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Understanding how child temperament, negative parenting, and dyadic parent–child behavioral variability interact to influence externalizing problems

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Abstract

To better understand the development of externalizing behavior, the current study examines how multiple levels of influence (child temperament, negative parenting, and dyadic interactions) work together to increase externalizing behaviors over time. Negative parenting (NP) and observed dynamic dyadic behavioral variability (DBV) in parent–child interactions (e.g., in discipline and compliance) are characteristic of coercive family processes. The present study first examined latent profiles of temperament in 3-year-olds (N = 150). Four temperament profiles emerged: high reactive, exuberant, low reactive, and inhibited. Temperament profiles were then examined as moderators of the effects of the age of three NP and DBV on child externalizing problems at the age of four. Exuberant temperament exacerbated the association between higher levels of NP and DBV and higher levels of child externalizing. Additionally, temperament moderated the combined effects of NP and DBV such that at low and mean levels of NP, children with exuberant temperaments who experienced higher DBV had higher externalizing behaviors, whereas at higher levels of NP, the influence of DBV was no longer significant. Results suggest pathways by which children's experiences of NP and DBV with parents contribute to their greater externalizing problems over time, in the context of the child's unique temperament profile.

KEYWORDS
externalizing, exuberance, harsh parenting, parent–child interactions, temperament

1 | INTRODUCTION

Early externalizing behaviors, including aggression, impulsivity, and other disruptive problem behaviors, are associated with adverse outcomes for children, including poorer peer relationships and conduct and adjustment problems in the school years (Campbell et al., 2010; Olson et al., 2017). Systems theories argue that the emergence of developmental psychopathology exists at the intersection of multiple influences, including child, parent, family, and contextual factors (Bronfenbrenner & Morris, 2006). Difficult child temperament, negative parenting (NP), and negative parent–child interactions are primary antecedents for the development of externalizing problems in children (Hollenstein et al., 2004; Lunkenheimer et al., 2011; Smith et al., 2014). Individual parent and child risk factors often interact to exacerbate children's externalizing problems, such as when difficult child temperament evokes more NP behaviors (Klein et al., 2018). In turn, NP may contribute to a parent–child coercive cycle (Patterson, 2002; Scaramella & Leve, 2004), exacerbated by the fact that NP is often characterized by inconsistency in disciplinary interactions. However, little research has integrated these multiple influences empirically while including the effects of dyadic-level processes. The present study addressed this gap by examining the interaction of child temperament, NP, and parent–child dyadic behavioral variability (DBV) in preschoolers to predict children's externalizing behaviors 1 year later. In testing this question, we added methodological rigor by applying a person-centered approach to temperament and a dynamic time series approach to the assessment of DBV.

1.1 | Child temperament

Temperament encompasses early emerging dispositions rooted in biology that include domains of activity, affectivity, attention, and self-regulation (Putnam & Rothbart, 2006; Shiner et al., 2012). These early emerging dispositions predispose children to interact with their environments with distinct and relatively stable patterns of behavior, such as higher levels of fear/shyness, impulsivity, or negative emotionality (Shiner et al., 2012). Certain temperament types may predispose children to greater sensitivity to environmental influences, which may lead to psychological outcomes depending on the temperament trait and the environment in which it is expressed. For example, a child with high impulsivity or reactivity may present with higher externalizing behaviors when exposed to harsh or threatening environments (Olson et al., 2017).

To better understand how temperament confers risk for developmental psychopathology, previous studies have used person-centered techniques to examine temperament (both parent-reported and observed) and found similar temperament profiles (Dollar et al., 2017; Moding & Stifter, 2018; Prokasky et al., 2017; Putnam & Stifter, 2005). For example, researchers using the CBQ found temperament profiles that included *unregulated* (high activity level, approach, and anger, low regulatory control, and average fear and shyness), *high reactive* (high levels of anger and fear, and average regulatory control, approach, and shyness), *bold* (high activity and approach, low fear and shyness, and average anger and regulatory control), *average* (average on all characteristics), *well-adjusted* (high regulatory control and average on all other characteristics), and *regulated* (low activity, anger, and approach, average fear and shyness, and high regulatory control). Profiles using observed temperament were similar, finding *bold/ exuberant*, *average* (Dollar & Stifter, 2012; Putnam & Stifter, 2005), and *highly inhibited or inhibited* profiles (high wariness and negative affect with low activity and positive affect). Observed studies have also found a *low/low* profile (low approach, negativity, positivity). Overall, both parent-report and observed studies demonstrate that person-centered approaches

are useful for understanding temperament types such as exuberance that are made up of orthogonal characteristics, such as the combination of low negative affectivity and high surgency. Additionally, by finding similar groups across studies, these results demonstrate the continued potential for person-centered approaches to clarify the nature of child temperament.

Research has demonstrated that these temperament profiles may be differentially associated with maladaptive outcomes. For example, children with exuberant temperament show higher externalizing behaviors whereas children with inhibited temperament show higher internalizing behaviors (Putnam & Stifter, 2005). Further, for exuberant children, higher inhibitory control has been shown to support better peer acceptance whereas inhibited children with higher attentional control experience better peer acceptance (Dollar et al., 2017). These results demonstrate how different temperament profiles may confer unique risk for maladaptive outcomes, particularly in the context of other risk factors.

1.2 | Child temperament and negative parenting

NP, defined here as parenting that is high in harsh physical and verbal discipline, punitive practices, negative reactions to child misbehavior, and often involves inconsistent use of discipline strategies, plays a unique role in the development of externalizing problems (Kim et al., 2010; Yan & Ansari, 2016). Patterson's coercion model suggests that the escalation of parental physical and verbal discipline as well as inconsistency in limit setting negatively reinforces children's aversive behaviors, leading to increases in externalizing problems (Patterson, 2002). To complicate matters, certain temperament characteristics may evoke more physical or harsh verbal responses from parents (Slagt et al., 2016; Zhang et al., 2021), exacerbating this cycle. For example, children with more difficult temperament characteristics (i.e., higher negative affective or high approach tendencies) who receive harsher parenting demonstrate more externalizing problems within and across time (Pitzer et al., 2011; Rubin et al., 2003).

Both differential susceptibility and diathesis stress frameworks may be invoked to consider how temperament and parenting shape children's development. A diathesis stress framework postulates that those with more difficult temperaments may be particularly vulnerable to negative parenting and experience worse outcomes (Stoltz et al., 2017; Zuckerman, 1999). For example, children with more impulsivity, lower effortful control, and/or higher negative affectivity were more vulnerable to negative parenting resulting in higher behavior problems but did not experience increased benefits from positive parenting (Slagt et al., 2016). In contrast, a differential susceptibility framework postulates that children with more difficult temperaments may experience both exacerbated effects of negative parenting and greater benefits of positive parenting, thus demonstrating greater plasticity (Belsky, 2013; Stoltz et al., 2017). For example, children with more difficult temperaments who experienced more maternal sensitivity experienced fewer behavior problems, whereas those who experienced less sensitivity experienced more problems (Zhang et al., 2021).

