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ORIGINAL PAPER

Mother–Child Synchrony and Child Problem Behavior

Nancie Im-Bolter · Muniq Anam · Nancy J. Cohen

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Abstract Synchrony refers to parent–child interactions that are mutually regulated, reciprocal, and harmonious. Synchrony is associated with a variety of positive developmental outcomes but a small literature indicates that children with less synchronous relationships tend to display emotional and behavioral problems. Despite this association, no study to date has observed synchrony among clinical child populations and little is known about the mechanisms underlying the synchrony–child behavior relation. Since strained parent–child relations are often associated with parenting stress and parenting stress increases the risk of child maladjustment we propose that parenting stress mediates the relation between synchrony and child behavior problems. We tested this hypothesis and examined the clinical relevance of synchrony by observing naturalistic play in 19 clinic-referred and 23 non-clinic referred mother–child dyads. Children ranged in age from 6 to 10 years. We found lower synchrony in clinic-referred dyads compared to non-clinic referred dyads and that parenting stress mediated the association between synchrony and child problem behavior. The findings from the current study have implications for the development of emotional and behavioral problems in children as well as for assessment and treatment for child clinic populations.

N. Im-Bolter (✉) · M. Anam
Department of Psychology, Life and Health Sciences Building, Trent University, Peterborough, ON K9J 7B8, Canada
e-mail: nimbolter@trentu.ca

N. J. Cohen
Hincks-Dellcrest Centre/Institute, Department of Psychiatry, University of Toronto, Toronto, ON, Canada

N. J. Cohen
Applied Psychology and Human Development, OISE/University of Toronto, Toronto, ON, Canada

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Introduction

Research has shown that parent–child synchrony, a pattern of interactions described as mutually regulated, reciprocal, and harmonious (Harrist and Waugh 2002), is related to a variety of positive and negative developmental outcomes in children. Positive outcomes include secure attachment relationships (Isabella and Belsky 1991), self-regulation (Lindsey et al. 2009), peer competence (Harrist et al. 1994; Lindsey et al. 2010, 1997), positive self-esteem and prosocial behavior (Lindsey et al. 2008), development of conscience (Kochanska and Murray 2000), and cognitive skills (Healey et al. 2010). Low synchrony (or nonsynchrony) is associated with greater child internalizing and externalizing problems (Criss et al. 2003; Deater-Deckard et al. 2004). Despite the link between synchrony and both positive and negative child outcomes, no study to date has observed synchrony among clinical child populations. Moreover, little is known about the mechanisms underlying the relation between synchrony and child outcomes. The goals of the current study are to establish the clinical relevance of synchrony as well as explore the possible mechanism of parenting stress as a mediator of the association between synchrony and child behavior outcomes.

Synchrony can be attributed to parent–child interactions characterized by coordinated and contingent behavior, where the parent and child are jointly focused, mutually responsive, and appear to genuinely enjoy each other's company (Harrist and Waugh 2002). Synchrony has been demonstrated to exist between parents and children in

infancy (Feldman 2007), as indicated by the presence of contingent and coordinated interactions between caregiver and child (Feldman 2007). Although synchrony has been studied extensively in the context of infant development, relatively little research exists on synchrony in later childhood. Despite this, it is theorized that parent–child synchrony is relevant in later childhood (Harrist and Waugh 2002) and adolescence (Chu and Powers 1995). Whereas early mother–infant interactions are largely facilitated by responsive caregivers who attune themselves to the needs of the infant, the burden of maintaining synchrony balances more equally between parent and child as the child's language develops. During this time, the child is more capable of initiating and changing the flow of interactions and manipulating the direction of their parent's attention (Harrist and Waugh 2002). As a result, the child is increasingly influential in creating interactional harmony. Consequently, the operationalization of synchrony in later childhood reflects a greater variety of dyadic processes that capture the complexity of synchronous interactions.

