

**Assessing Pre-Schoolers Interactive Behaviour: A Validation Study of The  
“Coding System For Mother-Child Interaction”**

Baiao R, Baptista J, Carneiro A, Pinto R, Toscano C, et al., Child: Care, Health and Development, 2018

**ABSTRACT**

*Background* The preschool years are a period of great developmental achievements, which impact critically on a child’s interactive skills. Having valid and reliable measures to assess interactive behaviour at this stage is therefore crucial. The aim of this study is to describe the adaptation and validation of the child coding of the Coding System for Mother–Child Interactions (CSMCI, Healey et al., 2010), and discuss its applications and implications in future research and practice.

*Methods* 220 Portuguese pre-schoolers and their mothers were videotaped during a structured task. Child and mother interactive behaviours were coded based on the task. Maternal reports on the child’s temperament and emotional and behaviour problems were also collected, along with family psychosocial information.

*Results* Inter-rater agreement was confirmed. The use of child Cooperation, Enthusiasm and Negativity as subscales was supported by their correlations across tasks. Moreover, these subscales were correlated with each other, which supports the use of a global child interactive behaviour score. Convergent validity with a measure of emotional and behavioural problems (CBCL 1 ½-5) was established, as well as divergent validity with a measure of temperament (CBQ-SF). Regarding associations

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with family variables, child interactive behaviour was only associated with maternal behaviour.

*Conclusions* Findings suggest that this coding system is a valid and reliable measure for assessing child interactive behaviour in preschool age children. It therefore represents an important alternative to this area of research and practice, with reduced costs and with more flexible training requirements. Attention should be given in future research to expanding this work to clinical populations and different age groups.

*Keywords:* Child interactive behaviour; observational measure; coding system; mother-child interaction; pre-schoolers.

### **Introduction**

Reliable and valid behavioural assessment is an essential tool for understanding child development. Most assessment of child behaviour is based on parents' or teachers' reports, which are relatively easy to acquire, but rely on the individual's ability to describe or quantify complex behavioural and relational characteristics (Lindhal & Malik, 2001) and are potentially subject to bias. Self-reports have obvious limited utility in young children, as they require an appropriate level of cognitive and linguistic skills that would not be sufficiently developed. Therefore, an important alternative (or complement) are observational measures. Observing child behaviour is valuable for assessing the different dimensions of childhood, providing an objective window on real processes and outcomes of interest. One of the domains where observational measures have been widely used is parent-child interaction, as they allow detailed measurement of the quality of such interaction (Gardner, 1997).

Specifically in the pre-school years, observing interactive behaviour is critical due to the major developmental achievements taking place during this period. At this time, children become more autonomous, with growing capacity for exploring the environment. As described by Marvin and Britner (2008), their representational and communicative abilities increase, and allow them to practice many social behaviours. In fact, by this age most children are able to reason in a gradually more sophisticated and accurate manner (i.e., nonegocentrically) (Marvin, Greenberg, & Mossler, 1976), and to communicate about events and emotional states, and beginning to relate logical sequences (e.g., Dunn, 1994). They are able to organize a plan, to construct a shared perspective (see Lewis & Mitchell, 1994), and to start to understand and apply complex implicit and explicit rules for social interaction (see Eisenberg, 2006). The preschool years are also a period of progress in emotion regulation, with children gradually

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developing the ability to attune their cognitions, behaviours, and emotions to respond to situational demands (Kopp, 1989), and going from other-reliant strategies to increasingly active and autonomous ones (Grolnick, McMenemy & Kurowski, 2006). All these socio-cognitive and emotional capacities contribute in important ways to children's capacity to engage in complex interactions with others (Marvin & Britner, 2008). Despite the relevance of observation as an assessment tool for child's interactive behaviour, remarkably few measures exist focusing on the preschool period, and even less are accessible for professionals and researchers. Specifically, some of the existing scales have significant costs or training burden that impedes their broad use.