Patterns of traits vary under the umbrella of the construct of difficult temperament and thus heterogeneity in this construct may hinder an understanding of the specific risks that difficult temperament confers (Rothbart, 1982). For example, inhibited children who experience maternal over-control show higher levels of later social anxiety (Lewis-Morrarty et al., 2012), whereas exuberant children who experience negative parenting demonstrate higher behavior problems (Hare & Graziano, 2020). Although there is a strong link between temperament and negative outcomes in the context of NP, exploring the role of dyadic interaction processes may help deepen our understanding of how temperament and NP shape children's externalizing.

1.3 | Dyadic parent–child interactions

Microsocial patterns of parent–child interaction contribute to the development of behavior problems (Hollenstein et al., 2004; Lunkenheimer et al., 2011). The transactional model suggests that behaviors learned and reinforced

through moment-to-moment parent–child interactions repeat and accumulate over time to shape longer-term development (Sameroff, 2010). For example, a dyadic pattern in which parents and children reinforce escalation of one another's aversive behaviors – a coercive cycle – may foster the stability of children's corresponding behavior problems over time (Patterson, 2002). This is particularly true for children prone to externalizing difficulties.

Although we know that negative parent–child interactions characterized by rigidity contribute to children's externalizing problems (Hollenstein et al., 2004; Lunkenheimer et al., 2011), it has been more challenging to conceptualize and test the effects of negative interactions characterized by DBV. Variability in individual parenting behavior plays a key role in the coercive cycle. For example, parents set limits but then fail to maintain those limits in the face of children's aversive responses (Patterson, 2002). In turn, harsh mothers' more variable and indiscriminate disciplinary behaviors are related to children's higher behavior problems (Dumas & Wahler, 1985; Gardner, 1989). Further, in dyads with higher maternal physical and verbal discipline and child externalizing problems, mothers' individual behavior becomes more variable specifically during episodes of child misbehavior, interpreted as inconsistent and ineffective parenting (Lunkenheimer et al., 2016).

Individual variability in parenting behavior may contribute to DBV, or the degree of change in dyadic behavioral states (e.g., parent directive-child compliance) during face-to-face interactions (Lunkenheimer et al., 2020). During early childhood, it is common for parents to show variability as they rapidly alternate between strategies to gain child compliance, especially during challenging situations (Gardner, 1989; Patterson, 2002). Children may show increased behavioral variability as they take a more active role in shaping interactions, try new strategies, and show a broader range of reactions to interpersonal challenges (Harrist & Waugh, 2002). Thus, early childhood presents a stage in which maladaptive patterns may develop, yet dyadic interaction dynamics are still malleable as dyads navigate newly developing autonomy (Davis et al., 2017). Parents and children organize their behaviors into routines and rhythms over time that children rely upon to experience security, understand expectations, and internalize regulatory skills (Olson & Lunkenheimer, 2009). However, if variable interactions become the norm and are not complemented by positive, predictable interactions (Oldershaw et al., 1986), children may lack the predictable patterns on which to model their own regulatory rhythms, which could hinder the development of regulatory skills (Patterson, 2002). For example, NP has been shown to disrupt positive and contingent dyadic interaction patterns, thereby increasing children's externalizing problems over time (Lunkenheimer et al., 2017).

1.4 | Present study

Our main goal was to investigate how child temperament, NP, and DBV jointly predicted children's externalizing behaviors. We used a person-centered approach to delineate child temperament profiles at the age of 3 years. Previous research has shown mixed evidence for the number of person-centered profiles when modeling child temperament (Gartstein et al., 2017; Prokasky et al., 2017). Thus, latent profile analysis was used to determine the optimal number of profiles for this sample and was considered exploratory.

The second aim was to examine the moderating effects of child temperament on the links between NP or DBV at the age of three and externalizing problems at the age of four. Although it was unknown what profiles would emerge, we generally expected that profiles that aligned with characteristics of difficult temperament, such as negative affectivity and surgency, would interact with NP and DBV to predict higher externalizing behaviors (Pitzer et al., 2011; Putnam & Stifter, 2005; Rubin et al., 2003).

The third aim was to examine the combined effects of NP, DBV, and temperament on later externalizing problems to explore how child, parent, and dyadic processes worked together to influence children's externalizing behaviors. We tested whether NP, DBV, and temperament interacted via moderated moderation analyses to predict externalizing problems at the age of four. Once again, it was generally expected that profiles with components of difficult temperament (e.g., exuberant and inhibited characteristics) would exacerbate the effects of NP and DBV on externalizing problems but given that it was unknown exactly which temperament profiles would emerge, we did not make a specific

a priori prediction regarding how NP, DBV, and temperament would interact with one another. Questions were tested with respect to families oversampled for higher risk (e.g., lower income, higher stress, higher child maltreatment risk), which increased the likelihood of observing NP and DBV in this sample (Brown et al., 1998).

Observed effortful control (EC) was included as a planned covariate in analyses with DBV to account for individual differences in children's self-regulation and engagement in the caregiver-directed task used in the present study. Observed EC has been related to more adaptive parent–child interaction patterns and better performance on challenging dyadic tasks (Lunkenheimer et al., 2011), including the task used in the present study (Lunkenheimer et al., 2013). Additionally, observed EC is a specific acute and time-locked response to the task at hand (Kochanska et al., 2000), whereas parent-reported EC as labeled here and in the previous literature encompasses a broader set of behaviors and context that is integrated and reported on by parent (Rothbart & Posner, 2004). In fact, previous research has found low correlations between observed and parent-reported EC, positing that assessments of observed EC may be useful in complementing parent-reported EC given that the latter reflects broader temperamental self-regulation whereas the former may capture children's situation-specific regulatory abilities (Gusdorf et al., 2011; Rademacher & Koglin, 2019).

2 | METHOD

2.1 | Participants

Participants were mother–child dyads from a larger study ($N = 150$, 80 girls) of families oversampled for familial risk. Families were assessed at child age 2½ years ($M = 2.48$, $SD_{age} = .15$), 3 years ($M = 3.04$, $SD_{age} = .11$), and 4 years ($M = 4.00$, $SD_{age} = .12$ years) and were recruited through the Department of Human Services, community agencies, and preschools serving lower-income families. Families were screened for income (less than 200% of the federal poverty level), government assistance (e.g., food stamps), self-reported life stress (five or more major life changes in the past year on an adapted Life Stress Inventory; Holmes & Rahe, 1967), and Child Protective Services involvement. They were excluded if children had a diagnosed physical or psychological disorder or if parents or children had cardiac problems that could interfere with the collection or interpretation of heart rate data. The analytic subsample of 121 mother–child was based on families who completed our temperament measure at the age of three, which was required to calculate temperament profiles. Data from the larger study ($N = 150$) has been used in previous studies (Diercks et al., 2020; Lunkenheimer et al., 2021, Fuchs et al., 2021a; Fuchs et al., 2021b).