Synchrony includes a constellation of subcomponent processes, which typically include: (a) joint engagement, (b) reciprocity, and (c) shared positive affect (Lindsey et al. 2009). Joint engagement refers to instances where parents and children are mutually focused on an object or activity and share an awareness that they are attending to, or participating in, the same activity (Eilan 2005). Reciprocity refers to dyadic turn-taking (Raver 1996) and the matching of both verbal and non-verbal behavior (Deater-Deckard et al. 2004). Lastly, shared positive affect occurs when both the parent and child appear contented and express positive emotions (Kochanska and Murray 2000). Although joint engagement and reciprocity appear consistently in operational definitions of synchrony, there is disagreement regarding the role of shared affect and whether positive affect is necessary for synchrony to occur (Harrist and Waugh 2002). It has been argued that the processes which govern the affective tenor of an interaction are separate from the attentional and behavioral aspects of synchrony (Deater-Deckard et al. 2004). However, research shows that the behavioral and attentional aspects of dyadic synchrony correlate negatively with negative affect and positively with positive affect (Lindsey et al. 2008; Maccoby 1992). Positive emotional ambiance also helps to sustain joint activity (Maccoby 1992), whereas negative emotions disrupt the flow of interactions or promote coercive cycles of parent–child interaction (Reid and Patterson 1989). These findings suggest that shared positive or neutral positive affect is a necessary condition for a synchronous exchange (Deater-Deckard et al. 2004).

While the core components of joint engagement, reciprocity, and shared positive affect have been shown to impact the quality of parent–child relationships and child outcomes, synchrony describes the optimal coordination of these processes. Indeed, positive parent–child relationships have been identified as an ideal context for the socialization of children (Maccoby 1992) because it allows for the easy transmission of parental influence (Kochanska 1997; Laible and Thompson 2007). Moreover, synchronous interactions may provide a safe and supportive environment where children learn how to express and respond to positive and negative emotions, which promote more appropriate interactions (De Rubeis and Granic 2012). Although greater synchrony appears associated with positive child development, studies that have specifically examined synchrony and child behavior problems indicate that children with less synchronous relationships with their parents have a higher incidence of conduct disorder (Criss et al. 2003) and aggression (Harrist et al. 1994). In addition, lower levels of synchrony are related to greater child internalizing and externalizing behavior problems (Criss et al. 2003; Deater-Deckard et al. 2004; Harrist et al. 1994). Similarly, dyadic regulation of affect (an aspect of synchrony) is related to decreased externalizing symptomatology in aggressive children post-treatment (De Rubeis and Granic 2012). The results of these studies suggest that children who experience fewer synchronous exchanges with their parents may be at greater risk for the development of clinically significant emotional or behavioral problems. One of the primary aims of the current study is to determine whether synchrony in parent–child dyads of children referred to mental health clinics differs from synchrony among parent–child dyads of non-referred children. This line of inquiry, which till now has largely been ignored, will help to establish the clinical relevance of synchrony.

The study of synchrony in the context of child psychopathology may shed new light on the etiology of clinically significant problem behavior in children. Within the child psychopathology literature, there is a tendency to emphasize negative influences on child development, such as negative or harsh parenting or difficult temperament in children (Deater-Deckard et al. 2004). By contrast, relatively little attention is paid to the influence of positive parent–child interactions on the development of child psychopathology. It is possible that a lack of positive interactions between parents and children may place children at a greater risk for disordered development and that positive interactions serve to protect children from developing clinically significant problems. Criss et al. (2003) noted that synchrony between parents and children may reduce the need for coercive parental tactics. Research has shown that responsive parents foster responsive children which, in turn, lessen the need for harsh parenting practices (Maccoby 1992). It follows that the association between synchrony and quality of parenting may be of particular

importance in the context of child psychopathology, given that disordered parenting is related to child psychopathology (Berg-Nielsen et al. 2002; Rothbaum and Weisz 1994). One aspect of parenting that may be connected to synchrony is parenting stress. Parenting stress arises in situations where both parents and children "…create difficult or challenging circumstances through their behavioral expectations or needs" (Crnic et al. 2005, p. 128) and is directly related to the parenting role (Abidin 1992). Research suggests that parenting stress is directly associated with dysfunctional parent–child relationships. The experience of daily parenting related stress has been found to be correlated to lower ratings of mutual enjoyment during dyadic interactions (Crnic et al. 2005) and with observed engagement in more disjointed and less coordinated parent–child interactive patterns (Moss et al. 1998). Parenting stress has also been shown to predict child internalizing and externalizing disorders both concurrently (Bagner et al. 2009; Bayer et al. 2008; Crnic et al. 2005; Guajardo et al. 2009) and longitudinally (Bayer et al. 2008; Crnic et al. 2005; Mäntymaa et al. 2012), and even after controlling for parent psychopathology (Bayer et al. 2008).

