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Parental behavior and child interactive engagement: a longitudinal study on children with a significant cognitive and motor developmental delay

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ABSTRACT

Knowledge on the long-term interactive interplay between children with a significant cognitive and motor developmental delay and their parents is very scarce. We aimed to characterize the (in)variability and potential mutual influence of parent's interactional style and child interactive engagement throughout early childhood. Every six months over the course of two years, thirty-five parent-child dyads (children aged 6–59 months) living in Flanders (Belgium) or the Netherlands were video-taped during a 15-minute unstructured play situation. Video-taped observations were scored using the Child and Maternal Behavior Rating Scales. No consistent group-level trend was found. Within singular interactions, parent's responsive behavior and child interactive engagement (attention and initiation) seem to be strongly related. Initial child initiation seems to positively predict parents' achievement orientation and directive behavior two years later. Parental responsiveness might be an effective interactional strategy to increase child engagement and higher levels of engagement in children possibly can facilitate parental responsiveness within a concrete interaction. The more initiative children show, the more parents might have hope for developmental benefits resulting from a directive/achievement oriented approach. Further research is warranted applying more differentiated and dynamically evaluated outcome measures and a longer follow-up time frame, with specific attention to inter-individual differences.

1. What this paper adds?

This paper is one of the first steps in filling the striking gap of knowledge on family and parenting factors in the current literature on the specific target group of young children with a significant cognitive and motor developmental delay. The parents of these children, and the professionals who guide them, experience of lot of uncertainty about recognizing and stimulating the interactional abilities of these children as well as about which parental interaction style is optimal for the child's development. Certainly knowledge on the long-term interactive interplay between children with a significant cognitive and motor developmental delay and their parents is very scarce. This paper confirms that parent's responsive behavior seems to be strongly related to their child's interactive engagement (attention and initiation). Therefore, parental responsiveness might be an effective interactional strategy to

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increase child engagement and higher levels of engagement in children possibly can facilitate parental responsiveness within a concrete interaction. Also, the more initiative children show, the more parents might have hope for developmental benefits resulting from a directive/achievement oriented approach. Also very important, this paper sets the stage for further research applying more differentiated and dynamically evaluated outcome measures and a longer follow-up time frame, with specific attention to inter-individual differences.

1. Introduction

The most important context for promoting child development, is the child's family and especially the child's interactions with parents (Bronfenbrenner, 1986; Lerner, Rothbaum, Boulos, & Castellino, 2002; Lochman, 2004; Sameroff, 2009). An extensive body of research on parenting behavior indicates that the way parents interact with their children, or their style of interaction, is associated with low to moderate amounts of variability in children's development (Mahoney & Nam, 2011; Sameroff, 2010). Parental support (e.g., sensitive responsiveness, warmth and stimulation) is generally found to be associated with adaptive child outcomes in a variety of developmental domains (e.g., Farah et al., 2008; Mahoney & Nam, 2011; Stams, Juffer, & van IJzendoorn, 2002; Zhou et al., 2002), also in the context of authoritative parenting (i.e. high levels of both responsiveness and demandingness; Larzelere, Morris, & Harrist, 2013; Rinaldi & Howe, 2012). To the contrary, intrusive directiveness and negativity appear to be inversely associated with developmental outcomes (e.g., Ispa et al., 2004; Larsson, Viding, Rijsdijk, & Plomin, 2008). While developmental outcomes attained by children with disabilities are clearly affected by the nature and severity of their disabilities, the same general patterns of parenting associated with optimal development in typically developing children are evident in studies on children with a developmental delay, especially with regard to sensitive responsiveness (Baker, Fenning, Crnic, Baker, & Blacher, 2007; Dyches, Smith, Korth, Roper, & Mandleco, 2012; Hastings, Daley, Burns, & Beck, 2006; Mahoney & Nam, 2011; Warren & Brady, 2007). Research into the association of (different levels of) directiveness with (positive as well as negative) child outcomes has shown mixed results, although higher levels of parental directiveness are often observed in children with lower levels of cognitive functioning (Guralnick, Neville, Hammond, & Connor, 2008; Spiker, Boyce, & Boyce, 2002).

Even though research on parenting within the target group of (young) children with a significant cognitive and motor developmental delay is very scarce (Chadwick, Cuddy, Kusel, & Taylor, 2005; Van keer & Maes, 2016), a recent explorative cross-sectional study on 25 children showed a positive association between parental responsiveness and child interactive engagement (Van keer, Colla , Van Leeuwen , Vlaskamp , Ceulemans , Hoppenbrouwers, Desoete , & Maes 2017), thus cautiously confirming the importance of sensitive responsiveness as primary variable in parenting research. Parent's directiveness and achievement orientation showed no significant association with child engagement. However, results were striking because of the low presence of these type of behaviors in parents' interactional style. Also, respectively moderate and low levels of child attention and initiation were found.