Participants were representative of a Western university town. Children's race/ethnicity was 64% Non-Hispanic White, 22% Hispanic, 7% Multi-ethnic, 3% African American, 1% Native American, and 3% unknown or did not wish to respond. At study entry, mothers were married (66.7%), living together (12.7%), single (11.3%), separated or divorced (8.7%), or unknown/unreported (.6%). The average annual income was $30,000 to $39,00. Mothers' education ranged from junior high school to graduate level, with median educational level being an Associate's degree. Nine percent of children met clinical cutoffs (Externalizing T-Score $M = 48.85$, Range = 28–77) for externalizing problems based on T-scores from the Child Behavior Checklist (Achenbach & Rescorla, 2000).

2.2 | Procedures

All study procedures were approved by the university Institutional Review Board. Informed consent was obtained by trained research staff and parents provided consent for children. As part of the larger study, families participated at three time points. For the purposes of this study, data was only utilized from the latter two assessments (the age of three and four) given that parent report of temperament was first collected at the age of three. Mother–child dyads completed several tasks at each 2-h lab visit. One task required mothers and children to work together to complete

a set of puzzles above the child's cognitive ability level to win a prize. Children completed tasks to measure effortful control, during which mothers were in an adjacent room completing surveys about parenting, child behavior, and family characteristics.

2.3 | Measures

2.3.1 | Parent–child challenge task (PCCT)

Dyads completed the PCCT (Lunkenheimer, Kemp et al., 2017), which was designed to assess interaction patterns during a challenging problem-solving task. The 10-min task involved baseline, challenge, and recovery conditions. Mothers and children were asked to complete three puzzles that increased in difficulty and were beyond the child's cognitive ability for the child to win a prize, thus requiring guidance from the parent. Mothers were asked to use only their words and not to physically handle the puzzle. During baseline, mothers and children worked for 4 min. The challenge condition began after the experimenter interrupted and stated the dyad had 2 min to complete the task. Following the challenge condition (which in reality lasted 3 min), the recovery condition involved the experimenter entering the room, providing the prize (regardless of how many puzzles the dyad finished), and asking the mother and child to play with the prize (for 3 min). To standardize the task, the duration was set to exactly 10 min (600 s) for all participants.

2.3.2 | Observational coding

The PCCT was videotaped using Noldus Observer 1.0 and coded offline by trained and reliable coders using a validated coding system (Lunkenheimer, 2009). There were nine parent behaviors: ***proactive structure***–effortful, child-centered attempts to keep the child on task, ***teaching statements***–statements that provided instruction and explained the task, ***positive reinforcement***–praise, for example, "Good job," ***emotional support***–attending to the child's emotional needs, ***directive statements***–direct commands, for example, "Place the red block there," ***engagement***–watching and attending to the child and the task without offering specific direction, ***negative discipline***–warnings, threats, or directives with negative consequences, ***intrusion***–physically taking over the task for the child, and ***disengagement***–ignoring the child and task. There were seven child behaviors: ***compliance***–complying with a parental request, ***persistence***–focused effort on the task without parental prompting, ***solitary play***–child off-task playing, ***noncompliance***–not complying with a parental request, ***disengagement***–undirected and disengaged off-task behavior, ***behavioral dysregulation***–temper tantrums, and ***social conversation***–off-task conversation with the parent. Behaviors were coded on a continuous, second-by-second time scale, requiring coders to capture the same behavior during the same window of time using a standard 3-s criterion in Noldus Observer to determine agreement. Given the complexity and sparsity of some codes, reliability analysis (as percent agreement) was performed with respect to both code content and the duration and precise timing of codes for the entire task. Interrater reliability was calculated for 20% of the total videos (avg interrater agreement = 74%, range 70%-78%).

2.3.3 | Child temperament

Child temperament was measured at the age of three via maternal reports on the Very Short Form Child Behavior Questionnaire (VSF-CBQ; Putnam & Rothbart, 2006), which consisted of 36 items, rated from 1 (extremely untrue) to 7 (extremely true). Items include statements such as, "Likes to go high and fast when pushed on a swing," "Is sometimes shy even around people s/he has known a long time," and "Tends to become sad if the family's plans don't work out."

TABLE 1 Bivariate correlations of modified subscales

	1 Ang	2 Fall React	3 Sad	4 Fear	5 Shy	6 Act Level	7 HIP	8 Impl	9 Attn focus
2	.38**								
3	.33**	.42**							
4	.20*	.24**	.20*						
5	.16	.16	.25**	.10					
6	.18*	.18*	.08	.14	−.25**				
7	−.07	−.13	−.07	−.15	−.22*	.27**			
8	.00	−.05	−.20*	.02	−.48**	.40**	.39**		
9	−.10	.10	.12	.02	.08	−.16	−.05	−.14	
10	−.21*	−.05	.09	.02	.02	−.03	−.00	−.01	.43**

*Indicates $p < .05$.
**Indicates $p < .01$.

Higher-order scales included negative affectivity, surgency, and effortful control. For latent profile analyses, subscales were used rather than higher-order scales, which included: (1) anger, falling reactivity, fear, and sadness for *negative affectivity*; (2) activity level, high-intensity pleasure, impulsivity, and shyness (reverse coded) for *surgency*; and (3) attention focusing and inhibitory control for *effortful control*. The three super scales all demonstrated good reliability, negative affective ($\alpha = .76$), surgency ($\alpha = .74$), effortful control ($\alpha = .75$).

Modified aggregates of subscales were formed given that the VSF-CBQ only contains three scales, yet research suggests that at least five indicators are necessary for LPA in smaller samples; the inclusion of at least five indicators assists in obtaining stable profiles, as too few or too many can lead to instability (Wurpts & Geiser, 2014). To form the modified subscales, we first identified the most robust and common scales in previous studies (Beekman et al., 2015; Gartstein et al., 2017; Prokasky et al., 2017). Second, using the CBQ subscales, we identified the question/item that corresponded to these subscales from the VSF-CBQ and averaged items to form modified subscales. We then verified that each modified subscale was normally distributed. Given that the modified subscales only included 2–3 items in each case, alphas were low to moderate. They ranged between .44 and .76, with the exception of activity level (.37) and inhibitory control (.24). Additionally, modified subscales were correlated with one another in expected ways, such that these scales may likely be capturing the intended behaviors, see Table 1. These CBQ subscales have been shown to be reliable (α ranging from .67 to .94; Rothbart, Ahadi, Hershey, & Fisher, 2001).

2.3.4 | Maternal negative parenting (NP)

NP was measured at the age of three via maternal self-report on the Parenting Scale, a 30-item survey on disciplinary strategies (Arnold et al., 1993). The hostile, lax, and overreactive parenting subscales were used. Each item was rated from 1 (effective discipline) to 7 (ineffective discipline). Hostile parenting assessed physical and verbal discipline, for example, "When my child misbehaves, I spank, slap, grab, or hit my child." The overreactive scale assessed pickiness and reactivity to the child, asking parents whether they let frustration build and then do things they don't mean to. Lax or permissive discipline included items such as, "When I want my child to stop doing something…I firmly tell my child to stop OR I coax or beg my child to stop." Scales were standardized and averaged to represent a proxy for NP practices (Lunkenheimer, Ram et al., 2017).

