Alone at the playground

Guida Veiga, Lizet Ketelaar, Wendy De Leng, Ricardo Cachucho, Joost N. Kok, Arno Knobbe, Carlos Neto & Carolien Rieffe

Routledge
Taylor & Francis Group

Alone at the playground

Guida Veiga[a,b], Lizet Ketelaar[c,d], Wendy De Leng[c], Ricardo Cachucho[e], Joost N. Kok[e], Arno Knobbe[e], Carlos Neto[f] and Carolien Rieffe[c,d]

[a]Departamento de Desporto e Saúde, Escola de Ciências e Tecnologia, Universidade de Évora, Évora, Portugal; [b]Laboratory of Motor Behavior, Faculdade de Motricidade Humana, Universidade de Lisboa, Lisboa, Portugal; [c]Developmental Psychology, Leiden University, Leiden, The Netherlands; [d]Dutch Foundation for the Deaf and Hard of Hearing Child, Amsterdam, The Netherlands; [e]Leiden Institute for Advanced Computer Science, Leiden University, Leiden, The Netherlands; [f]Laboratory of Motor Behavior, CIPER, Faculdade de Motricidade Humana, Universidade de Lisboa, Lisboa, Portugal

ABSTRACT
Starting pre-school is a major stepping stone for children's peer relations. Yet, some children spend their recess time alone, albeit in the presence of playful peers. These solitary behaviours have been noted in the literature as an alarm signal for a maladaptive social development. In this study, we identified four kinds of non-social behaviours engaged at recess (reticent, solitary-pretend, -functional, and -passive); and we examined the extent to which these different behaviours were related to social solitude at the playground six months later. Therefore, 97 children (aged 4–6 years old) were observed at the playground and their social-emotional skills were tested. Solitude was assessed through an innovative measuring method, based on Radio Frequency Identification Devices. The results demonstrated that solitary-pretend play in girls was related to an increase in solitary behaviours later on. Nevertheless, children who engaged in non-social behaviours showed a general lack of emotional skills, which may explain their initial withdrawal.

Children play for intrinsic pleasure, while simultaneously practicing many skills which prepare them for later life (Coplan & Arbeau, 2009). Additionally, playing with others, or so-called social play, also teaches children how to behave in groups, negotiate, and how to take their losses. This increases their social skills, whereas children who show a preference for solitary play, even when they are in the presence of peers, might be at a higher risk for an impaired social development (e.g., Coplan & Armer, 2007; Rubin, Coplan, & Bowker, 2009).

CONTACT Guida Veiga ✉ gveiga@uevora.pt

Social Participation
Parents / Siblings / Peers

Social Skills

Emotional Competence
Theory of Mind /
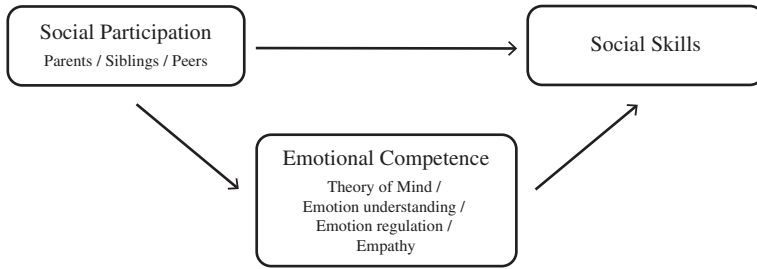Emotion understanding /
Emotion regulation /
Empathy

Figure 1. Emotion socialization process.

However, the view that all kinds of non-social play are equally damaging for the child's development, might be too narrow a viewpoint. Building a tower alone versus sitting alone, pretending to be occupied, meanwhile observing others, are different kinds of non-social behaviours, presumably with different underlying motives. Whereas some children might want to enjoy their own play, others might play alone because they fear peer rejection, feel insecure, or lack the emotional competence to approach others (Coplan, Wichmann, & Lagacé-Séguin, 2001b; Luckey & Fabes, 2005). These different kinds of non-social behaviours might contribute in different ways to isolation from the peer group.

The focus of this study is on children who recently entered pre-school, since that is a challenging transitional period in which the scene is set for later social adjustment (Mesman, Bongers, & Koot, 2001; Rose-Krasnor & Denham, 2009). The aim of this study is to examine the extent to which different kinds of non-social playground behaviours in the first semester of pre-school are related to children's playground solitude six months later. Additionally, the role of emotional competence will be taken into account.

Non-social play and emotional competence

Although a direct causal relationship between social participation and adaptive social functioning is assumed in the literature, it is also assumed that emotional competence has an important mediating role in this relationship. The 'emotion socialization hypothesis' (Figure 1) states that, albeit the capacity for emotional competence (e.g., recognising emotions in oneself and others; regulating emotions; expressing emotions adaptively) might be innate, children need social learning experiences to adaptively develop their emotional competence. More specifically, full social participation is essential for this development. In other words, children need to talk, share, overhear, argue with meaningful conversation partners, such as their parents, siblings, and peers (Rieffe, Netten, Broekhof, & Veiga, 2015). Thus, besides learning from their parents and siblings, free play situations with peers are a necessary addition to their social learning experiences in a relatively safe environment.

