NS}$) | −0.14 [−0.29, 0.02] | 0.09 [−0.07, 0.25] | 0.01 [−0.15, 0.17] | −0.20 [−0.39, 0.01] | 0.09 [−0.07, 0.25] | 0.08 [−0.11, 0.28] |
| NA variability, log($\pi_{NA}$) | **0.10 [0.01, 0.19]** | 0.06 [−0.03, 0.14] | **0.18 [0.10, 0.26]** | 0.01 [−0.08, 0.11] | 0.01 [−0.08, 0.09] | **0.17 [0.07, 0.26]** |
| Stress variability, log($\pi_{Stress}$) | 0.02 [−0.06, 0.11] | 0.04 [−0.05, 0.13] | **0.13 [0.04, 0.21]** | −0.05 [−0.15, 0.05] | 0.01 [−0.08, 0.09] | **0.14 [0.04, 0.24]** |
| Positive affect (PA) and situation positive (SitPos) | | | | | | |
| PA mean intensity ($\mu_{PA}$) | 0.00 [−0.09, 0.08] | **−0.21 [−0.28, −0.12]** | **−0.09 [−0.17, −0.00]** | 0.06 [−0.03, 0.16] | **−0.19 [−0.28, −0.11]** | −0.06 [−0.17, 0.03] |
| SitPos mean intensity ($\mu_{SitPos}$) | −0.06 [−0.15, 0.02] | **−0.18 [−0.27, −0.10]** | **−0.15 [−0.24, −0.07]** | 0.02 [−0.08, 0.12] | **−0.15 [−0.24, −0.07]** | **−0.12 [−0.23, −0.02]** |
| PA autoregression ($\varphi_{PP}$) | 0.01 [−0.15, 0.16] | −0.11 [−0.27, 0.02] | 0.04 [−0.11, 0.20] | −0.01 [−0.19, 0.16] | −0.14 [−0.28, 0.02] | 0.09 [−0.09, 0.25] |
| SitPos autoregression ($\varphi_{SPSP}$) | 0.01 [−0.13, 0.15] | 0.06 [−0.08, 0.20] | −0.10 [−0.23, 0.03] | 0.07 [−0.09, 0.23] | 0.10 [−0.04, 0.24] | **−0.16 [−0.31, −0.01]** |
| SitPos$_{t-1}$ → PAt cross-lag ($\varphi_{SPP}$) | 0.07 [−0.11, 0.25] | −0.03 [−0.19, 0.13] | −0.01 [−0.17, 0.14] | 0.09 [−0.10, 0.29] | −0.03 [−0.19, 0.14] | −0.06 [−0.24, 0.14] |
| PA$_{t-1}$ → SitPost cross-lag ($\varphi_{PSP}$) | 0.09 [−0.08, 0.25] | **−0.24 [−0.40, −0.08]** | **0.21 [0.04, 0.40]** | 0.00 [−0.17, 0.20] | **−0.32 [−0.48, −0.15]** | **0.29 [0.10, 0.46]** |
| PA variability, log($\pi_{PA}$) | 0.04 [−0.06, 0.13] | **−0.09 [−0.18, −0.01]** | 0.03 [−0.06, 0.12] | 0.03 [−0.07, 0.13] | **−0.11 [−0.20, −0.02]** | 0.04 [−0.06, 0.14] |
| SitPos variability, log($\pi_{SitPos}$) | **0.10 [0.01, 0.18]** | 0.03 [−0.06, 0.12] | **0.13 [0.04, 0.22]** | 0.04 [−0.06, 0.14] | −0.01 [−0.10, 0.08] | **0.11 [0.01, 0.20]** |

*Note.* Credibility intervals that do not contain 0 are viewed as significant (bolded). Estimates for conditional models (with MSS) represent standardized posterior estimates.
MSS = Multidimensional Schizotypy Scale; DSEM = Dynamic Structural Equation Modeling; PA = positive affect; NA = negative affect.