Further research on parental behavior and child interactive engagement in this target group is imperative. Due to the combination of significant cognitive and motor limitations, these children are highly dependent on their immediate caregivers to provide (opportunities for) meaningful experiences (Horn & Kang, 2012; Vlaskamp, 2011). Further, Mahoney and Nam (2011) state that parent's interactional style (primarily responsiveness) may impact development by enhancing the rate that children use pivotal developmental behaviors, i.e. behaviors that are central to wide areas of functioning such that a change in the pivotal behavior will produce improvement across a number of behaviors (Koegel, Koegel, & Carter, 1999; Mahoney, Kim, & Lin, 2007). Interactive engagement behaviors, such as attention and initiation, are considered by constructivist theories to be core processes of learning and development and thus regarded as pivotal developmental behaviors (Kim & Mahoney, 2004).

Within this understudied target group, to inform parents as well as professionals, it is important to increase our understanding of (the interplay between) parental and child behavior and, foremost, to identify which interactional strategies by parents are effective in increasing children's engagement. Therefore, it is a first necessary step to evaluate if the momentary (i.e. cross-sectional) levels of and the association between parental and child behavior as found by [Van keer et al., 2017] are consistent throughout early childhood. Further, the longitudinal mutual influence between parental and child behavior throughout early childhood should be evaluated. Longitudinal analyses, although hard to achieve in this target group because of recruitment issues and high drop-out rates could provide evidence that "parenting conceivably affects -rather than simply accompanies or follows from- child adjustment" (Collins, Maccoby, Steinberg, Hetherington, & Bornstein, 2000, pp. 223), and vice versa. Due to a lack of previous research, a range of theoretically plausible hypotheses can be formulated. In children, we can hypothesize increasing levels of attention and initiation due to maturation and learning experiences; however this expectation can be tempered by the significant limitations of these children and the possible lower (rate of) potential development. Parent's responsiveness and positive affect might be either characterized by stability (Dallaire & Weinraub, 2005; DeVeney, Cress, & Lambert, 2016), by an increase due to a better knowledge of and experience with the child or by a decrease due to (persistent) difficulties in interpreting the child's idiosyncratic signals. Since initial low levels of parent's directiveness and achievement orientation are expected, stability is a plausible hypothesis. If we assume that these low levels are related to parent's perception of their child's functioning, either by knowing/assuming the child does not understand, respond to or appreciate (verbal, gestural, physical,…) directives or by having few hopes for developmental benefits resulting from a directive/achievement oriented parental approach, a possible increase or decrease might be related to the child's (rate of) further development (DeVeney et al., 2016). Further, we hypothesize that parents and children might influence one another through interactions, on a momentary as well as a longitudinal basis. For example, higher levels of parental responsiveness might be associated with higher levels of child engagement within the context of each specific interaction (cf. momentary interaction dynamics); while initial levels of responsiveness might also (additionally) be predictive of child engagement at a later time point (cf. developmental stimulation). Therefore, the research questions addressed in this study with regard to the group of young children with a significant cognitive and

motor developmental delay within the preschool period (< 6 years) are:

1 Are parent's interactional style and children's interactive engagement characterized by stability or change?
2 Is there a consistent momentary (i.e. cross-sectional) association between parent's interactional style and children's interactive engagement?
3 Is there a predictive (i.e. longitudinal) association between parent's interactional style and children's interactive engagement; and vice versa?

2. Method

2.1. Participants

Thirty-five unique parent-child dyads participated in this study, recruited and selected as described in the cross-sectional study of [Van keer et al., 2017]. In short, dyads were included when the child (a) was between the age of 6 months and 4 years at the first measurement moment, (b) had a significant cognitive delay, operationalized as functioning below a quarter of their chronological age according to the 'Tandemlijst' (Stadeus, Windey, Vermeir, & Van Driessche, 1994) and (c) had a significant motor delay, operationalized as functioning at level IV or V (or level III when the child was less than 2 years old) according to the 'Gross Motor Function Classification System - Expanded & Revised' (GMFCS-E&R; Palisano, Rosenbaum, Bartlett, & Livingston, 2007). The presence of a significant developmental delay in both the cognitive and the motor domain was regarded as a necessary and sufficient inclusion criterion (in analogy with the definition of profound intellectual and multiple disabilities; Nakken & Vlaskamp, 2007), which means that children were not excluded based on the cause of their developmental delay or because of additional constraints. Detailed inclusion criteria are available from the first author upon request. Detailed background information on the parent-child dyads at the first measurement moment is presented in Table 1.

Participating families were recruited in Belgium (Flanders) and the Netherlands. In these (culturally comparable) countries, the typical nuclear family, consisting of husband, wife and child(ren), although it is losing importance, is still the most common family form (Audenaert, 2018a; Bucx, 2011). Even though imbalances between mothers and fathers still exist, parents strive for more equality between partners, with the current imbalance being more pronounced in the distribution of housework than in the care for the children (Audenaert, 2018b). In general, parents within these countries employ an authoritative parenting style, showing high levels of positive involvement (especially in young children) and a focus on providing routines, structure and teaching rules, primarily by giving explanations, pointing out potential consequences of behaviour, social rewarding or mild disciplining behaviors, such as raising their voice or providing time outs (Bastaits, Van Leeuwen, & Travers, 2018; Bucx, 2011; Rousseau, Van Leeuwen, Desoete, & Hoppenbrouwers, 2015). Excessive or physical punishment is not common (Bastaits et al., 2018; Bucx, 2011). Parents mainly strive for their children to have respect for other people, to take responsibility and to develop autonomy and assertiveness in their children (Bucx, 2011; Vancoppenolle & Dupont, 2018).