Therefore, given the need for reliable, valid and available observational methods, the present study aimed to adapt and validate a measure for assessing child interactive behaviour for preschool age children, during a structured mother-child interactive task. The coding system was developed by Healey and colleagues (2010), based on previous measures: the NICHD Study of Early Child Care (NICHD Early Child Care Research Network [ECCRN], 1999, 2003, 2006); Campbell, Pierce, March, Ewing, and Szumowski (1994); and Eyberg, Bessmer, Newcomb, Edwards, and Robinson (1994). These previous coding systems have been extensively used in research on mother-child interactions and found to be valid and reliable measures of both individual and dyadic behaviours. The new Coding System for Mother-Child Interactions has recently been evaluated in research studies, which report good intercoder reliability, and therefore underline the value of this new coding system (Gopin, Healey, Grossman, Campbell & Halperin, 2011; Healey et al., 2010; Rajendran, Kruszewski, & Halperin, 2016)

In the current enquiry, we focus on the child behaviour codings, which assess the dimensions of Cooperation, Enthusiasm and Negativity, during the structured mother-child interactive task. Our aim is a) to conduct the first reliability study of these child

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codings in a pre-schoolers sample; b) to report on its descriptive data, and its convergent and discriminant validity; and c) to test its association to other relevant maternal and environmental factors.

### **METHOD**

#### **Participants**

The sample consists of 220 Portuguese pre-schoolers and their mothers.

Children's ages ranged from 40 to 77 months ( $M = 58.23$ ,  $SD = 7.66$ ); 120 (54.5%) were girls. 82 (37.3%) of the children were only children, and the mean number of children per family was 1.88 ( $SD = .90$ , range = 1-6).

Mothers' ages ranged from 20 to 48 years ( $M = 33.35$ ,  $SD = 5.66$ ). Regarding education level, 54 mothers (24.5%) had less than nine years of education, 66 had completed 9 years of education (30%), 63 (28.6%) completed high school; and 37 (16.8%) had a higher education degree. With respect to marital status, 43 (19.5%) of the mothers were single, 41 (18.5%) were living with partners, 114 (51.8%) were married, 19 (8.6%) were divorced and 3 (1.4%) were widowed.

#### **Procedure**

Ethical approval was obtained from University of Minho, the Portuguese Ministry of Education, and National Commission for Data Protection. Portuguese public pre-schools and Private Social Security Institutions from the north of Portugal (districts of Braga and Porto) were contacted, and the project was presented to the board of the schools. Following their approval ( $N = 25$  schools), parents of children aged 3-6 years were contacted. A session was then booked with the parents who showed interest in taking part in the study, conducted either in participants' homes or pre-schools,

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depending on participants' availability. When tested, no group differences according to settings were found regarding the variables of interest. The visit started with the study description. Then, informed consents from the mothers were obtained. Mothers were then asked to fill in the questionnaires described below and to join the child in an interactive task. The interaction was videotaped across three 5-minute episodes involving: (a) child playing with a challenging toy under mother's guidance; (b) child playing exclusively with an uninteresting toy, after being instructed not to touch more interesting, but difficult-to-reach toys, while mother completes a sham questionnaire; and (c) child and mother engaging in free play for half the period, followed by mother-directed child clean-up.

### **Measures**

#### *Child interactive behaviour*

The child codings of the Coding System for Mother–Child Interactions (CSMCI, Healey, Gopin, Grossman, Campbell, & Halperin, 2010) aims to assess a child's behaviour based on observation of an interactive task. It consists of three subscales: (a) Cooperation-Compliance, which measures whether the child responds to maternal suggestions and commands quickly/cheerfully; (b) Enthusiasm, an assessment of whether the child invests in the task and approaches it with energy and excitement; and (c) Negativity and Hostility, a measure of whether the child forcefully rejects the mother's ideas or is unreasonably demanding.

For the present validation, child behaviour was assessed based on the videotaped mother-child interactive task. Following the work of Haley et al. (2010), we considered two episodes of that interaction (episodes (a) and (c) described in the section "Procedure"), in order to include three tasks: 1) child playing with a demanding toy

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under mother's guidance (5min); 2) free play with the mother (2,5min); and 3) clean up task (2,5min). The coding system was requested from the team who developed it. It was then adapted to the Portuguese language and learned by two coders experienced in other observational measures without direct training from the developers. Afterwards, those two coders introduced the system to a team of naïve coders during 3 half days of training (12h total). The videos were coded individually and in group during the training. Ten videos were then coded individually for the reliability analysis.