Using the Spearman-Brown correction (Rhoades & O'Leary, 2007), alphas for the hostile, overreactive, and lax scales were $\alpha = .55$, $\alpha = .69$, and $\alpha = .70$, respectively. Although the hostility reliability was low, prior research acknowl-

edges these potential given differences between verbal versus physical items (Arnold et al., 1993) and the scale having only three items. Most parents endorsed physical but not verbal hostility; thus, this variable represented physical hostility toward the child. In this sample, hostility was not significantly correlated with laxness ($r = .14$, $p = .13$) but was positively correlated with over reactivity ($r = .27$, $p = .002$); laxness and over reactivity were also intercorrelated (= .37, $p < .001$). Thus, the combination of these scales provides a global representation of negative parenting rather than specific types of negative parenting.

2.3.5 | Dyadic behavioral variability

At the age of three, dyadic behavioral variability was operationalized as the frequency of change in dyadic goal-directed behavioral states during a structured, goal-oriented task (Lunkenheimer et al., 2020; Lunkenheimer & Wang, 2017). Using the second-by-second codes from the coding system noted above, State Space Grids (SSGs) were calculated using GridWare software (Lamey et al., 2004). SSGs allow researchers to capitalize on rich moment-to-moment dynamics and graphically map overall patterns of parent–child dyad interaction. Parent behaviors (9 codes) and child behaviors (7 codes) were mapped onto a 9 × 7 grid with parent behaviors defining the rows and child behaviors defining the columns—the resulting 63 unique dyadic states or cells. The 63-cell SSG represented all possible dyadic states, for example, parent directive–child compliance or parent directive–child noncompliance. Dyadic behavioral variability was calculated as the total number or frequency of cell visits (i.e., dyadic behavioral state transitions), with higher scores representing higher DBV. In other words, if a dyad had higher DBV, that dyad was changing their behavior at a higher frequency. These transitions were represented as any time the dyad moved to a new cell on the grid (i.e., at least one individual changed behavior). This included, for example, a dyad moving from a directive–noncompliance state to directive–compliance state or a dyad moving from engagement–social conversation to teaching–compliance. Figure 1(a) represents a dyad with higher DBV where they frequently changed behaviors (i.e., visited more cells), while Figure 1(b) shows a dyad with lower DBV where they changed behaviors less frequently (i.e., visited fewer cells) over the course of the interaction.

2.3.6 | Externalizing problems

Child externalizing was measured at the age of four via maternal report on the Child Behavior Checklist 1.5–5 (Achenbach & Rescorla, 2000). Each of the 100 items is rated on a 3-point scale: 0 = "not true (as far as you know)", 1 = "somewhat or sometimes true" and 2 = "very true or often true." The externalizing scale was formed by aggregating 24 items; items on this scale included behaviors such as, "Can't stand waiting, wants everything now" and "Destroys things belonging to his/her family or other children." Cronbach's alpha at the age of four was $\alpha = .9$.

2.3.7 | Observed effortful control

Observed EC was assessed via standardized tasks (Kochanska et al., 1996) at the age of three. Two tasks were introduced as games and children were reminded of the rules about halfway through each task. In a turn-taking task, children were asked to take turns with the experimenter placing blocks on a tower. Scores reflected the proportion of blocks placed by the child. In a gift delay task, children were asked to not touch a prize/gift until the experimenter finished wrapping it. The experimenter then stepped out to get a bow and asked the child to continue waiting without touching the gift. Scores reflected how many times the child peeked at/touched the gift. A total EC score was calculated by standardizing and averaging scores from the individual tasks.

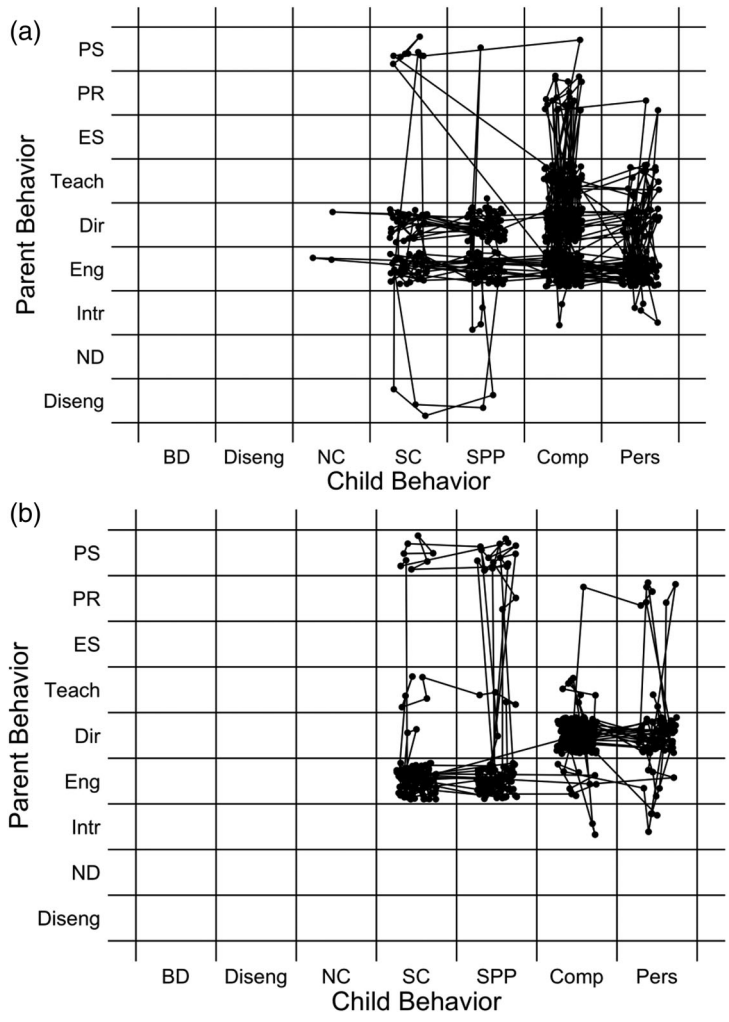

FIGURE 1 Dyadic behavioral variability (DBV) as captured by state space grids, where each circle represents a visit to that cell and each line a transition to or from that cell. Panel (a) is representative of a dyad with high DBV while panel (b) represents a dyad with low DBV

2.4 | Data analytic strategy

2.4.1 | Missing data

For latent profile analyses, participants had to complete the VSF-CBQ at the age of three; thus, only those families were included in primary analyses ($N = 121$). There were no significant differences in sociodemographic factors between families who did and did not participate at the age of three or four. Little's Missing Completely at Random test (MCAR; Little & Rubin, 1989) revealed data were missing completely at random, X^2 (90, $N = 121$) = 97.18, $p = .28$.

2.4.2 | Latent profile analysis (LPA)

LPA in Mplus 8.2 (Muthén & Muthén, 1998–2019) was used to construct child temperament profiles from the nine modified subscales of the VSF-CBQ. A primary assumption of LPA is that person-oriented subgroups can be created,

with within-subgroup members being more similar as compared to members of other subgroups on the included items (Bergman & Magnusson, 1997). LPA presents several advantages over traditional clustering techniques. In particular, group membership can be quantified with formal statistical models to note an individual's probability (.00–1.00) of being in any one category. LPA uses an MCAR framework to handle missing data, which allows parameters to be informed by all available cases and improves model accuracy (Little & Rubin, 1989).