2.2. Procedure and instruments

This study was approved by the Social and Societal Ethics Committee (KU Leuven) and written informed consent was obtained from parents prior to data collection. Every six months over the course of two years, the participating parent-child dyads were videotaped during a 15-minute unstructured play situation. Ideally, this resulted in five time points (T) for each participating dyad. However, as was expected, a considerable (definitive as well as temporary) drop-out rate was present in this study, primarily because the families could not combine their participation with their busy schedule (e.g. birth of a sibling, health issues of the child,…) or because the participating child passed away ($n = 2$). Of the 35 dyads who participated at T1, respectively 30 dyads participated at T2, 23 dyads at T3, 22 dyads at T4 and 21 dyads at T5. For 19 dyads, data is available for each of the five time points (further referred to as the 'core group').

Observations took place in a familiar and quiet room at home or at the day care facility of the child. No one other than the parent, the child and the observer were present. Parents were instructed to engage with the child as they would normally do, but were not informed on the parental and child behaviors of interest to the study. Parents could choose how to position the child, for example in the child's wheelchair, on a play mat or on the parent's lap. Due to the significant (cognitive, motor and/or sensory) limitations and idiosyncratic needs and preferences of the children, we did not provide a standard set of toys. This meant that parents could (bring and) use toys familiar to the child as well as make use of a whole range of typical child toys (such as a rattle, a ball, a mirror,…) brought by the observer. Two cameras were used, each directed at one interaction partner: one was placed on a tripod (usually directed at the child) and one was manually handled by the researcher in order to ensure optimal angle views.

Afterwards, the videotaped observations were scored using an adapted version of the Child Behavior Rating Scale-Revised (CBRS; Mahoney, 1998) and the Maternal Behavior Rating Scale-Revised (MBRS; Mahoney, 2008). The choice for the MBRS and CBRS was inspired by its previous usage in groups of young children with developmental and intellectual disabilities as well as its aim to evaluate (aspects of parental behavior specifically related to) broader child development (Hostyn, Petry, Lambrechts, & Maes, 2011; Mahoney & Nam, 2011). Validation research on the original MBRS and CBRS showed a Cronbach's Alpha of 0.89 (Kim, Sung, & Hyun, 2000). The CBRS identifies two domains of children's interactive engagement: attention *(consisting of the items: attention to activity, persistence, involvement and cooperation)* and initiation *(consisting of the items: initiating activities, joint attention and affect)*. The MBRS identifies four domains of parental interactional style: responsive/child oriented behavior *(consisting of the items: sensitivity to child's*

Table 1
Sample Characteristics at T1.

Variable	*n*	%	Range	*M*	*SD*
Children	35				
Gender					
Male	12	34			
Female	23	66			
Age (in months)			11 – 58	36.47	11.60
Sensory impairments					
Reduced vision	14	40			
Blindness	3	9			
Reduced hearing	1	3			
Deafness	2	6			
Motor impairments					
Hypotonia	23	66			
Hypertonia	15	43			
Contractures	4	11			
Scoliosis	7	20			
Others	8	23			
Health problems					
Gastro-intestinal problems	19	54			
Heart problems	1	3			
Respiratory problems	9	26			
Epilepsy	24	69			
Others	10	29			
Use of feeding tube	16	46			
Etiology					
Genetic defect	17	49			
Perinatal asphyxia	3	9			
Acquired brain injury	2	6			
Unknown	13	37			
Parity					
Firstborn	13	37			
Not firstborn	22	63			
Parents	35				
Gender					
Male	8	23			
Female	27	77			
Age (in years)[a]			26 – 54	34.85	5.76
Highest educational level[b]					
Primary education	2	6			
Secondary education	19	54			
Higher education	13	37			
Activity status[b]					
Working full-time	12	34			
Working part-time	15	43			
(Consciously) unemployed	7	20			
Families	35				
Number of family members			3 – 8	4.06	1.06
Parent(al figure)s			1 – 2	1.94	0.24
Children			1 – 6	2.11	1.02
One-parent households	2	6			
Reconstituted families	1	3			
Country of residence					
Belgium (Flanders)	15	43			
The Netherlands	20	57			

[a] This information was missing for two parents.
[b] This information was missing for one parent.

interest, responsivity and effectiveness), affect/animation *(consisting of the items: acceptance, enjoyment, expressiveness, inventiveness and warmth)*, achievement orientation *(consisting of the items: achievement and praise)* and directive behavior *(consisting of the items: directiveness and pace)*. All items were rated on a 5-point Likert scale, indicating a low to high presence of the behavioral dimension. A general description of MBRS and CBRS items is presented in Table 2. Modifications to the original scoring instructions are described in [**blinded for peer review**].

Two separate teams of two master's students in Educational Sciences were chronologically involved in this study and carried out the final ratings, taking care of approximately and respectively one third and two thirds of the observations. The first team rated 86 % of T1's observations and 30 % of T2's, while the second team rated 14 % of T1's, 70 % of T2's and 100 % of T3's to T5's observations.