The coding of the subscales (Cooperation, Enthusiasm and Negativity) is based on an anchored, 5-point Likert scale (1 = very low to 5 = very high). Negativity scores were inverted so that higher scores in the three subscales represent better (more adaptive) behaviour. Ratings reflect qualities of the child interactive behaviour occurring through the observational period, as exhibited in the observed interaction with the mother. Following the original study reporting to this measure (Healey et al., 2010), a minimum interrater reliability of .70 was ensured for each subscale, in the present report.

### *Child Emotional and Behavioural Problems*

The Child Behaviour Checklist for ages 1 1/2-5 (CBCL 1 1/2-5; Achenbach & Rescorla, 2000; Portuguese version Dias, Sousa Lima, Machado, Carneiro & Campos, 2017) was used to assess child emotional and behavioural problems. The 100-item questionnaire was completed by mothers in a 3-point Likert scale (0 = Not true to 2 = Very/Often True). It assesses empirically based subscales, DSM-oriented subscales and two second order subscales: internalizing and externalizing problems. A total score is also computed – i.e., Total Problems Scale - which compiles all the child's emotional and behavioural symptoms reported by the parent. In the present study, the subscales of

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Externalization and Internalization problems were used, as well as the Total Problems Scale. Good validity has been reported for the Portuguese version (Dias et al., 2017).

### *Child Temperament*

The Children's Behaviour Questionnaire - Short Form Version (CBQ-SF, Rothbart, 2000; Portuguese version by Lopes, 2011) was used to assess mother's perspective of child's self-regulation strategies and emotional reactions. This instrument is composed of 94 items that assess 15 domains of temperament in children aged 3 to 7 years, and three broad dimensions of temperament (Extraversion/Surgency, Negative Affectivity, and Effortful Control). Mothers were asked to rate how much the items described the children's behaviour in the past six months, on a scale ranging from 1 (extremely untrue) to 7 (extremely true). In this study, the three broad dimensions were used. The validity of the Portuguese scale has been established and reported by Lopes (2011).

### *Maternal behaviour*

Maternal behaviour was assessed based on the 15 minutes videotaped interaction task, using Ainsworth's scales (Ainsworth, Bell, & Stayton, 1974) for rating maternal sensitivity, meaning the mother's ability to accurately perceive the child's signals and to respond to them promptly, contingently and appropriately; and cooperation, defined as mother's ability to respect the child's autonomy while avoiding situations in which she might have to interrupt the child's activity or exert direct control. The coding is based on 9-point scale with higher scores indicating more sensitive/cooperative behaviour. Coding achieved good interrater reliability (sensitivity: ICC = .93, N = 87; cooperation: ICC = .86, N = 84). In line with previous studies (Baptista, et al., 2013; Juffer, Hoksbergen, Riksen-Walraven, & Kohnstamm, 1997; Tharner et al., 2012), a dimension

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of *sensitive responsiveness* was considered. The score was computed by averaging the two highly correlated scales of sensitivity and cooperation ( $r = .73, p < .001$ ).

### *Maternal Psychopathology*

Mothers completed the 53-item of the *Brief Symptom Inventory* (BSI; Derogatis, 1982; Portuguese version, Canavarro, 1999), based on a 5-point scale (0 = not at all to 4 = extremely), in terms of the presence of various symptoms experienced in the past week. The questionnaire assesses nine basic psychopathological dimensions and three global scores. The Positive Symptoms Distress Index (PSDI), one of the global scores, was used in the study, as a measure of symptom intensity corrected for the number of symptoms. The Portuguese validation study reports on the good psychometric qualities of the inventory, and states the validity of the PSDI as a separate scale (Canavarro, 2007).

### *Quality of the environmental context*

Sociodemographic information was collected in line with Weitzman, Edmonds, Davagnino, and Briggs-Gowan (2013) to derive a quality of the environmental context, variable based on the presence (vs. absence) of nine factors: teenage pregnancy (10, 4.5%); single parenthood (40, 18.2%); (low) parental educational level (i.e., one of the parents had under nine years of education) (95, 43.2%); parental unemployment (i.e., one of the parents was unemployed at the time of the study) (74, 33.6%); economic difficulties (93, 42.3%); absence of social support (20, 9.1%); family conflict (67, 30.5%); maternal psychopathology (see above) (49, 22.3%); chronic health conditions in the family living with the child (133, 60.5%). The factors were analysed based on Item Response Theory (Bolt, 2005). A standardized score was calculated based on the

presence/absence of the aforementioned factors, by summing and reversing those considered “negative”, with higher scores reflecting better environmental context quality.