To determine the best fitting model, model fit statistics included the Bayesian information criterion (BIC) and the Bootstrapped Log-Ratio Test (BLRT; Nylund et al., 2007). In simulation studies, the BLRT has been shown to be a more accurate and reliable predictor of the number of profiles, but in non-simulated data, the BLRT has been shown to overestimate the number of classes (Nylund et al., 2007). Additionally, evaluation of fit involved theoretical grounding from previous research and consideration of model parsimony.

2.4.3 | Moderation analysis

We examined whether the effects of NP and DBV on later externalizing behaviors was moderated by child temperament profiles using PROCESS (v3.3; model 1) in SPSS (Hayes & Little, 2018). NP and DBV were entered as the predictors (in separate models), temperament profile was the multi-categorical moderator, and the outcome was externalizing problems. The multi-categorical option allowed for comparison across temperament groups by setting one temperament profile as the reference group.

2.4.4 | Moderated moderation analysis

Using PROCESS (v3.3; model 3) we examined whether NP, DBV, and temperament interacted to predict later externalizing problems. A moderated moderation approach allowed a test of the combined effects of NP, DBV, and temperament in predicting externalizing behaviors. In order to maximize the analytic sample, we used the probability of being in a particular temperament profile rather than group assignment, which allowed us to use the entire sample and not be limited by the cell size of any given profile. We also included observed EC as a covariate to account for individual differences in children's regulatory ability that would likely influence their engagement in and contribution to the parent–child interaction task.

3 | RESULTS

3.1 | Preliminary analysis

Descriptive statistics and correlations are presented in Table 2. Study variables, including temperament, NP, DBV, EC, and externalizing problems, demonstrated normal distributions. Externalizing behaviors did not differ by child sex, $t(92) = -1.61$, $p = .11$. Annual family income was not related to NP ($r = .01$, $p = .90$) or externalizing at the age of three ($r = -.01$, $p = .95$) or the age of four ($r = .00$, $p = .99$). Maternal education was also unrelated to NP ($r = -.03$, $p = .76$) or externalizing at the age of three ($r = .07$, $p = .45$) or the age of four ($r = -.13$, $p = .20$). Thus, child sex, income, and maternal education were not included as covariates. Additionally, in line with previous research, there was no significant relation between observed and parent-reported EC ($r = .05$, $p = .63$). Given the non-significant relation, we retained observed EC as the sole covariate in the moderation analyses.

TABLE 2 Means, standard deviations, and bivariate correlations of study variables

	1. Attn Focus	2. Act Level	3. Ang	4. Fear	5. Fall React	6. HIP	7. Impl	8. IC	9. Sad	1. Shy	11. Ext	12. NP	13. EC	14. DBV
2.	−.16	1.00												
3.	−.10	**.18**	1.00											
4.	.02	.14	**.20**	1.00										
5.	.10	**.18**	**.38**	**.24**	1.00									
6.	−.05	**.27**	−.07	−.15	−.13	1.00								
7.	−.14	**.40**	.00	.02	−.05	**.39**	1.00							
8.	**.43**	−.03	**−.21**	.02	−.05	.00	−.01	1.00						
9.	.12	.08	**.33**	**.20**	**.42**	−.07	**−.20**	.09	1.00					
1.	.08	**−.25**	.16	.10	.16	**−.22**	**−.48**	.02	**.25**	1.00				
11.	**−.29**	**.37**	**.25**	.14	**.25**	.12	**.21**	−.16	**.26**	.02	1.00			
12.	−.09	**.18**	**.21**	**.18**	**.23**	.11	−.06	**−.24**	.16	.01	**.20**	1.00		
13.	.09	**−.24**	.00	**.22**	.10	−.13	**−.22**	.10	.16	**.22**	−.06	−.01	1.00	
14.	.11	**−.20**	−.14	.02	−.15	.12	−.01	.03	−.05	−.03	−.02	.01	**.21**	1.00
M	5.16	4.83	4.74	3.21	3.07	5.63	3.95	4.96	4.03	3.92	12.07	.01	.31	159.49
SD	1.17	.93	1.22	1.55	1.5	.98	1.03	.93	1.21	1.24	7.84	2.14	.4	32.94

Note: Attn Focus = Attention Focusing. Act Level = Activity Level. Ang = Angry. Fall React = Falling Reactivity. HIP = High Intensity Pleasure. Impl = Impulsivity. IC = Inhibitory Control. Ext = Externalizing Problems. NP = Negative Parenting; EC = Effortful Control. DBV = Dyadic Behavioral Variability. Bolded values indicated significant correlations at $p < .05$

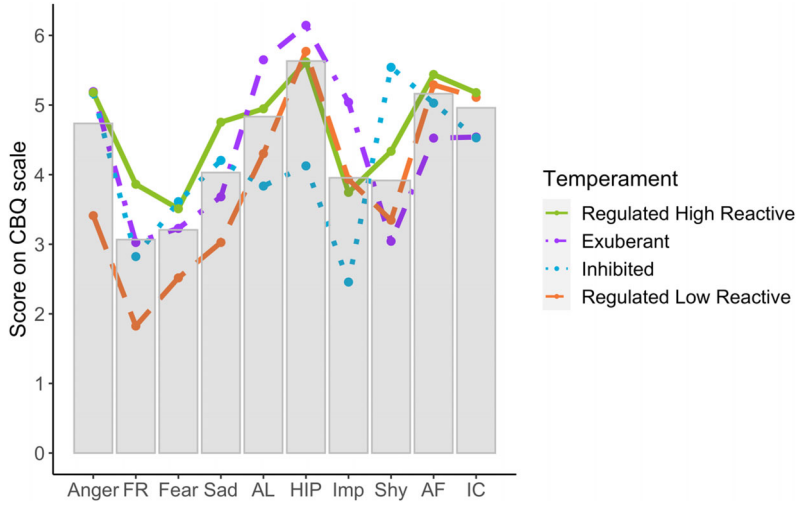

FIGURE 2 Temperament profiles. The gray bars represent the sample mean for each scale Note FR = Falling reactivity. AL = Activity Level. HIP = High intensity pleasure. Imp = Impulsivity. AF = Attention Focusing. IC = Inhibitory control

3.2 | Latent temperament profiles

We formed child temperament profiles using LPA. Given the ambiguity in prior temperament classifications that found two to five profiles (Dollar et al., 2017; Gartstein et al., 2017; Prokasky et al., 2017; Putnam & Stifter, 2005), we used LPA in an exploratory manner. We tested models for two to five profiles and found that a four-profile solution fit best, BIC = 3683.34, BLRT = 49.94, $p < .001$, as compared to a three-profile solution, BIC = 3715.30, BLRT = 57.14, $p < .001$, or a five-profile solution, BIC = 3664.22, BLRT = 37.09, $p = .04$. Although the five-profile solution had a lower BIC, the profiles in this solution were not theoretically sound nor in line with previous research. Thus, we retained the four-profile solution as the best fitting model (see Table 1).