Table 2
Description of MBRS and CBRS Items.

MBRS - Responsive/ child oriented behavior	
Sensitivity to child's interest	The extent to which the parent seems aware of and understands the child's activity or play interests, assessed by parent's engaging in child's activity choice, verbal comments in reference to child's interest and visual monitoring of child's behavior or activity.
Responsivity	The frequency, consistency and supportiveness of parent's responses to the child's behaviors. Responses are supportive when they match the child's actions, requests and intentions.
Effectiveness[a]	The parent's ability to engage the child in the interaction: to gain the child's attention, cooperation and participation.
MBRS - Affect/animation	
Acceptance	The extent to which the parent's behaviors and communications accept or affirm the child and what the child is doing.
Enjoyment	The parent's enjoyment of interacting with the child. There is enjoyment in child's being himself rather than the activity the child is pursuing.
Expressiveness	The tendency of the parent to communicate and react emotionally toward the child, including the frequency of verbal and nonverbal communications as well as the intensity and animation of these communications.
Inventiveness	The range of stimulation parents provide; including the ability to find different things to interest the child, different ways of using materials etc.
Warmth	Positive affective expression through pats, lap-holding, caresses, kisses, hugs, tone of voice, and verbal endearments.
MBRS - Achievement orientation	
Achievement	Parent's encouragement of sensorimotor and cognitive achievement, whether through play, instruction, training, or sensory stimulation.
Praise	Quantity of verbal praise given to the child, given for compliance, achievement or for the child being himself.
MBRS - Directive behavior	
Directiveness[a]	Frequency and intensity in which the parent requests, commands, hints or attempts in other manners (e.g., physical) to direct the child's immediate behavior.
Pace	Parent's rate of behavior, assessed apart from the child's behavior.
CBRS – Attention	
Attention to activity	The extent to which the child attends to activities, whether or not the child is actively involved.
Persistence	The extent to which the child practices actions/vocalizations and continues to try solutions even though not successfully reaching his or the adult's goal.
Involvement	The intensity with which the child is motivated to engage/participate in the activities regardless of whether they are adult or child initiated.
Cooperation[a]	The degree to which the child attempts to comply with the requests or suggestions of the adult.
CBRS – Initiation	
Initiating activities	The extent to which the child initiates new or altered activities, without waiting for the adult's suggestion or guidance.
Joint attention	The extent to which the child initiates interaction and shares the attention for an object/event with the adult.
Affect	The child's general emotional state during the interaction, expressed through smiles, laughs or vocalizations.

Note. Description of items is based on Mahoney (1998, 2008).
[a] Item was adapted to the specific characteristics of this study's target group (see [Van keer et al., 2017]).

Several measures were taken to ensure the reliability of the rating process, such as the raters being unfamiliar with the parent-child dyads and other test results, the implementation of a 30 -h training until raters had reached over 90 % mutual agreement within one point and over 50 % exact agreement (within and across teams), as well as the use of child communication profiles to enhance the raters 'understanding of the communicative utterances of the participating children. After incorporating an adjustment period of two minutes in order to reduce observation effects, the subsequent 10 min of the video-taped observations were rated for each dyad, by two raters. The fragment was further divided into five time sections of two minutes, since test-runs showed that considerable fluctuations in child behavior (e.g. varying levels of attention, characteristic of this target group) and subsequent parental behavior impeded the raters' ability to reliably decide on overall scores. For each rater, the scoring process resulted in 95 section scores (19 items x 5 time sections) per dyad. Overall, the interrater agreement within one scale point was 97 %. For 62 % of section scores exact agreement was obtained. Rater differences were dealt with by averaging raters' section scores that differed one scale point (35 % of all scores). Section scores differing more than one scale point (3% of all scores) were discussed and decided upon through a consensus rating procedure. Interrater agreement for the individual scale items for each time point is summarized in Table 3. For the MBRS, the average agreement over the five time points ranged from 48 % to 79 % (exact) and 88%–100% (within one point). For the CBRS, the average agreement over the five time points ranged from 52 % to 86 % (exact) and 96%–99% (within one point). As a final step, the five section scores per item were averaged, resulting in 19 item scores for each dyad. In five instances, only 3 or 4 out of the 5 time sections were available and consequently averaged to obtain the dyads' item scores (i.e. due to fatigue of the child). Global domain scores relating to the four domains of parent's interactional style and two domains of child's interactive engagement were obtained by averaging item scores. More details on the specific rating procedure can be found in [Van keer et al., 2017].

2.3. Data analysis

Overall, non-parametric tests were used because of the small sample size and the presence of non-normality in the data.

To answer research question 1, the mean and standard deviation of domain scores of the core group ($n = 19$) on the MBRS and CBRS were calculated for each of the five time points and visually presented. This focus on the core group was warranted to allow for a reliable evaluation of (the magnitude of) a potential increase, decrease or stability in the participants' behavior. In that regard, Wilcoxon signed rank tests were conducted on the core group's results to compare subsequent time points. Effect sizes r were calculated by dividing the Z-statistic by the square root of N (Fritz, Morris, & Richler, 2012). For research question 1, a priori power-

Table 3
Overview of the Average Interrater-reliability of the MBRS and CBRS Ratings at the Five Time Points.