### **Statistical analysis**

Firstly, inter-coder reliability was calculated for the three subscales of the coding system, based on Intraclass Correlation (ICC) (Winer, 1971). Descriptive statistics were then computed for the variables of interest, as well as cross-situational consistency. A series of correlations were performed to assess the validity of the coding system. Finally, bivariate correlations were run to test for associations between variables of interest, regarding the child, mother and environmental context.

### *Results*

#### *Reliability*

Inter-coder reliability was determined by randomly assigning 28.18% of the cases (62 cases) to 3 pairs of coders. Coders were blind to participant’s information. Between the pairs of coders, reliability ranged from ICC = .88 to .93 for Cooperation; .91 to .93 for Enthusiasm; and .89 to .94 for Negativity. These values are indicative of high inter-coder agreement.

#### *Descriptive statistics and correlation analysis of the child codings*

First of all, to examine the consistency of Cooperation, Enthusiasm and Negativity scores, we tested their associations across the three tasks (i.e., puzzle, free play and clean up).

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INSERT TABLE 1

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As presented on Table 1, Cooperation scores were significantly associated across the different tasks. The same was the case for Enthusiasm and Negativity. The magnitude of the correlations was moderate ( $r > .30$ ) to high ( $r > .50$ ) in the case of Cooperation and Negativity; and small to moderate for Enthusiasm ( $r > .21$ ) (Cohen, 1988). Given the significant associations, Cooperation, Enthusiasm and Negativity scores across the three tasks were averaged and considered as subscale scores for the entire interaction.

Table 2 presents descriptive data and associations between the subscales, and child age and sex. The subscales scores were rated from 1 to 5, with means ranging from  $M = 3.46$  ( $SD = .73$ ) for Enthusiasm and  $M = 3.96$  ( $SD = .79$ ) for Negativity. Regarding associations, subscales were moderate to highly correlated among them ( $r > .397$ ,  $p < .001$ ), and for that reason were standardized and averaged into a global Child Interactive Behaviour variable. Child age was positively associated with Cooperation and Enthusiasm, but not with Negativity. Sex was not significantly associated with the other variables.

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INSERT TABLE 2

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*Convergent and discriminant validity*

Due to the expected overlap between the child interactive behaviour and emotional and behavioural problems, CBCL 1 1/2-5 scores were included in the analysis for convergent validity. As presented on Table 3, child's interactive behaviour was inversely associated with emotional and behavioural problems meaning that higher

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scores in child interactive behaviour were related to lower levels of reported behavioural and emotional problems. This was the pattern of associations for all subscales of both measures, as well as for the global scores. Despite being significant, the magnitude of those associations was under .30 ( $r < -.237$ ), which is considered a small association (Cohen, 1988).

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INSERT TABLE 3

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To investigate the discriminant validity of the coding scales, we examined the associations between child interactive behaviour, and a measure of temperament. According to Table 3, there was only one significant and positive association between Cooperation and Effortful Control ( $r = .140, p = .04$ ). Nonetheless, this association was small in magnitude.

### *Associations between child interactive behaviour and maternal and environmental factors*

Correlation analyses were also performed regarding child interactive behaviour and maternal and environmental factors. As displayed on Table 4, child Cooperation, Enthusiasm and Negativity were inversely associated with maternal psychopathology ( $r > -.135, p < .05$ ), meaning that lower maternal psychopathology scores were associated with better outcomes in child interactive behaviour.

Finally, we analysed the associations between maternal and child interactive behaviour – considering both the subscales and global measures. As presented on Table 4, all interactive behaviour constructs were positively correlated.

Non-significant associations were found between the other variables.