It has been demonstrated that both synchrony and parenting stress explain variance in child behavior problems, which indicates that all three develop in relation to one another over time (Moss et al. 1998). In the current study we propose that one of the mechanisms by which synchrony impacts negative child outcomes is through its association with parenting stress (i.e., that parenting stress is a mediator of the synchrony-child problem behavior relation). We predict that low synchrony in parent–child relationships is associated with greater parenting stress, which is turn increases the probability of negative child outcomes such as child problem behavior.

Method

Participants

The sample consisted of 25 children, aged 6–10 years who had been consecutively referred to a children's mental health centre, and their mothers (clinic group: mean age = 7.84, *S.D.* = 1.41) as well as 25 children, and their mothers, recruited from the community in the same catchment area as the mental health centre (non-clinic group: mean age = 8.00, *S.D.* = 1.44). There were 15 males (60.00 %) in the clinic group and 10 males (40.00 %) in the non-clinic group. Participants were from ethnically diverse backgrounds (e.g., from families of West Indian, South Asian, and East Asian descent) although the majority of both the clinic and non-clinic group were White (clinic = 68 %; non-clinic = 76 %). The majority of dyads from both groups came from exclusively English speaking homes (clinic = 80 %; non-clinic = 76 %).

The children's mental health centre is a government funded institution in a large urban city, which provides both mental health prevention and intervention programs for children and their families. The types of problems seen at this centre are representative of referrals to mental health and psychiatric clinics. The most common reasons for referral are behavioral, emotional, and family adjustment problems.

The children in the clinic group were referred for a host of different problems, of which behavioral and emotional problems were most prevalent. Nearly 80 % of these children were referred for behavioral problems, of which 67 % had concurrent emotional problems. Reported behavioral problems included displaying aggression and tantrums. Reported emotional problems included displaying depressive and withdrawn behaviors. School and attention related difficulties also were frequently cited as reasons for referral.

Mothers of children recruited from the community were given a telephone screening interview to exclude those who had children who were receiving, or who had received any form of therapy or treatment for behavioral or emotional problems. Participants were excluded if children, in both the clinic and non-clinic group: a) failed to obtain an estimated verbal or performance IQ score within the average range (i.e., >85) or had hard neurological signs such as those accompanying cerebral palsy, autism, and hearing impairment. Additionally, children in the non-clinic group were excluded if they had internalizing or externalizing problem scores on the child behavior checklist (CBCL; Achenbach 1991a) or Teacher Report Form (TRF; Achenbach 1991b) that were within the clinical range (i.e., >59). All mothers provided informed written consent and all children provided verbal assent for participation and both were told they could withdraw from the study at any time.

Measures

Mother–child dyads were assessed at one time point and were initially separated so that the child could be administered child-specific tests and the mother could fill out questionnaires. The dyads then were reunited to participate in a play interaction.

Background History and Parenting Stress

Mothers completed a personal history questionnaire and a short form of the Parenting Stress Index (PSI: Abidin 1995).

The personal history questionnaire contained questions regarding income and employment as well as questions pertaining to child education and medical history. The Blishen Socioeconomic Index for Occupations in Canada (Blishen et al. 1987) was used to code socioeconomic status (SES). The Blishen assigns a numerical score to an extensive list of professions, which takes into account income level and education. It ranges from 17.81 (newspaper carriers and vendors) to 101 (physicians and surgeons) with higher scores reflecting a higher SES. A score was assigned to the mother's and father's occupation and the higher score of the two was used as the SES score.

The short form of the PSI, which correlates highly with the long form (.94; Abidin 1995), was used to measure parenting stress. Mothers rated 36 items on a 5-point scale. These 36 items are separated into three subscales (Parental Distress, Parent–child Dysfunctional Interaction, and Difficult Child) and are summed to provide a Total Stress Score. The reliability coefficient for the Total Stress Score on the PSI has been reported at .95 (Abidin 1995).