	T1 *(n = 35)*		T2 *(n = 30)*		T3 *(n = 23)*		T4 *(n = 22)*		T5 *(n = 21)*		Overall average	
	E	W	E	W	E	W	E	W	E	W	E	W
M1. Responsive/ child oriented behavior												
Sensitivity to child's interest	61.27	97.69	53.74	97.28	63.48	97.39	50.00	99.09	60.19	99.03	57.74	98.10
Responsivity	57.80	97.11	63.27	97.96	58.26	97.39	55.45	99.09	56.31	100	58.22	98.31
Effectiveness	47.98	98.27	47.62	95.24	49.57	99.13	46.36	98.18	62.14	98.06	50.73	97.78
M2. Affect/animation												
Acceptance	64.16	98.84	58.50	99.32	67.83	100	69.09	100	59.22	100	63.76	99.63
Enjoyment	64.74	100	70.75	99.32	59.13	98.26	59.09	100	66.99	100	64.14	99.52
Expressiveness	64.16	98.84	59.18	100.00	49.57	95.65	72.73	100	59.22	100	60.97	98.90
Inventiveness	55.49	95.95	51.70	97.28	58.26	98.26	68.18	100	60.19	98.06	58.76	97.91
Warmth	63.58	98.27	64.63	97.96	60.87	100	69.09	100	57.28	100	63.09	99.25
M3. Achievement orientation												
Achievement	52.60	89.60	57.14	87.07	53.91	87.83	32.73	82.73	52.43	94.17	49.76	88.28
Praise	64.74	95.38	66.67	97.28	57.39	97.39	65.45	98.18	63.11	95.15	63.47	96.68
M4. Directive behavior												
Directiveness	46.24	94.22	56.46	94.56	47.83	96.52	42.73	90.91	48.54	95.15	48.36	94.27
Pace	63.01	99.42	72.79	98.64	80.87	100.00	87.27	100	92.23	100	79.23	99.61
C1. Attention												
Attention to activity	53.76	92.49	46.26	94.56	64.35	98.26	48.18	98.18	61.17	97.09	54.74	96.12
Persistence	73.41	89.60	79.59	95.24	88.70	96.52	98.18	100	91.26	99.03	86.23	96.08
Involvement	56.07	97.69	57.14	95.92	57.39	94.78	54.55	100	53.40	100	55.71	97.68
Cooperation	54.34	95.38	53.06	93.88	60.87	98.26	67.27	97.27	66.99	99.03	60.51	96.76
C2. Initiation												
Initiating activities	75.14	97.69	80.27	98.64	80.00	99.13	90.91	99.09	88.35	100	82.93	98.91
Joint attention	52.02	95.95	41.50	95.24	50.43	97.39	59.09	94.55	57.28	96.12	52.06	95.85
Affect	69.36	98.27	75.51	97.96	71.30	100	60.00	99.09	58.25	99.03	66.88	98.87
Overall average												
MBRS	58.71	96.98	59.97	96.59	59.20	97.32	60.00	97.35	61.67	98.33	**59.91**	**97.31**
CBRS	62.02	95.27	61.92	95.82	67.20	97.76	69.09	98.31	68.13	98.64	**65.67**	**97.16**
MBRS + CBRS	59.93	96.35	60.69	96.27	62.29	97.62	63.49	97.75	63.50	98.40	**61.98**	**97.28**

Note. M refers to the Maternal Behavior Rating Scales, C refers to the Child Behavior Rating Scales, W = Agreement within one point, E = Exact agreement.

analyses (using G*Power 3.1; Faul, Erdfelder, Lang, & Buchner, 2007) with a specified power of 0.8 (Moore & McCabe, 2005) revealed that the sample sizes allow for a reliable detection of medium to large, but not small differences. For interpretation of effect sizes, we followed the guidelines of Cohen (1988), regarding 0.3 as a medium and 0.5 as a large effect. Since children were not the same age at T1, the relation between chronological age and global domain scores was evaluated at each time point separately. All analyses related to research question 1 were conducted with SPSS Statistics 25.0 (IBM Corp. Released, 2017).

To answer research question 2, partial Spearman rank correlations between the domain scores of the complete group on the MBRS and CBRS were calculated for each of the time points. Since children within the group were not the same age and this could have an influence on child behavior (e.g. less or more developmental chances and learning experiences) as well as parental behavior (e.g. differential treatment of child depending on age and previous experiences with the child), the analyses were controlled for child age. The focus on the complete group, resulting in different sample sizes for each time point, was chosen to maximize the analyses' power and is in line with the research question which focuses on the consistent presence of a momentary association within the interaction rather than the magnitude of longitudinal change.

To answer research question 3, partial Spearman rank correlations between the domain scores of the MBRS and CBRS at T1 and T5 were calculated for the 21 participating dyads for which data was available at those two time points. Ideally, a cross-lagged panel analysis would have been conducted, however this was not feasible due to the small sample size. To approximate the advantages of this analysis (i.e. taking into account contemporaneous relationships and construct stability; Kearney, 2017), the correlations were controlled for the respective interaction partner's behavior at T1 and T5. Additionally, as was the case in research question 2, the analyses were controlled for child age (at T1). The focus on time points T1 and T5 (and therefore the associated 21 participating dyads) was chosen in line with the focus of the research question on longitudinal change and the additional consideration that more intermediate comparisons would increase the chance of type 1-errors.