**Figure 2**

*Within-Level Standardized Posterior Estimates for Autoregressive and Cross-Lag Random Effects*




*Note*. Significant pathways (bolded solid lines with *) represent estimates that have a 95% credibility interval that does not contain 0.

high in disorganized schizotypy, such that Table 2 Momentary Conditional DSEM Model With MSS Subscales Predicting Random Effects (n reporting elevated stress compared to one's baseline was associated with subsequent NA. Next, there was a weakened within-person association between reporting PA and subsequently appraising a situation as positive (φPSP) for individuals high in negative schizotypy. In contrast, this within-person association was stronger for individuals high in disorganized schizotypy.

Lastly, our results indicated that the schizotypy dimensions are largely unrelated to affective instability (Table 3) across our sampling period. Specifically, we evaluated the extent to which positive, negative, and disorganized schizotypy were associated with NA and PA instability using three models—one in which we examined the bivariate associations between each of the three dimensions and instability, one in which the three dimensions were entered simultaneously as the only predictors, and one in which mean levels of affect were added as a fourth predictor. Notably, positive schizotypy was associated with NA instability at the bivariate level, but was no longer associated when all three dimensions were entered simultaneously. Furthermore, disorganized schizotypy predicted NA instability at the bivariate level and when the three schizotypy subscales were entered as simultaneous predictors; however, this association was better accounted for by mean levels of NA (which were elevated in disorganized schizotypy). None of the schizotypy dimensions were associated with instability of PA in either the bivariate or simultaneous models.

## Discussion

Affective dysregulation has long been identified as a key feature and indicator of risk for psychopathology, including schizophreniaspectrum disorders (e.g., Myin-Germeys & van Os, 2007). Differences in mean levels of affect have been widely reported in clinical disorders (Watson & Naragon-Gainey, 2010), as well as in specific schizotypy dimensions (Kemp et al., 2018; Martin et al., 2011). Beyond single measures of state or trait affective differences, however, affective dynamics may convey additional information about affective regulation and risk for disorders (e.g., Trull et al., 2015). These dynamics have been investigated in clinical disorders (Strauss et al., 2020; Westermann et al., 2017) and are beginning to be investigated in subclinical schizotypy (Li et al., 2022; Nittel et al., 2019; Nowak & Lincoln, 2021). Although initial evidence suggests the differential expression of affective dynamics across dimensions, to our knowledge these dynamics have not been examined in positive, negative, and disorganized schizotypy. The present study extended investigations of affective dysregulation in schizophrenia-spectrum psychopathology by employing ESM to examine the daily-life expression of affective dynamics in positive, negative, and disorganized schizotypy in a nonclinically ascertained sample. As hypothesized, we replicated findings of mean levels of affect across schizotypy dimensions, and found the dimensions were differentially associated with affective dynamics above mean levels.

Positive schizotypy includes psychotic-like experiences such as odd beliefs, unusual perceptions, and suspiciousness. In studies limited to examining positive and negative schizotypy, positive schizotypy has often been associated with elevated negative affect (e.g., Brown et al., 2008; Kwapil et al., 2012; Lewandowski et al., 2006). Recent research including disorganized schizotypy, however, indicates that these associations for positive schizotypy occur at the bivariate level, but “migrate” to disorganized schizotypy (Kemp et al., 2018; Kwapil et al., 2020). Consistent with these findings and our hypotheses, the present study demonstrated that positive schizotypy was associated with mean levels (intensity) and variability of NA at the bivariate level but that these experiences were better explained by disorganized schizotypy. It may be that disruptions in the abilities to organize, understand, and express emotions are core aspects of disorganized schizotypy, whereas expression of negative affect in positive schizotypy is secondary to core features of the dimension such as suspiciousness, odd beliefs, and strange perceptual experiences, which may be exacerbated by disorganized schizotypy. We believe that understanding the processes underlying the disrupted affective experiences in all three schizotypy dimensions is a fruitful area of further study.

Negative schizotypy involves deficit-like experiences, including affective flattening and anhedonia. Accordingly, negative schizotypy is typically robustly associated with diminished PA in studies using either two-dimensional (e.g., Kwapil et al., 2012; Martin et al., 2011) or three-dimensional (Kemp et al., 2018; Kwapil et al., 2020) conceptualizations of schizotypy. In the present study, negative schizotypy was also associated with diminished intensity and variability of PA. Negative schizotypy thereby demonstrates not only lower mean levels of PA, but also diminished deviation from baseline levels of PA across 1 week.