Child Problem Behavior

Mothers completed the CBCL (Achenbach 1991a), a 113 item questionnaire that provides standardized scores for Internalizing, Externalizing, and Total Problem Behavior. A meta-analysis conducted to examine variability among reported internal consistency reliability scores of the CBCL revealed that, across 40 studies, the CBCL total scale scores had a reliability of .91 (Nassen 2008). The Teacher Report Form (TRF; Achenbach 1991b), a parallel form of the CBCL, was mailed to the child's school teacher with the mother's written consent. To encourage a higher rate of questionnaire return, teachers were provided with a self-addressed stamped return envelope. Like the CBCL, the TRF provides standardized scores for Internalizing, Externalizing and Total Problem Behavior. Inter-rater reliability for the total scale of the TRF has been shown to range from .30 to .66 (Achenbach 1991b). In order to obtain an index of child problem behavior that reflected general emotional and behavioral problems, a composite score was created by calculating the average of the Total Problem Behavior T-score from the CBCL and TRF.

Intelligence

The Vocabulary and Block Design subtests of the Wechsler Intelligence Scales for Children-Third Edition (WISC-III: Wechsler 1991) were administered to provide an estimated verbal, performance, and full scale IQ score. This two-subtest version has been shown to be a reliable and valid measure of IQ and correlates highly with the full version of the WISC-III (Sattler 2001).

Language Skills

Receptive, Expressive, and Total Language scores were obtained using the core language subtests of the Clinical Evaluation of Language Fundamentals-Third Edition (CELF-3: Semel et al. 1995). The CELF-3 is a standardized measure that assesses the receptive and expressive components of morphology, semantics, and syntax.

Mother–Child Play Interaction

Each mother and child dyad took part in a 20-min play interaction, which was video recorded. Before the interaction took place a large plastic mat was placed in the middle of the room on top of which were arranged an array of age appropriate toys. A variety of toys was provided in order to encourage both imaginative and physical play (e.g., playing catch). The arrangement of the toys was standardized, such that each mother–child dyad encountered the same array and arrangement of toys. In addition to the toys there was a craft table equipped with paper, glue, scissors, and "play-doh" located in one corner of the room.

Synchrony

Synchrony was assessed using a 10 min sample of the 20 min video recordings made of each mother and child pair engaging in naturalistic play. A 10 min sample was chosen because it allowed for: (a) a 5 min grace period at the beginning of each play session during which parents and children could settle into play, and (b) at least 10 min of uninterrupted play between mothers and children to be coded consistently across all dyads.

The measure of mother and child synchrony was adapted from existing measures (Aksan et al. 2006; Lindsey et al. 2008), which allowed the operationalization of synchrony as a dyadic construct composed of the following subcomponent processes: (1) mother–child responsiveness, (2) mutual engagement, (3) reciprocity, (4) harmonious communication, and (5) shared positive affect.

Mother–child responsiveness was measured by the degree to which mothers and children responded to one another in a warm and timely manner. Mutual engagement was measured by the degree to which mothers and children interact and remain focused on the same activity. The reciprocity subcomponent reflected the extent to which mother and child matched each other in level of activity. Harmonious communication gauged the degree to which communication during the interaction had an effortless, connected quality. Lastly, shared positive affect measured the extent to which the interaction reflected an ambiance of positivity and warmth shared by both mother and child.

Each dyadic subcomponent was rated separately with a 5 point Likert scale (that ranged from 1 to 5) for every 30 s interval of the 10 min interaction. Each point on the scale was defined in terms of observable criteria, referred to as anchor points. A score of 1 indicated that the behavior of interest was noticeably absent; whereas a score of 5 indicated that the behavior was clearly evident for the entire 30 s interaction. A score of 3 was used as a midpoint indicating that the behavior was neither overtly expressed nor noticeably lacking.