For both research question 2 and 3, Cohen's (1988) guidelines were followed for evaluating the strength of the correlations. Additionally, bootstrap confidence intervals (95 % confidence level, 5000 samples) for the statistically significant correlations were calculated. Bootstrapping is a technique in which the sampling distribution of a statistic is estimated by taking repeated samples (with replacement) from the data set (Field, 2009), resulting in a more robust estimation in case of a small sample size (Adèr & Adèr, 2008)

Table 4
Overview of Mean Domain Scores on the Maternal and Child Behavior Rating Scale of the Core Group (n = 19) for each of the Five Time Points.

Domain scores	T1	T2	T3	T4	T5
M1. Responsive/child oriented behavior	3.04 (0.61)	3.35 (0.57)	3.63 (0.43)	3.27 (0.49)	3.33 (0.50)
M2. Affect/animation	3.02 (0.59)	2.98 (0.52)	3.09 (0.41)	3.09 (0.43)	3.01 (0.47)
M3. Achievement orientation	1.63 (0.42)	1.71 (0.39)	1.79 (0.59)	1.96 (0.51)	1.91 (0.67)
M4. Directive behavior	2.35 (0.43)	2.45 (0.30)	2.52 (0.31)	2.59 (0.33)	2.58 (0.42)
C1. Attention	2.48 (0.44)	2.48 (0.41)	2.59 (0.35)	2.55 (0.35)	2.51 (0.35)
C2. Initiation	2.14 (0.33)	2.31 (0.32)	2.31 (0.27)	2.09 (0.29)	2.07 (0.31)

Note: 'Core group' refers to the group of participants for which data is available for each of the five time points.

and the presence of non-normality in the data (Wood, 2004). All analyses pertaining to research question 2 and 3 were conducted in R (RStudio Team, 2015) by means of the package "ppcor". The additional bootstrap analyses were self-programmed and cross-checked with results using the package "RVAideMemoire". In text, results are only regarded as significant whenever the *p*-value is smaller than .05 and zero is not included within the bootstrap confidence interval. For research questions 2 and 3, a priori power-analyses (using G*Power 3.1; Faul et al., 2007) with a specified power of 0.8 (Moore & McCabe, 2005) revealed that the sample sizes allow for a reliable detection of large, but not small to medium correlations. In advance, scatterplots of the related variables were visually inspected for monotonicity of the relationship.

3. Results

3.1. Variability

The first research question aimed to explore if parent's interactional style and children's interactive engagement were characterized by stability or change. The mean and standard deviation of the domain scores on the MBRS and CBRS are presented in Table 4 and visually represented in Fig. 1. No significant Spearman rank correlations with children's age were found, with the exception of parent's directive behavior at T2 ($r_s = 0.52, p = 0.022$). Looking at the statistically significant results, Wilcoxon signed rank tests (presented in Table 5) showed medium increases in responsive/child oriented behavior from T1 to T2 ($Z = -2.496, p < .05, r = 0.40$) and from T2 to T3 ($Z = -2.352, p < .05, r = .38$), followed by a large decrease from T3 to T4 ($Z = -3.161, p < .01, r = .51$). Child initiation showed a medium increase from T1 to T2 ($Z = -2.074, p < .05, r = .34$) and a large decrease from T3 to T4 ($Z = -3.105, p < .05, r = .50$). No other statistically significant results were found.

Further, it can be noted that the relative order within the children's behavioral domains and the parent's behavioral domains remained stable: the mean score on children's attentiveness remained higher than their average initiation level, while parents consistently showed the highest level of responsive/child oriented behavior, followed in order by affect/animation, directive behavior and achievement orientation. Visual exploration of individual trajectories indicates this order was also individually present in the majority of participants.

3.2. Cross-sectional associations

The second research question aimed to explore if a consistent momentary (i.e. cross-sectional) association between parent's interactional style and children's interactive engagement was present. The partial Spearman rank correlations between the domain scores on the MBRS and CBRS including 95 % bootstrap confidence intervals are presented in Table 6. At each time point, parent's

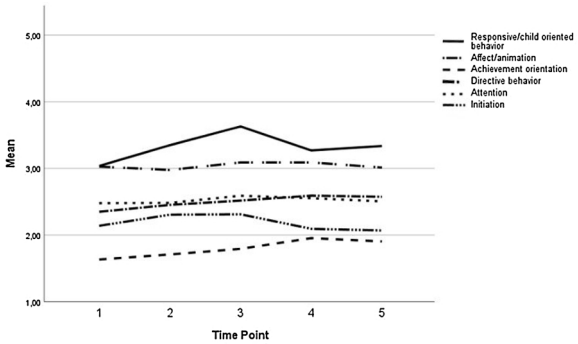


Fig. 1. Visual Representation of Mean Domain Scores of the Core Group ($n = 19$) on the Maternal and Child Behavior Rating Scale for each of the Five Time Points.

Table 5
Results of Wilcoxon Signed Rank Tests on MBRS and CBRS Scores of the Core Group (n = 19) for Subsequent Time Points.