**Table 3**

Association of Schizotypy with Positive and Negative Affective Instability in Daily Life

| | Bivariate model | | | Model 1 | | | Model 2 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Criterion | Positive schizotypy | Negative schizotypy | Disorganized schizotypy | Positive schizotypy | Negative schizotypy | Disorganized schizotypy | Positive schizotypy | Negative schizotypy | Disorganized schizotypy | Mean affect |
| NA instability | **.08*** | .06 | **.15***** | .01 | .02 | **.14**** | .01 | .01 | .03 | **.41***** |
| PA instability | .01 | −.07 | .02 | .01 | −.08 | .04 | −.02 | .01 | .06 | **.29***** |

Note. Statistically significant results in bold. Raw multilevel regression coefficients indicating the relationship of the level 2 predictors (schizotypy dimensions) with the level 1 (daily life experience) criteria. PA = positive affect; NA = negative affect.

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

Historically, the association of negative schizotypy with NA is less clear than with PA, consistent with the broader literature on negative symptoms of schizophrenia and negative affect (e.g., Cowan et al., 2020; Yee et al., 2019). For example, previous ESM studies have found that negative schizotypy is associated with elevated NA in daily life (e.g., Kwapil et al., 2012), unassociated with NA (e.g., Barrantes-Vidal, Chun, et al., 2013), and associated with diminished NA (e.g., Kwapil et al., 2020). In a large survey study, Li et al. (2019) found that negative schizotypy based on the Revised Social Anhedonia Scale (Eckblad et al., 1982) was associated with increased trait NA and attention to negative emotion. In contrast Kemp et al. (2018) found that negative schizotypy assessed by the MSS was unassociated with NA. Furthermore, the review by Horan et al. (2008) highlights that non-ESM studies have reported that negative schizotypy is associated with elevated NA.

We suggest that some of this inconsistency may at least in part reflect inconsistency in operationalization and measurement of negative schizotypy. Specifically, it appears that some older measures purporting to assess negative schizotypy tap constructs such as social anxiety and neuroticism that are not conceptualized as part of this dimension. The MSS negative schizotypy subscale was developed on a model that emphasized social disinterest, flat affect, anhedonia, alogia, anergia, and avolition, not elevated NA, as core features. Thus, it is not surprising that the MSS negative schizotypy subscale is unassociated with neuroticism (Kwapil, Gross, Burgin et al., 2018), which is characterized by elevated NA. Furthermore, when MSS negative schizotypy has been associated with depression-related measures, it appears to be due to items tapping loss of interest and pleasure, not items tapping elevated NA (Kemp et al., 2018, 2022). Accordingly, although negative schizotypy was associated with elevated NA intensity at the bivariate level in the present study, this association was again better accounted for by disorganized schizotypy. Negative schizotypy was also unassociated with variability of NA. Although it would not be surprising that the experience of prominent negative schizotypy could create a sense of discontent, this does not appear to be a primary characteristic of negative schizotypy. The inconsistent findings regarding negative schizotypy and negative affect highlight the need for clarity in terms of the conceptualization and measurement of negative schizotypy, as well as the assessment of its association with negative affect across multiple modalities.

In contrast to our hypotheses and prior findings with nonclinical (Li et al., 2022) and clinical samples (Westermann et al., 2017), negative schizotypy was unassociated with affective dynamics captured on a moment-to-moment basis. Specifically, negative schizotypy was unassociated with affective inertia, reactivity, or instability in all models. Our results suggest that investigating affective expression on a moment-to-moment timescale may be less relevant to examining negative schizotypy and more relevant to examining other dimensions. Another consideration is that early termination of data collection due to the COVID-19 pandemic may have limited the number of high schizotypy scorers as well as amount of variance for negative schizotypy to detect hypothesized dynamics related to increased inertia or diminished reactivity and instability of affect. Initial findings for the expression of affective dynamics in negative schizotypy are promising but may benefit from further oversampling.