For Mother–Child responsiveness, a score of 1 indicated that the dyad ignored one another, whereas a score of 5 reflected that the mother consistently and appropriately responded to the child while the child earnestly complied with maternal bids for attention. A score of 1 for Mutual Engagement indicated that the dyad was engaged in parallel play and a score of 5 indicated that the dyad was consistently mutually engaged. A score of 1 for Reciprocity meant that the mother and child never reciprocated with either verbal or non-verbal behavior, whereas a score of 5 was given if the interaction was characterized by coherent and immediate turn-taking. With respect to Harmonious Communication, a 1 indicated that all communication between mother and child was disjointed and incoherent, whereas a 5 reflected effortless communication. A score of 1 for Shared Affect indicated that the interaction was characterized by negative affect and a score of 5 was given if the interaction was characterized by positive affect.

Correlations among the subcomponent processes of synchrony ranged from $r = .38$ (mother–child responsive and shared affect) to $r = .79$ (mother–child responsiveness and harmonious communication) and were found to be statistically significant at $p < .05$. In addition, correlations between each component process and the overall synchrony measure ranged from $r = .58$ (shared affect) to $r = .93$ (reciprocity) ($p < .01$). A Cronbach's Alpha value of .80 indicated good internal consistency between all 6 subscales.

An overall synchrony score was calculated for each mother–child dyad from the ratings of all the subcomponent processes based on a scoring procedure from Aksan et al. (2006). First, the proportion of low scores (ratings of 1 and 2) and high scores (ratings of 4 and 5) were calculated. A difference score was then computed by subtracting the proportion of low scores from the proportion of high scores.

Reliability

Ten videos, not included in the current study, were coded by two independent coders blind to group designation in order to establish reliability. The coders individually viewed and rated synchrony for the same 10 min segments of play for each mother–child dyad. A kappa statistic was calculated for each subscale of synchrony in order to determine inter-rater reliability. Reliability (kappa) ranged from .77 (shared affect) to .93 (reciprocity) at a significance level of $p < .001$.

Results

Data Screening

Before analyzing the data, we examined data distributions for normality and outliers. This revealed the presence of one outlier. A child in the clinic group received very high scores on both the CBCL and TRF Total Problem Behavior scores. A review of the test observations notes indicated that this child was exceptionally disruptive during the test sessions and required a great deal of support in order to complete tasks. Since it was highly likely that the results from this participant were not valid, the child's data were dropped from further analysis.

Given that the TRF Total Problem Behavior score was used as part of the child problem behavior composite score, data from seven participants (clinic group $n = 5$, non-clinic group $n = 2$) could not be included in the analysis because the TRF was not returned by the participant's teacher. The final sample was comprised of a total of 42 dyads, 19 in the clinic group (mean age = 8.11, *S.D.* = 1.37) and 23 in the non-clinic group (mean age = 8.00, *S.D.* = 1.51). There were 12 males (63.15 %) in the clinic group and 10 males (43.48 %) in the non-clinic group.

Sample Characteristics

There were no significant group differences with respect to proportion of males, χ^2 $(1, N = 42) = 3.36$, $p = .07$ (clinic group = 63 %, non-clinic group = 34 %), age, SES, estimated IQ, and language ability (see Table 1). With respect to SES, the two groups were approximately middle class. Both groups performed within the high end of the average range on measures of language and performance IQ, and in the above average range on estimated verbal and full scale IQ.

As expected, children in the clinic group were rated by their mothers and teachers as having significantly higher internalizing, externalizing, and total problem behaviors compared to the non-clinic group (see Table 2). Also as expected, mothers in the clinic group reported significantly greater parenting stress ($M = 90.55$, $SD = 16.48$) than mothers in the non-clinic group ($M = 72.61$, $SD = 20.19$), $t(40) = 3.12$, $p = .003$.