	T1-T2		T2-T3		T3-T4		T4-T5	
	Z	r	Z	r	Z	r	Z	r
M1. Responsive/child oriented behavior	−2.496*	.40↑	−2.352*	.38↑	−3.161**	.51↓	−.382	.06↑
M2. Affect/animation	−.403	.07↓	−1.764	.29↑	−.081	.01↓	−1.133	.18↓
M3. Achievement orientation	−.866	.14↑	−.322	.05↑	−1.503	.24↑	−1.657	.27↓
M4. Directive behavior	−1.230	.20↑	−.888	.14↑	−1.243	.20↑	−1.199	.19↓
C1. Attention	−.022	.00↑	−1.087	.18↑	−.828	.13↓	−.604	.10↓
C2. Initiation	−2.074*	.34↑	−.218	.04↑	−3.105**	.50↓	−.543	.09↓

Note: 'Core group' refers to the group of participants for which data is available for each of the five time points. Upward and downward arrows respectively indicate rising and falling trends in the associated variables.
*$p < 0.05$, **$p < 0.01$.

Table 6
Overview of Spearman Rank Correlations between Domain Scores of the MBRS and CBRS including 95 % Bootstrap Confidence Intervals.

Correlations	T1 (n = 35)		T2 (n = 30)		T3 (n = 23)		T4 (n = 22)		T5 (n = 21)	
M1-C1	.54**	[.21, .80]	.44*	[.04, .76]	.74**	[.46, .91]	.61**	[.17, .89]	.56**	[.06, .92]
M1-C2	.54**	[.17, .82]	.21		.73**	[.42, .87]	.61**	[.27, .81]	.77**	[.54, .89]
M2-C1	.29		−.19		.63**	[.27, .84]	.44*	[-.06, .82]	.36	
M2-C2	.37*	[-.01, .67]	.05		.52*	[.10, .79]	.42		.49*	[-.02, .83]
M3-C1	.04		.52**	[.21, .75]	.50*	[.09, .79]	.30		.27	
M3-C2	−.05		.19		.02		.08		.10	
M4-C1	−.06		.32		.46*	[.03, .74]	.26		.24	
M4-C2	−.03		−.07		.13		.06		.19	

*$p < 0.05$, **$p < 0.01$.
Note: M1 = Responsive/child oriented behavior, M2 = Affect/animation, M3 = Achievement orientation, M4 = Directive behavior, C1 = Attention, C2 = Initiation. In text, results are only regarded as significant whenever the p-value is smaller than .05 and zero is not included within the bootstrap confidence interval.

responsive behavior showed a rather large significant correlation with children's attention and children's initiation (except with the latter at T4). Further, only at T3, parent's affect showed a large significant correlation with child's attention and initiation. Parent's directiveness showed a significant correlation with child attention at T2 and T3, while achievement orientation of the parent only did so at T3.

3.3. Longitudinal association

The third research question aimed to explore if a predictive (i.e. longitudinal) association between parent's interactional style and children's interactive engagement was present. The partial Spearman rank correlations between the domain scores of the MBRS and CBRS at T1 and T5 are presented in Table 7. No significant correlations were found between parental behavior at T1 and child behavior at T5. On the other hand, child initiation showed a large significant correlation with both parental achievement orientation and directiveness at T5.

Table 7
Overview of Partial Correlations between Domain Scores of the MBRS and CBRS at T1 and T5 including 95 % Bootstrap Confidence Intervals.

Domain scores	M1 (T5)	M2 (T5)	M3 (T5)		M4 (T5)		C1 (T5)	C2 (T5)
MBRS								
M1. Responsive/child oriented behavior (T1)	/	/	/		/		.13	−.00
M2. Affect/animation (T1)	/	/	/		/		.07	−.19
M3. Achievement orientation (T1)	/	/	/		/		−.06	.10
M4. Directive behavior (T1)	/	/	/		/		.40	.23
CBRS								
C1. Attention (T1)	−.38	−.30	.26		.59**	[-.05; .86]	/	/
C2. Initiation (T1)	−.07	−.30	.60**	[.05; .86]	.64**	[.11; .87]	/	/

*$p < 0.05$, **$p < 0.01$.
Note. The correlations are controlled for the respective interaction partner's behavior at T1 and T5 as well as child age at T1. The slashes (/) indicate relations that were not part of the research question. In text, results are only regarded as significant whenever the p-value is smaller than .05 and zero is not included within the bootstrap confidence interval.

4. Discussion

4.1. Conclusions

This study aimed to exploratively characterize the (in)variability of and the momentary and predictive association between parent's interactional style and children's interactive engagement over a two-year period, within the target group of pre-school aged children with a significant cognitive and motor developmental delay.