The four profiles were *Regulated High Reactive* ($n = 52$), *Exuberant* ($n = 27$), *Regulated Low Reactive* ($n = 32$), and *Inhibited* ($n = 10$) (Figure 2). *Regulated High Reactive* consisted of the highest levels of effortful control characteristics (inhibitory control and attention focusing), high levels of negative affectivity characteristics (anger, fear, sadness, and falling reactivity), and average levels of surgency characteristics (high intensity pleasure, activity level, impulsivity, and low shyness). *Exuberant* showed the highest levels of surgency characteristics, average levels of negative affectivity characteristics, and the lowest levels of effortful control characteristics. *Regulated Low Reactive* was average/high in effortful control characteristics, average in surgency, and lowest in negative affectivity characteristics. *Inhibited* was average to high in negative affectivity characteristics, average to low in effortful control characteristics, and lowest in surgency characteristics (i.e., highest shyness, lowest high intensity pleasure). Given that the high reactive group was the largest profile they were the reference group in the single moderator analyses. We also tested temperament profile differences in NP and DBV. We found group differences in NP, $F(3, 117) = 5.31$, $p = .002$, with post-hoc Tukey tests revealing the low reactive profile was significantly lower in NP than the high reactive profile, $p = .001$. There were no group differences in DBV, $F(3, 111) = 1.44$, $p = .23$.

3.3 | Negative parenting, temperament, and externalizing

Next, we examined whether the relation between NP at the age of three and externalizing problems at the age of four was moderated by temperament profiles. Using a multi-categorical moderation analysis with regulated high reactive

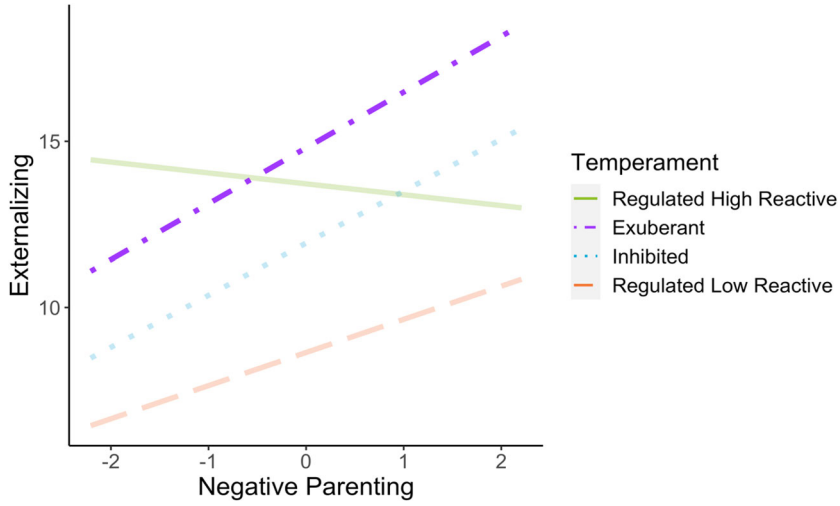

FIGURE 3 Only exuberant temperament significantly moderated the relation between NP at the age of three and child externalizing at the age of four

temperament as the reference group, we found temperament significantly moderated the relation between NP and externalizing behaviors, $F(7, 99) = 3.33$, $p = .003$, $R^2 = .19$. Results showed that the exuberant temperament group was a significant moderator, $b = 2.01$, $t(107) = 2.00$, $p = .04$, 95% CI [.01, 4.01], such that children with exuberant temperament who experienced more NP at the age of three had on average significantly higher externalizing problems at the age of four as compared to the high reactive reference group (Figure 3).

3.4 | Dyadic behavioral variability, temperament, and externalizing

We then examined whether the relation between DBV at the age of three and externalizing problems at the age of four was moderated by temperament profiles. Using a multi-categorical moderation analysis with high reactive temperament as the reference group, we found the relation between DBV and later externalizing was significantly moderated by temperament profile, $F(8, 67) = 2.84$, $p = .009$, $R^2 = .25$. Results showed the effect of DBV was only significantly moderated by exuberant temperament, $b = .17$, $t(67) = 2.36$, $p = .02$, 95% CI [.03, .32], such that children with exuberant temperament who experienced more DBV at the age of three had on average significantly higher externalizing problems at the age of four as compared to the high reactive reference group (Figure 4).

3.5 | Negative parenting, dyadic behavioral variability, and temperament

To address the third aim, we applied a moderated moderation model to examine the combined effects of NP, DBV, and temperament on children's externalizing problems. Since the prior analyses demonstrated that NP and DBV were only significantly moderated by exuberant temperament, we tested the effect of the probability of belonging to the exuberant temperament profile in the moderated moderation analysis. By using the probability of being in the exuberant temperament profile rather than group membership, we were able to maximize sample size and analytic power.

NP, DBV, and temperament exerted combined effects on later externalizing problems, $F(8,67) = 4.69$, $p < .001$, $R^2 = .36$. The three-way interaction between NP, DBV, and probability of exuberant temperament was significant,

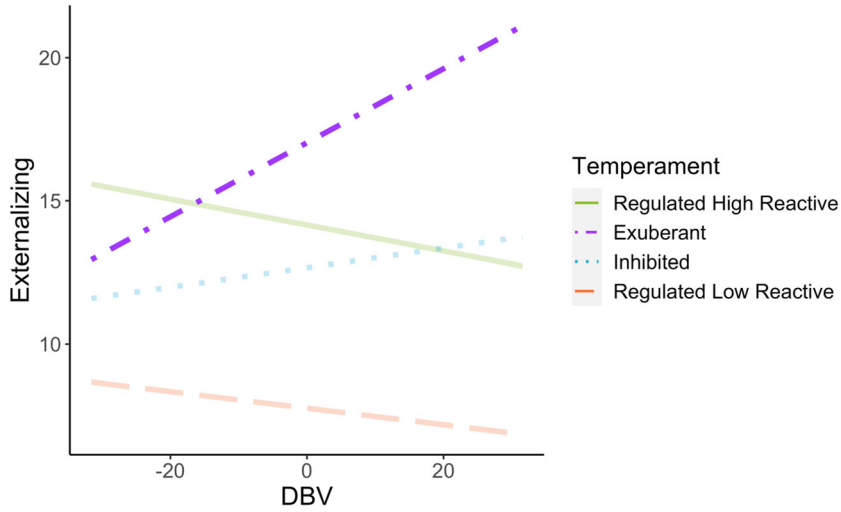

FIGURE 4 Only exuberant temperament significantly moderated the relation between DBV at the age of three and child externalizing at the age of four