Table 1 Group differences in background characteristics, estimated IQ, and language

	Clinic group $n = 19$		Non-clinic group $n = 23$		$t(1,40)$	Cohen's d
	M	*S.D.*	*M*	*S.D.*		
Age (Years)	8.11	1.37	8.00	1.51	.24	.08
SES	47.85	11.42	54.24	14.48	−1.56	.49
Estimated intelligence						
Verbal IQ	123.26	17.58	116.69	13.78	1.36	.42
Performance IQ	111.79	17.23	121.13	19.28	−1.64	.51
Full Scale IQ	119.56	16.71	120.87	13.98	−.27	.09
Language						
Receptive	109.89	11.04	109.61	12.76	.08	.02
Expressive	104.47	10.53	106.96	15.73	−.59	.19
Overall	107.16	10.53	108.22	14.51	−.26	.08

Table 2 Group differences in parent and teacher perception of behavioral and emotional problems

Scales	Clinic group $n = 19$		Non-clinic group $n = 23$		t	Cohen's d
Parent perception (T scores)	*M*	*S.D.*	*M*	*S.D.*		
Internalizing	61.42	10.13	52.09	8.73	3.21*	.99
Externalizing	60.63	8.99	46.48	7.83	5.45**	1.68
Total problem	63.63	9.49	49.74	6.90	5.49**	1.67
Teacher perception (T scores)						
Internalizing	55.53	10.10	48.39	11.02	2.17^{+}	.68
Externalizing	58.95	7.18	49.74	9.95	3.37*	1.06
Total problem	58.74	8.54	49.87	10.19	3.02*	.94

$^{+}$ $p < .05$; * $p < .01$; ** $p < .001$

Synchrony

As predicted, the clinic group showed a significantly lower overall synchrony score ($M = .26$, $SD = .29$) compared to the non-clinic group ($M = .44$, $SD = .25$) [$t(40) = -2.09$, $p = .04$].

Parenting Stress as a Mediator of the Synchrony–Child Problem Behavior Relation

Based on a statistical technique by Baron and Kenny (1986), parenting stress would function as a mediator to the extent that it accounts for the relation between synchrony and child problem behavior. Although this technique provides a test of whether the data are consistent with the model, it does not show causality. Parenting stress functions as a mediator if the following four conditions are met: (1) synchrony and parenting stress are significantly related (path *a*), (2) parenting stress and child problem behavior yield a significant effect (path *b*), (3) parenting stress and child problem behavior (path *b*) yield a significant effect when the contribution of synchrony is controlled, and (4) the effect of synchrony on child problem behavior (path *c*) is eliminated or significantly decreased when the contribution of parenting stress (path *a*–*b*) is controlled (see Fig. 1: top panel).

Multiple regression analysis was conducted on the total sample of 42 dyads to examine the mediator model using the following variables: (1) synchrony (overall synchrony score), (2) parenting stress (total score from the short form of the PSI), and (3) child problem behavior (mean of the total problem behavior score from the CBCL and TRF).

Prior to carrying out the mediation model analysis the data was screened for linearity and multivariate normality and outliers. A scatter plot of residuals and predicted values did not show any unusual patterning, indicating linearity of residuals. Histograms and QQ plots of residuals also indicated normality of residuals. Finally, regression diagnostics were carried out in order to determine the presence of multivariate outliers. Leverage, Cook's, and Mahalanobis' Distance values were observed to reveal no multivariate outliers in the dataset.

Pearson product moment correlations showed that synchrony was significantly related to parenting stress $r(40) = -.62$, $p < .01$ (path *a*) and to child problem behavior, $r(40) = -.39$, $p < .05$ (path *c*). In addition,

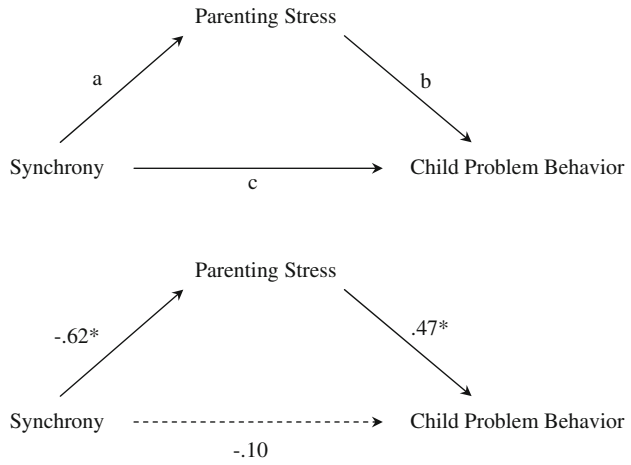

Fig. 1 *Top panel*: proposed mediation model for the relation between synchrony and child problem behavior as mediated by parenting stress. *Bottom panel*: final mediation model for the relation between synchrony and child behavior as mediated by parenting stress. Numbers reflect beta values. *$p < .01$