First, no consistently increasing or decreasing group-level trend was found in any of the examined variables. Parent's responsiveness and child initiation did show (a) significant increase(s) within the first year, followed by a significant decrease at the 18 months follow-up. However, given the differential age of the children at the first time point and the absence of significant associations of these variables with child age, the observed changes do not seem to be specifically age-related. Study-related changes in test administrators and raters were scrutinized but do not coincide with the observed changes in parental and child behavior. Since substantial inter-individual differences were present in the data, it is possible that more individual or subgroup trends are obscured by the group analyses. Further, given the stable relative order within the children's and within the parent's behavioral domains, this study longitudinally confirms the results of [Van keer et al., 2017], suggesting that interaction within this target group is more oriented at creating a mutually shared experience (characterized by responsive and affective behavior) rather than being regarded as a teaching opportunity (which would be characterized by more achievement orientated and directive behavior).

Second, despite the often wide bootstrap confidence intervals, this study indicates the presence of a relatively stable momentary (i.e. cross-sectional) association between parent's responsive behavior and child behavior (i.e. attention and initiation) over the course of two years. So within singular concrete interactions, parent's responsive behavior and child behavior seem to be strongly related. Parental responsiveness might be an effective interactional strategy to increase child engagement, higher levels of engagement in children can possibly facilitate parental responsiveness, or both. Longitudinally, no (large) predictive associations between initial parental behavior and child behavior two years later were found. This finding does not allow us to formulate a more substantiated hypothesis on the (bi)directionality of the consistent momentary association between parental responsiveness and child behavior. Also, it is important to consider that some predictive associations might be obscured by the limited statistical power of this study (preventing us from detecting statistically small/medium differences), the rather broad measure of child behavior (preventing the detection of smaller developmental steps) and the arguably small time frame (i.e. two years), certainly when considering the plausible lower rate of development within this target group. The other way around however, the level of initial child initiation seems to positively predict the level of parents' achievement orientation and directive behavior two years later. Generally, the parents within this target group show remarkably low levels of directiveness and achievement orientation [Van keer et al., 2017], which contrasts with earlier research indicating that parents are more directive when children have lower developmental levels, presumably in an attempt to optimize children's opportunities for developmental learning (Spiker et al., 2002). Therefore, it is possible that within the specific target group, children who show less initiative within interaction lead parents to have less hope for developmental benefits resulting from a directive/achievement oriented parental approach and/or to be less motivated to (consistently) apply such an approach.

The latter is a very important consideration for professionals working with this target group: it could be helpful to parents to support them in recognizing and discussing the cognitive, emotional and behavioral aspects of what could be described as a sort of 'learned helplessness'. Further, this study underlines the importance of including parental sensitive responsiveness as a key variable in interventions aimed at (parents of) young children with a significant cognitive and motor developmental delay. Supporting parents in recognizing and consistently and appropriately responding to their child's (idiosyncratic) behavior may well pave the way to increased child interactive engagement. To conclude, this study does not identify a clear group-level trend, but does show that changes in children's interactive engagement are present and possible at this young age. This confirms the value of paying attention to children's pivotal behaviors in early childhood and exploring how we can support the expression and development of these behaviors.

4.2. Strengths, limitations and future research

This study's foremost strength is its longitudinal design applied to an understudied population, in which recruitment issues and high drop-out rates easily result in small sample sizes and missing data, complicating a reliable statistical analysis of the data. Therefore, the applied analyses were carefully selected and complemented by the use of bootstrap confidence intervals to correctly assess the results. However, as mentioned before, due to the limited statistical power of the study, it is possible that smaller differences or weaker relations were not detected. Additionally, this explorative study uses a rather broad categorization of child interactive functioning (5 point Likert Scale) based on a momentary observation at each time point. Future research on this specific target group could benefit from focusing on more differentiated and dynamically evaluated outcome measures, to accommodate to the developmental rate and fluctuations in behavioral patterns of these children.

Within this study, research questions at group-level were evaluated, primarily with age as a control variable. However, substantial inter-individual differences seem to be present in the studied variables. This suggests that further research is warranted to explore more individual or subgroup trajectories and interrelations with relevant variables such as, for example, the children's sensory functioning or parent's SES. Also, although a challenging endeavor, future research could try to establish specific age cohorts and aim for a larger follow-up time frame in order to obtain a more comprehensive view on the preschool development of these children and their parent's interactive behavior. Although the evaluated child (and parental behaviors) do not seem to be directly related to child

age within the studied time frame; it is still possible that the developmental rate itself differs throughout time (e.g. greater improvements in younger than older children with severe ID; Beadle-Brown et al., 2000; Chadwick et al., 2005) or other predictive variables can be identified (such as the child initial level of functioning, motor skills, aetiology etc.). To conclude, it would be very interesting to explore if certain combinations of parental behavioral dimensions are related to child interactive functioning/development (e.g. combining high levels of responsiveness with high levels of achievement orientation) or if (in)consistency in parental behavior is present and has predictive value (e.g. consistent levels of parental responsiveness might be associated with more adaptive outcomes; Landry, Smith, Swank, Assel, & Vellet, 2001).

CRediT authorship contribution statement

Ines Van keer: Conceptualization, Formal analysis, Investigation, Writing - original draft, Project administration, Funding acquisition. **Nadja Bodner:** Software, Methodology. **Eva Ceulemans:** Software, Methodology, Writing - review & editing. **Karla Van Leeuwen:** Conceptualization, Writing - review & editing, Supervision, Funding acquisition. **Bea Maes:** Conceptualization, Writing - review & editing, Supervision, Project administration, Funding acquisition.

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