Disorganized schizotypy, which involves disruptions in the experience and expression of thought, speech, and behavior, is the least studied of the schizotypy dimensions. There is compelling evidence from prior studies (Kemp et al., 2018; Kerns, 2006; Kwapil et al., 2022) and the present study that these disruptions extend to the organization and expression of affect. As hypothesized, affective dynamics were most pronounced in disorganized schizotypy, and this dimension better accounted for associations that likely would have been attributed to positive schizotypy in two-dimensional models. Specifically, disorganized schizotypy had the strongest associations with intensity, variability, and reactivity of NA. Disorganized schizotypy was also associated with intensity and variability of appraising a situation as stressful. Finally, disorganized schizotypy demonstrated NA instability before accounting for mean levels of NA, which were also elevated in disorganized schizotypy. These findings are consistent with the associations that have been drawn between disorganized schizotypy and borderline personality traits (Kwapil et al., 2022) and suggest that dysregulated NA in particular is robustly associated with disorganized schizotypy. The consistent associations between disorganized schizotypy and affective dysregulation in terms of both mean levels and temporal affective dynamics are especially notable given that the MSS disorganized schizotypy subscale does not contain items directly inquiring about affective experiences.

In contrast to our hypotheses, disorganized schizotypy was unassociated with PA reactivity, instability, and variability, suggesting that this dimension is not characterized by generalized deficits in affective regulation. Considering the presentation of disorganization, evidence suggests that disruptions in communication occur when discussing emotionally negative topics (e.g., Docherty & Hebert, 1997). Furthermore, disorganized schizotypy has been associated with meta-emotion constructs of increased emotional confusion and emotionality (Kerns, 2006), and emotional confusion has been associated with disruptions in thought in response to acute stress (Gohm et al., 2001). Features of disorganization, therefore, may be specifically linked to dysregulation of responses to stress, such as NA, rather than dysregulation of PA. However, it is unclear the extent to which disorganized schizotypy results in and/or is a consequence of dysregulated NA. Two important next steps for studying affect in schizotypy include an examination of the temporal precedence of disorganized experiences and affective disruptions in daily life, as well as the assessment of meta-emotion in relation to affective dynamics and schizotypy.

A possible criticism is that the associations of trait-based positive, negative, and disorganized schizotypy with the ESM measures of affect and affective dynamics might represent "criterion contamination" in the form of overlap between the MSS and ESM measures. However, none of the MSS positive or disorganized schizotypy items directly tap affective experiences. We did, however, identify six MSS negative schizotypy items that inquire about affect or affective dynamics. Four items broadly tap trait-like flattened affect (e.g., My emotions have almost always seemed flat regardless of what is going on around me), whereas two tap trait-like anhedonia (e.g., There are just not many things that I have ever really enjoyed doing). However, rather than a risk of criterion contamination, we believe that it offers support that trait-like reports are in fact associated with real-world, hypothesized affective experiences (consistent with our model of negative schizotypy). Consensus seems to support that anhedonia and flattened affect are core components of negative schizotypy and negative symptoms of schizophrenia. As hypothesized, we expected that individuals who report trait-like negative schizotypy would be more likely to report momentary experiences of diminished positive affect and disrupted patterns of affective experiences. In fact, failure to find associations between MSS negative schizotypy and such experiences in the real world would raise grave concerns about the validity of the measures at hand. Furthermore, keep in mind that anhedonia and flattened affect measured by the MSS and positive affect assessed in our ESM questionnaire are measured in very different time scales. As noted by Kwapil et al. (2020) "the convergence of symptoms and impairments across assessment modalities strengthens the construct validity of the multidimensional schizotypy model and measures. Furthermore, such a criticism ignores that schizotypy questionnaires, structured interviews, and ambulatory assessments are assessing different, albeit related, experiences on different timescales" (p. 500).

Temporal dynamics of affect convey context-relevant information regarding affective regulation differences, such as an individual's sensitivity to a prior emotion-inducing event and ability to selfregulate. Previous studies indicate that at least some people with schizophrenia-spectrum disorders react more strongly to stress (Myin-Germeys et al., 2001; van der Steen et al., 2017), and the present findings in multidimensional schizotypy corroborate this finding, especially for individuals high in disorganized schizotypy. Our study provides support, in particular, for evaluating variability due to its associations with negative and disorganized schizotypy even when accounting for mean levels using DSEM. That is, the extent to which a person deviates from their home base across a time series appears to be an important identifier of multidimensional schizotypy, rather than moment-to-moment fluctuations like instability. Although we found evidence that some affective dynamics are differentially associated with schizotypy dimensions above mean levels, our findings suggest that mean levels better account for instability. This is consistent with Dejonckheere et al.'s (2019) warnings that affective dynamics do not account for much added variance beyond mean levels of affect. It is possible, however, that instability would be robust to mean levels of affect in more severely impaired samples, or in samples that are successfully enriched with higher scorers on the schizotypy dimensions. Another consideration is whether participants conflate affect and situational appraisals when providing ratings in daily life, especially given high withinand between-correlations within our sample (Table 7 in the online supplemental materials). Future studies would benefit from evaluating the influence of specific events (e.g., social rejection) on temporal dynamics of affect in multidimensional schizotypy.