Table 3 Hierarchical multiple regression analysis predicting child problem behavior

Predictor	B	SE B	$R^2/\Delta R^2$	β	*F*
Step 1					
Synchrony	−12.00	4.47	.15	−.39*	7.23
Step 2					
Synchrony	−3.12	5.25		−.10	
Parenting stress	.20	.07	.14	.47*	7.98
Total R^2	.29				
N	42				

* $p < .01$

parenting stress was significantly related to child problem behavior, $r(40) = .53$, $p < .01$ (path *b*).

A hierarchical regression analysis was conducted to examine parenting stress as a mediator of the synchrony-child problem behavior relation. On step 1 of the hierarchical regression synchrony was entered into the model and was found to be a significant predictor of child problem behavior (see Table 3). On step 2, the parenting stress score was entered into the model and accounted for significant additional variance as well as the reduction to nonsignificance of the synchrony-child problem behavior relation (full mediation). A diagram of the final mediation model is shown in Fig. 1 (bottom panel). The R^2 values for synchrony (percent of variance accounted for by direct paths) for synchrony and parenting stress were .15 and .14, respectively, indicating medium effect sizes for both (Cohen 1992).

In summary, the results indicate that parenting stress completely mediates the relation between synchrony and child problem behavior.

The Aroian version of the Sobel test was used to determine whether the indirect effect of synchrony on child problem behavior via parenting stress was significant (i.e., if the mediated effect was significant). Results from the Sobel test indicated that the indirect effect of parenting stress was significant, $z = -2.37$, $p = .02$.

Discussion

As predicted, we found low synchrony among parent–child dyads in the clinic group compared to the non-clinic group and that parenting stress was a mediator of the synchrony-child problem behavior relation. These results demonstrate that synchrony is a clinically relevant construct and that parenting stress is a potential intervening factor that helps to explain how lower synchrony may place a child at risk for emotional and behavioral problems.

Although previous research has shown that low synchrony is associated with child problem behaviors (Criss et al. 2003; Deater-Deckard et al. 2004; Harrist et al. 1994), this is the first study to establish this association with a clinic-referred sample. Furthermore, the results demonstrate that the level of synchrony between parents and children can discriminate between clinic referred and non-clinic referred children. This finding corroborates a long held belief that nonsynchrony may play a role in the development of child problem behaviors (Criss et al. 2003; Deater-Deckard et al. 2004). Indeed, Deater-Deckard et al. (2004) argued that the associations between synchrony and child outcomes found among typical child populations likely hold true for families of children with clinically significant problems and that the difference is a matter of degree. This suggests that the processes that underlie the outcomes associated with synchrony in children with typical development are relevant for children presenting for services at mental health clinics and is an important focus for future research. An added significance of our results is that synchrony, a positive aspect of parent–child interactions, has been shown to bear a relation with child problem behavior.

The focus of intervention for clinic referred children is often the problem behavior itself or negative parenting (Deater-Deckard et al. 2004). The finding that low synchrony is associated with clinical problems suggests that positive aspects of parent–child interactions may be influential in their absence. This is consistent with previous research that shows a lack of synchrony is more predictive of child problem behavior than the presence of conflict and negativity in parent–child interactions (Harrist et al. 1994). Also of note is that we observed synchrony in the context of a play situation, which should promote positive interactions rather than frustration or conflict. That the clinic-

referred dyads showed low synchrony in this type of context suggests they have difficulty achieving synchronous interactions even in, what some might consider, low stress situations.