$b = -.12$, $t(67) = -2.11$, $p = .04$, 95% CI [−.24, −.07]. A Johnson-Neyman test revealed the moderation effect was only significant at mean levels of NP or below. In other words, children showed higher externalizing problems as the probability of exuberant temperament increased when also coupled with mean or low levels of NP and higher levels of DBV (Figure 5). In contrast, at higher levels of NP, there was no longer a significant effect of DBV. At higher levels of NP, only the interaction effect between higher NP and the higher probability of exuberant temperament predicted increased externalizing problems. Thus, at mean and lower levels of NP, higher DBV emerged as an additional risk factor, interacting with children's greater exuberance to predict children's higher externalizing problems. (See Supporting information 1)

4 | DISCUSSION

In understanding the etiology of externalizing behavior, it is important to consider the contributions of the child, parent, and parent–child dyad, as child development is a product of a multifactorial familial system (Sameroff, 2010). This multilevel approach is also important during early childhood when there is still considerable plasticity in dyadic interactions and externalizing behavior (Davis et al., 2017; Hollenstein et al., 2004), and this malleability may influence how dyadic interactions interact with temperament and parenting. Our results support previous work illustrating that temperament characteristics can be modeled effectively with a person-centered approach and offer novel information on how temperament profiles interact with environmental factors to shape developmental outcomes. We found that temperament characteristics interact independently with NP and DBV, with an exuberant temperament profile putting children at heightened risk for externalizing problems. Further, NP, DBV in goal-directed interactions, and child temperament interacted to shape children's externalizing behaviors. Specifically, at average and lower levels of NP, DBV emerged as a risk factor for higher externalizing, suggesting either that NP outweighs the effects of DBV or that these influences make unique contributions to children's externalizing problems. Understanding how moderators at multiple levels (i.e., child temperament, parenting, and dyadic interactions) exacerbate externalizing trajectories may be particularly critical in early childhood, a time when parents are the primary socialization influence (Dallaire & Weinraub, 2005), children are developing their autonomy (Davis et al., 2017), and coercive cycles are most likely to form (Patterson, 2002).

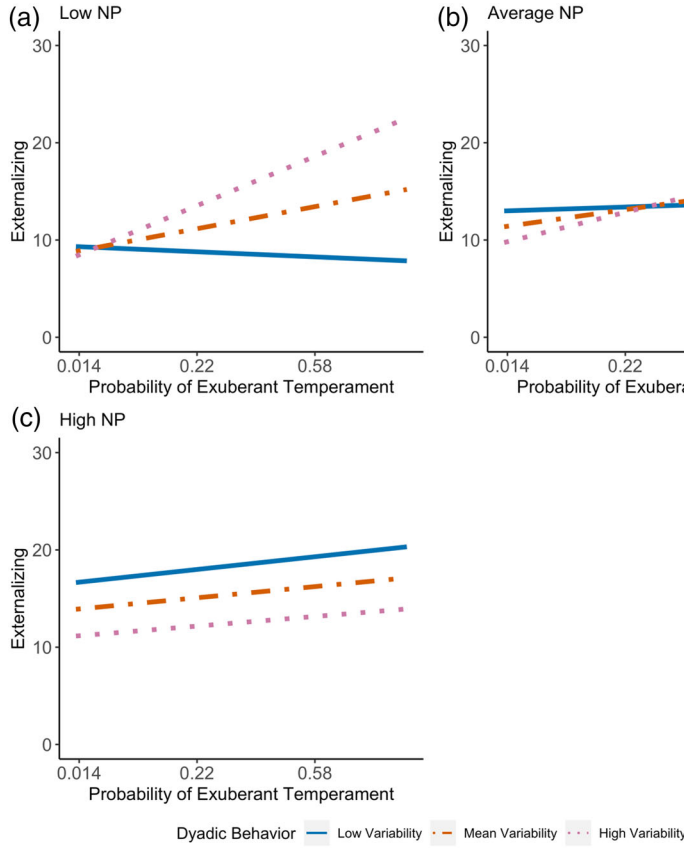

FIGURE 5 The moderating effects of DBV at low, mean, and high levels of NP. A = Low levels of NP. B = Average or mean levels of NP. C = High levels of NP

4.1 | Person-centered approaches can inform etiology

The present study examined child temperament through a person-centered approach. We found four profiles: High Reactive, Exuberant, Low Reactive, and Inhibited. The latter three mapped onto profiles seen in the extant literature. Dollar et al. (2017) and Putnam and Stifter (2005) also found exuberant and inhibited temperament profiles, where "exuberant" reflected higher impulsivity and approach behaviors, which can be challenging for parents to manage, and "inhibited" reflected higher sadness, fear, and shyness, which can make it difficult for parents to soothe children or help them engage in novel situations. Further, our Low Reactive profile was similar to the Low/Low group found by Putnam and Stifter (2005). Thus, these results provided continued evidence for person-centered approaches to temperament and replicated prior exuberant, inhibited, and "low" (i.e., the absence of difficulty) temperament types. When compared to the subscales of the Children's Behavior Questionnaire, these clusters mapped on relatively cleanly to the surgency, and negative affectivity subscales such that the Exuberant group was characterized by the highest levels of surgency and the Inhibited group was characterized by the highest levels of negative affectivity.

However, unique to the present study, we also found a "High Reactive" group. This group showed the highest levels of effortful control combined with heightened negative affect. Without a person-centered approach, these children may have been overlooked, given that effortful control and negative affectivity are not usually positively related from a variable-centered perspective (Putnam & Rothbart, 2006). One possibility is that this group reflects children who are somewhat "overregulated," meaning they are able to exert regulatory control that, in the context of heightened

negative affect, can elicit and sustain patterns of anxiety (Dallaire & Weinraub, 2005). Another possibility is that this group reflects our sample (i.e., families oversampled for familial risk) such that children had a higher level of reactivity on average; thus, future research and replications with various samples are needed to better understand this temperament profile.

Overall, these results highlight not only that temperament characteristics may cluster within children but that the notion of "difficult" may be too broad a label when delineating how temperament is related to behavior problems (Shiner et al., 2012; Zentner & Bates, 2008). Indeed, three of the four profiles reflected some form of difficult behavior, and yet only one showed a particular susceptibility to NP in terms of externalizing problems: this lends support to Rothbart's claim that the label "difficult temperament" may be ill-fitting as it has negative connotations and suggests a vulnerability that may not always be present (Rothbart, 1982). Susceptibilities associated with difficult temperament may be dependent on the type of difficult behavior. For example, children who experience NP and also display more inhibited temperament may show more susceptibility to internalizing than externalizing problems (Lewis-Morrarty et al., 2012). Thus, the vulnerability implied by difficult temperament may or may not be present or may shift in form, depending on the context.

Additionally, the current temperament profiles account for maternal report of children's effortful control, a characteristic that is rapidly developing during early childhood (Kochanska et al., 2000; Rothbart, 2007). It is necessary to account for effortful control during this developmental period as it may contribute to interactions with parenting behaviors. In fact, differences in EC have been related to differential evocation of positive and negative parent behaviors (Eisenberg et al., 2010, 2015).