Given that affective dynamics are differentially associated with psychometrically assessed schizotypy, future studies should investigate whether affective dynamics predict subsequent schizotypic experiences in daily life, and whether these dynamics predict the later development of clinical disorders in schizotypic individuals. For example, clinical research on first-episode psychosis noted that changes in affect precede symptom episodes (Hermans, van der Steen et al., 2020). Furthermore, affective dynamics have been shown to concurrently and prospectively predict bipolar disorders (Sperry et al., 2020), which share etiological features with psychotic disorders (e.g., Cardno & Owen, 2014). Thus, studying affective dynamics in schizotypy may similarly clarify whether differential reactions to experiences in daily life predispose individuals to schizophrenia-spectrum psychopathology.

The present study provides further support for the multidimensional model of schizotypy and demonstrates that the schizotypy dimensions are associated with distinct correlates. Positive, negative, and disorganized schizotypy are differentially associated with symptoms, impairment, and disorders (Kemp et al., 2021; Kwapil et al., 2022), as well as normal personality (Kwapil, Gross, Burgin et al., 2018), cognitive functioning (Sahakyan et al., 2019), and affect (Kemp et al., 2018). Failure to consider the dimensions separately from one another results in an important loss of conceptual and empirical information. For example, scoring highly in schizotypy, without regard to the different dimensions, is broadly associated with elevated negative affect and diminished positive affect (e.g., Najolia et al., 2011). This may characterize people with mixed presentations of schizotypy (Li et al., 2019) but neglects experiences that may differentiate risk for schizophrenia-spectrum psychopathology. Similarly, if we were to consider schizotypy as an omnibus construct in the present study, it would not have been possible to capture the differential affective patterns in schizotypy. The differential patterns of affective dysregulation in terms of mean levels and dynamics of PA and NA across the schizotypy dimensions thereby provide additional support for its multidimensional structure and the possibility of distinct etiological pathways for schizophrenia-spectrum disorders.

We have strenuously argued here and elsewhere (e.g., Kwapil & Barrantes-Vidal, 2015; Kwapil, Gross, Burgin et al., 2018) that schizotypy should be conceptualized as a multidimensional construct and offered empirical evidence that failing to treat schizotypy multidimensionally loses conceptual and statistical power (e.g., Kemp et al., 2021). We also believe that there are compelling reasons to consider these dimensions as part of a superordinate construct of schizotypy, rather than independent dimensions. So, conceptually and empirically we would expect that there should be some degree of overlap between the dimensions. This is borne out in the moderate positive correlations (typically .20–.40) between the three MSS subscales. We believe that the residualized schizotypy scores (after the simultaneous entry of the MSS subscales) provide a useful representation of the core features of the dimension. This said we are also cognizant of the "perils of partialing" concerns raised by Lynam et al. (2006) and more recently by Hoyle et al. (2022) and believe it is important to report and interpret both the bivariate and residualized findings for the schizotypy dimensions. However, numerous studies have examined the unique associations of the three schizotypy dimensions with interview, questionnaire, laboratory, and ESM measures of symptoms and impairment. These studies consistently support that, as hypothesized, the core features of positive schizotypy are odd beliefs, unusual perceptual experiences, and suspiciousness, the core features of negative schizotypy are anhedonia, flattened affect, asociality/social anhedonia, anergia, and avolition, and the core features of disorganized schizotypy are disruptions in the organization and expression of thought, communication, behavior, and emotion. We believe that the present findings are consistent with these operationalizations and that the residualized effects bring clarity to these hypothesized associations.

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