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INSERT TABLE 4

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### **Discussion**

The present inquiry focused on the child codings of the Coding System for Mother-Child Interactions and had three aims. The primary one was to conduct the first reliability study of the codings in a pre-schoolers sample. Our results confirm high levels of interrater agreement, which support the reliability of the coding system for assessing child's Cooperation, Enthusiasm and Negativity. In fact, the high values of reliability suggest that the content of the subscales was based on well operationalized definitions which were clear for the coders. This is of relevance since observational coding of behaviour is a challenging task, and it is therefore crucial that constructs are conceptually well defined in order to derive reliable and consistent data (Furr & Funder, 2007).

The second aim of this study was to report on the descriptive data of the coding system and analyse its validity. First of all, associations of Cooperation, Enthusiasm and Negativity across tasks suggest the stability of the constructs, which do not seem to be task dependent, and support their use as subscales. Of note, the lower magnitude of associations regarding Enthusiasm may mean that it is more task-specific, which is not surprising given the content of the episodes (puzzle, free play and clean up). The three subscales were positively associated which, in turn, supports the use of a global score for child interactive behaviour.

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Regarding child's variables, age was positively associated with Cooperation and Enthusiasm, such that older children tended to score higher on those subscales. As mentioned in the introduction, the preschool years are a period in which the child acquires many critical social abilities and skills, which are likely to facilitate cooperation. The same is true regarding the Enthusiasm subscale, as it relates to the ability to be involved in the task, and being confident and interested (Healey et al. 2010), which can benefit from the growing autonomy and self-reliance. The absence of a significant age-association for the Negativity subscale might seem surprising since this period is also characterized by achievements in emotion regulation. Nonetheless it should be noted that, in this particular scale, negativity is assessed specifically regarding child-mother interaction, and not the general ability to regulate emotions.

Concerning convergent validity, children's emotional and behavioural problems and interactive behaviour were associated, which supports the convergent validity of the scale. The strongest associations were found for externalizing behavioural problems, although the effect sizes were small in magnitude. This stronger association may not be surprising, as externalizing behaviour is expressed through clearly outwardly observable behaviour, which might be more easily captured by the child behaviour codings.

In the case of divergent validity the absence of a significant association between the measures suggests that they do assess different constructs, being the coding system related to interactive behaviour in a dyadic situation, and temperament based on general individual differences in reactivity and self-regulation (Rothbart, Posner, Kiers, 2006). A small, although significant, association was found between the CBQ-SF dimension of Effortful Control and the Cooperation subscale, which seems reasonable as effortful control relates to the capacity to organize attention and regulate emotions and behaviours according to immediate and long-term goals (Posner & Rothbart, 2000).

The third aim of this research was to test the association between child interactive behaviour and relevant maternal and environmental variables. As expected, we found a significant negative association with maternal psychopathology. This result is in line with a vast literature on the impact of maternal psychopathology on child development and behaviour (Cicchetti, Rogosch, & Toth, 1998; Cummings & Davies, 1994; Goodman & Gotlib, 1999). Child behaviour was, perhaps surprisingly, not significantly associated with maternal education or quality of the environmental context. The presence of these factors documents that the families are facing multiple chronic stressors known to impact on the parent-child relationship, supportive parenting and the child's healthy socio-emotional development (Cicchetti, Rogosch, & Toth, 1998). Nonetheless, it is possible that these factors do not impact specifically on the child's behaviour when interacting with the mother, but would (and in our sample does) impact on other more general and less context specific measures of child adjustment, such as emotional and behavioural problems and mental development (unpublished data). Future studies should include different environmental variables and test them separately and composited to assess their association with child interactive behaviour.

Regarding the associations between mother-child interactive behaviour, a consistent significant and positive pattern was found. It is in line with research underlining the role of sensitive parenting in facilitating positive exchanges and promoting the establishment of a mutually responsive relationship (e.g., Kochanska, 1997). These findings are also in line with studies linking sensitive and responsive parenting to a range of adaptive outcomes in children (Eisenberg et al., 2001; Kochanska & Murray, 2000). That said, as this study is cross-sectional a direction or causality should not be implied.

Despite the relevance of these findings, this study has some limitations that should be addressed. Methodologically, it should be noted that the validation included two different methods (observation and questionnaires), with information provided by two different informants (observer/researcher and mother), and therefore the possibility of method effects should be acknowledged (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Also, it would be informative to test for the convergent validity of the child codings using a different observational measure of child behaviour; and to include more informants of the child behaviour, besides the mother – for example, the father. These issues should be addressed by future research.