4.2 | The risks associated with exuberant temperament

Children with exuberant temperament are already at higher risk for externalizing behaviors, likely due to their approach tendencies and higher activity and impulsivity levels (Deault, 2010). As expected, NP exacerbated this risk. We found that children with exuberant temperament who experienced more NP and DBV had higher externalizing a year later. NP puts children at risk for externalizing problems, possibly through mutually aversive interactions that lack the scaffolding needed for children to develop self-regulatory abilities (Cicchetti & Lynch, 1993). NP may also hinder the development of children's self-regulation by disrupting safety, security, and consistency in the parent–child relationship (Smith et al., 2014). Previous research has suggested that exuberant children may be more sensitive to NP (McDoniel & Buss, 2018; Sturge-Apple et al., 2012) and thus experience more maladaptive outcomes when experiencing NP. Exuberant behaviors tend to be categorized as "acting out" and require greater parental attention compared to the more internalized behaviors of inhibited children (Miner & Clarke-Stewart, 2008). It is also notable that the Exuberant group had the lowest effortful control, an important form of self-regulation that aids in child compliance (Kochanska et al., 1996). Children low in self-regulation skills may create more stress for parents and exhaust their disciplinary strategies (Nicholson et al., 2005). Therefore, the interaction between exuberance and NP may be especially likely to exacerbate children's externalizing problems. DBV may also interact with the higher activity and impulsivity characteristic of exuberance to heighten dysregulated externalizing problems. Children's more dysregulated behavior may also contribute to inconsistent interactions with parents (Lengua & Kovacs, 2005). Additionally, more exuberant children may have a particularly hard time adjusting in the absence of consistent, predictable interactions with their parents (Johnston & Jassy, 2007).

Although these results lend support to the diathesis stress framework, future research should test a fuller range of positive and negative parenting behaviors to better examine a differential susceptibility framework. Additionally, future research could consider examining specific components of NP, such as physical discipline or psychological control, as these components may differentially affect child temperament profiles (Kiff et al., 2011; van Zeijl et al., 2007). The investigation of specific behaviors of NP may also be crucial in relation to outcomes other than externalizing. Although not investigated in the current study, research has shown that inhibited children experiencing NP show

heightened internalizing problems (Pitzer et al., 2011), though most of these studies oversample for inhibited temperament (Kagan, 2012). Future research in this area may provide insights into how different temperament profiles such as inhibited profiles may be related to other child outcomes, including internalizing problems.

4.3 | Integrating parent, child, and dyadic influences on developmental psychopathology

This study also explored how NP, parent–child interaction patterns (DBV), and temperament worked in tandem to shape externalizing behaviors. Prior research has suggested that parent–child behavioral variability exacerbates the development of children's aversive behavior (Dumas & Wahler, 1985; Patterson, 2002), but no known research has tested the role of child temperament profiles in these relations. We found that higher DBV and exuberant temperament predicted higher externalizing problems, but only at average or low levels of NP. Perhaps DBV was only significant at average and low levels of NP because higher NP was detrimental enough to trump the influence of dyadic patterns, at least with respect to behavioral variability. NP is typically related to parents' inconsistent limit-setting (Kim et al., 2010); therefore, it seems possible that high levels of NP outweighed the effects of variability rather than that these two mechanisms operated orthogonally in influencing externalizing problems. However, given that parental inconsistency and DBV are separate constructs, such that parental inconsistency tends to focus on discipline (Dumas & Wahler, 1985), whereas DBV captures both positive and negative behaviors. DBV is focused more on unpredictability across the spectrum of behaviors. Unpredictability, though, maybe crucial in the context of temperament as children with certain characteristics may benefit from predictability or may be particularly vulnerable to unpredictability (Oldershaw et al., 1986; Spinrad et al., 2004). Therefore, it may be that NP and DBV may interact with temperament in unique ways to shape child externalizing behaviors or may represent two separate pathways to externalizing problems. Additionally, DBV could be assessed on different time scales. For example, parent–child interactions change across task contexts (Davis et al., 2017; Lunkenheimer, Ram et al., 2017), and across developmental transitions (Granic et al., 2007), thus future research could explore the effects of dyadic variability at these broader time scales.

The consideration of dyadic influences in the etiology of externalizing problems holds potential implications for family intervention. A dyadic approach may help increase the efficacy of an intervention by targeting problem behavior from multiple angles. For example, Parent Management Training (Kazdin, 1997), which already targets improvements in parental limit setting, may benefit from adding a focus on consistent responding of parent to child and child to parent. Some evidence-based family interventions already emphasize sensitive and timely responding to child cues (e.g., Attachment and Biobehavioral Catch-Up; Bernard, Meade, & Dozier, 2013); expanding efforts to target both individual and dyadic processes may be fruitful.

4.4 | Limitations and future directions

Although this study has numerous strengths, there are a few limitations to consider. First, this sample was comprised of mostly lower income families which may limit generalizability; lower-income families may experience more stress or fewer resources in their daily lives (Keim et al., 2011), which may influence parenting behaviors (de Maat et al., 2021). Additionally, although approximately one-third of children were of ethnic minority background, additional diversity in future research could strengthen the generalizability of these findings across ethnic groups and allow one to test potential variation as a function of cultural context. It may be that families of different cultural backgrounds value different behaviors in their children, which could have implications for whether children are perceived as difficult and thus the likelihood of parents engaging in negative parenting as defined in this study (Garcia Coll, 2002). For example, the outgoing and energetic behaviors that characterize exuberance may be more or less valued across cultures. In our sample, only 9% of children met clinical criteria for an externalizing disorder (T-Score $M = 48.85$ Range = 28–77), thus

it is not clear whether the combined impact of NP, DBV, and temperament on externalizing behaviors would operate similarly among children with clinical diagnoses. It may be that when behavior problems are above a certain threshold, qualitatively different patterns of NP and DBV are present (Woltering et al., 2015).

Although a strength of this study is that externalizing was measured a year later (i.e., involved two measurement occasions), the stability of externalizing and temperament over time was not accounted for. Claims of the effects of parenting and dyadic processes may be more robust if demonstrated above and beyond stability in externalizing over time. However, multiple constructs related to externalizing were accounted for at the age of three via temperament characteristics of anger, high activity level, inattention, and impulsivity, which created a multicollinearity issue such that prior externalizing was not included as a covariate. Although child temperament is considered stable over time (Shiner et al., 2012), effortful control may increase across early childhood (Kochanska et al., 2000). Thus, future research could examine how child temperament profiles change with time (Gartstein et al., 2017) and whether this change is differentially affected by NP or DBV. Additionally, this study made use of modified subscales from the VSF-CBQ, that although correlated in expected ways did demonstrate low to moderate reliability. This lower reliability may be attributed to the fact that modified subscales only contained 2–3 items each which may easily skew alphas (Rhoades & O'Leary, 2007). Future research should use the full CBQ as it would offer more detailed information on temperament characteristics. Finally, although a strength of this study was the inclusion of both observed and maternal reports, use of maternal report across constructs could have created single reporter bias. Ultimately, understanding which children are more susceptible to specific environmental influences can help further our understanding of the etiology of externalizing behaviors as well as point to malleable targets for family interventions.

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CONFLICT OF INTEREST

The authors have no conflict of interest.

DATA AVAILABILITY STATEMENT

The data used herein is not publicly available.

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