Although the design of the current study precludes any discussion of causality, our results suggest that lower synchrony in parent–child interactions may place a child at risk for psychopathology. Treatments that have focused on improving parent–child interactions by promoting warmth and responsiveness have been shown to improve outcomes for children with disruptive behavior disorders (Bagner and Eyberg 2007; Schuhmann et al. 1998) as well as children with anxiety disorders (Choate et al. 2005). Such therapies focus on parent–child interaction quality and are often conducted in a parent–child play context (Guerney 2000). Improving the quality of synchrony between parents and clinic-referred children would follow in this tradition but would highlight the importance of focusing on the dyadic quality of parent–child interactions. Where other therapies may coach parenting strategies and child social skills, the goal of synchrony training would be to guide parents and children to interact in a harmonious and optimal way that could allow for collateral gains in child adaptive functioning or to put parents in a position to follow their child's lead (e.g., Cohen et al. 2002). It has been argued that synchrony may be more useful as a clinical intervention target because conflict and negativity in parent–child interactions make up a small percentage of the exchanges parents and children experience on a daily basis (Harrist et al. 1994). Rather than focus on diminishing these less common episodes of conflict, greater improvements in parent–child relationship quality and child outcomes may result from teaching parents and children to interact more harmoniously on a regular basis.

In addition to demonstrating synchrony as a clinically relevant construct, the current study extends the existing synchrony literature by showing that the association between synchrony and child outcomes is mediated by parenting stress. To date, the role of synchrony in relation to child outcomes has largely remained a theoretical argument concerned with the inherent properties of synchrony. Parenting stress has not previously been discussed in relation to synchrony but we argue that parent–child synchrony may be directly associated with parenting stress because synchrony reflects longstanding patterns of interaction that have a daily impact on parent and child relations (Harrist and Waugh 2002). Crnic et al. (2005) demonstrated that parenting stress in particular, rather than stress in relation to major life crises, is associated with parents' perception of the quality of parent–child dyadic interaction. Parents and children who routinely experience low synchrony are more likely to find it difficult to negotiate everyday conflict and this could result in challenging parenting situations. The day to day experience of low synchrony may make parents more vulnerable to stress associated with the parenting role and, subsequently, these parents may be more likely to use negative parenting practices such as those associated with authoritarian parenting (Reid and Patterson 1989). Conversely, higher levels of synchrony are more likely to decrease parenting-related stress, which would decrease the need for authoritarian parenting (Reid and Patterson 1989) and increase positive parenting (Criss et al. 2003). This idea is supported by findings that, on one hand, show mother and child interactions characterized by a mutual lack of pleasure were more likely to involve mothers with greater parenting stress (Dubois-Comtois et al. 2013). The children of these highly stressed mothers also were more likely to report greater socio-emotional problems. On the other hand, mother–child interactions characterized by greater maternal sensitivity and child responsiveness have been found to be related to lower parenting stress and children with better emotional adjustment (Stack et al. 2012). In terms of clinical implications, our results suggest that regular and periodic assessment of parenting stress throughout the treatment process may be beneficial.

While the current study furthers the synchrony literature, we acknowledge that we must be cautious about drawing any causal conclusions regarding the mediation of parenting stress in the synchrony-child problem behavior relation due to the non-experimental nature of our study and since data were collected contemporaneously. Synchrony is a bidirectional construct, which means that both parent and child characteristics contribute to the quality of synchrony. Previous research has demonstrated that parents and children mutually influence each other to shape the course of child development (Kuppens et al. 2009; Larsson et al. 2008; Pardini et al. 2008). As such, we cannot ignore the possible bidirectional association between child behavior problems and synchrony. Ultimately, longitudinal and intervention studies will help to confirm whether the quality of synchrony has an impact on parenting stress, which in turn impacts child problem behavior. We also acknowledge that there are probably other factors, that we did not measure, that may act as mediators of the synchrony–child problem behavior relation. For example, it has been suggested that synchrony may provide an optimal context for the development of child self-regulation (Criss et al. 2003; Harrist and Waugh 2002). Problems of self-regulation are often implicated in both externalizing and internalizing disorders (Burt et al. 2008; Eisenberg et al. 2001, 2010; Röll et al. 2012). It is possible that lower synchrony places children at risk for problem behaviors by disrupting the development of self-regulation.

The present study contributes to our understanding of how synchrony is related to child outcomes by including a

clinic-referred school-aged sample and showing that parenting stress is a mediator of the synchrony-child problem behavior association. Research that focuses on the clinical utility of synchrony as well as the mechanisms underlying the relation between synchrony and negative child outcomes may assist in furthering therapies that incorporate the dynamics of parent–child interactions in later childhood.

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