Moreover, despite its advantages and pertinence, the use of observational measures entails limitations. One of them is observer bias; nonetheless, the high values of reliability found in this study reduce that possibility. Reactivity effects could have also accounted for the results (Kazdin, 2003), resulting in more mild behaviour, particularly from parents. To minimize this effect, researchers allowed time for participants to become familiarised with them and with the procedures, and reduced as possible the intrusiveness of the recording equipment. The fact that both maternal and child interactive behaviour scores have a large range suggests that a wide variety of behavioural performances were captured.

In conclusion, this work contributes to the existing literature on the assessment of child's interactive behaviour, by providing data on the reliability of an observational method. Given that the coding system validated here can be requested from the developing team without any cost, and trained by in-house coders (who, although being experienced in other observational measures, had no formal training in this system), it represents a low-cost investment, with more flexible training requirements than some

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other systems currently available. It therefore overcomes some of the difficulties faced by research teams or practitioners when learning and accessing other observational measures. Its use is recommended as a part of a multi-method approach of the study of child interactive behaviour. Future research should expand this work to clinical populations and possibly other age groups.

### **KEY MESSAGES:**

- Preschool years are a period of great developmental achievements, which impact critically on a child's interactive skills
- It is crucial to have valid and reliable measures to assess interactive behaviour at this stage
- The child codings of the "Coding System for Mother-Child Interaction" is a valid and reliable measure, which represents an important alternative, with reduced costs and flexible training requirements.

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**TABLES**

**Table 1.** Associations between Cooperation, Enthusiasm and Negativity scores across the three tasks

	<b>Cooperation</b>		<b>Enthusiasm</b>		<b>Negativity</b>	
	1.	2.	1.	2.	1.	2.
1. Puzzle						
2. Free play	.523**		.282**		.590**	
3. Clean Up	.398**	.476**	.208**	.301**	.459**	.580**

Pearson correlations. \* $p < 0.05$ ; \*\* $p < 0.01$ .

**Table 2.** Descriptive data and associations between child interactive behaviour and child age and sex

	<b>Range</b>	<b>M (SD)</b>	<b>1.</b>	<b>2.</b>	<b>3.</b>	<b>4.</b>
1. Cooperation	1.33-5	3.75 (.75)	-			
2. Enthusiasm	1.33-4.67	3.46 (.73)	.636**	-		
3. Negativity	1-5	3.96 (.79)	.779**	.397**	-	
4. Age (months)	40-77	58.23 (7.66)	.185**	.239**	.130	-
5. Sex	-	-	-.131	.011	-.070	.104

Pearson and point-biserial correlations. \*\* $p < 0.01$ .

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**Table 3.** Associations between the child interactive behaviour, emotional and behavioural problems and temperament

	Convergent validity			Divergent validity		
	CBCL Internalizing	CBCL Externalizing	CBCL Total problems	CBQ Surgency- Extraversion	CBQ Effortful control	CBQ Negative affect
Cooperation	-.141*	-.229**	-.186**	-.028	.140*	-.089
Enthusiasm	-.143*	-.135*	-.155*	-.019	.111	-.075
Negativity	-.151*	-.237**	-.192**	-.049	.050	-.098
Child Interactive Behaviour	-.169*	-.234**	-.207**	-.037	.117	-.102

Pearson correlations. \* $p < 0.05$ ; \*\* $p < 0.01$

**Table 4. Correlations between the child interactive behaviour and maternal and environmental factors**

	Maternal age	Maternal education	Maternal psychopathology	Quality of the environmental context	Maternal sensitive responsiveness
Cooperation	.076	-.004	-.147*	-.094	.288**
Enthusiasm	.075	.088	-.135*	-.087	.270**
Negativity	.126	-.020	-.156*	-.096	.275**
Child Interactive Behaviour	.108	.025	-.170*	-.108	.324**

\* $p < 0.05$ ; \*\* $p < 0.01$

**Note.** Maternal sensitive responsiveness – average of maternal sensitivity and cooperation.