A higher level of emotional competence, in turn, is related to higher quality social relationships and better social skills (Denham et al., 2003). Emotional competence refers to a variety of skills, all of them beneficial to keep positive social relationships. For example, it is important to read emotions of others from their facial expressions, sympathize with them, and be responsive to their needs, i.e., be empathic. It is also important to understand that different children can have different intentions, desires, or beliefs which guide their actions; in other words a so-called 'Theory of Mind'. Moreover, emotions may rise high in playful peer situations, which requires skills to control this level of arousal, i.e., skills for emotion regulation (Ketelaar, Rieffe, Wiefferink, & Frijns, 2012; Rieffe et al., 2015; Wiefferink, Rieffe, Ketelaar, & Frijns, 2012).

When children enter preschool, they enter with a certain level of emotional competence and social skills. Participating in the peer group, will enhance both areas. In fact, children who more frequently engage in social play at the outset of the school year, also tend to do so at later periods, and this social disposition is associated with higher long-term peer-acceptance (Ladd, Price, & Hart, 1988). Children who prefer solitary play, might miss out on developing these social skills necessary to be accepted within the peer group; but this might depend on the kind of solitary play and the level of emotional competence that is present at the start, because these can be intertwined as we will describe here further. Three kinds of non-social play can be distinguished: reticent, solitary-active, and solitary-passive behaviour (Choo, Xu, & Haron, 2011; Coplan, Rubin, Fox, Calkins, & Stewart, 1994; Rubin, 1982), and thus far, the literature suggests that levels of emotional competence are differently related to these kinds of non-social play.

Reticent behaviour refers to observing others, whilst sitting or standing in vein (Coplan et al., 1994). While for many children reticent behaviour serves to approach other children playing, some children are less able to initiate and maintain social interactions and remain alone. Reticent children are often inhibited. Social stimuli seem to evoke wariness rather than actively seeking contact or participation. Possibly, reticent children desire to approach others, but lack the necessary emotional competence (Asendorpf, 1991). Various studies showed that reticent behaviour is indeed associated with impaired social skills and more peer rejection (Choo et al., 2011; Coplan, DeBow, Schneider, & Graham, 2009; Coplan, Gavinski-Molina, Lagacé-Séguin, & Wichmann, 2001a; Hart et al., 2000; Nelson, Hart, & Evans, 2008; Nelson, Rubin, & Fox, 2005; Rubin, 1982). For example, during free play sessions with unfamiliar peers at a laboratory playroom, pre-schoolers were less likely to engage in similar behaviours with reticent children, but instead, were more likely to respond to reticent behaviour with social rejection (Chen, DeSouza, Chen, & Wang, 2006).

Solitary-active behaviour is characterized by solitary-pretend play (e.g., pretending to be a teacher alone) and/or solitary-functional activity (e.g., climbing or running alone) whilst in the company of peers (Rubin, 1982). Children who prefer solitary-active play show more impulsivity and aggression (Coplan

et al., 1994, 2001a, 2001b), suggesting problems in their emotion regulation. This might explain why these children are also rated as being less popular and are more often rejected by their peers (Harrist, Zaia, Bates, Dodge, & Pettit, 1997; Hart et al., 2000). However, when examined separately, Nelson and colleagues (2008) found that emotion dysregulation was related to solitary-pretend play but not to solitary-functional play. These outcomes suggest that the two forms of play should not be grouped into one category.

Solitary-passive behaviour is characterized by solitary exploration of objects or constructive activity while in a social group (Rubin, 1982). Contrary to the other kinds of non-social play, no associations were found for solitary-passive behaviour with aggression or social rejection in pre-schoolers. Instead, this kind of play is related to more internalising problems, such as shyness and anxiety, especially in older children, although not all studies could confirm this (Coplan & Rubin, 1998; Coplan et al., 1994, 2001a; Rubin, 1982; Rubin, Coplan, Fox, & Calkins, 1995). Hence, the underlying motive for this form of solitary play may not stem from a lack of emotional competence, but rather from a tendency to refrain from social interactions.

Measuring non-social play

Observing children's social behaviours across the school year can be extremely time consuming. To overcome this limitation, researchers have conducted observations in artificially constructed settings. For example, the majority of the studies on solitary play have been developed in laboratories or inside children's classrooms. However inherent space constraints and adults' presence within these settings, may restrict pretend and functional activities, and bias the understanding of these behaviours. Additionally, it is important to capture the non-social phenomena using methodological designs without affecting the children's natural behaviour (Fabes, Martin, & Hanish, 2009; Nelson et al., 2008). Recent advances in sensing technology have provided a new method for the collection of data in social interactions, through the use of wearable sensors, based on Radio-Frequency Identification Devices (RFID), which register face-to-face proximity between subjects (Cattuto et al., 2010). Few and recent studies have applied this technology to investigate children's social dynamics (Atzmueller, Doerfel, Hotho, Mitzlaff, & Stumme, 2012; Stehlé, Charbonnier, Picard, Cattuto, & Barrat, 2013; Stehlé et al., 2011).

Present study

To date, being alone on the playground is considered as a possible indicator of emotional problems within pre-school children, predicting later social problems (Rubin, Burgess, Kennedy, & Stewart, 2003). However, it is unknown to which extent different kinds of non-social behaviours are related to later solitude,

and whether children's level of emotional competence serves as a protective or risk factor in this trajectory towards solitude. Hence, the aim of this study was threefold.

First, we examined how often different kinds of non-social play behaviours were present in pre-school children when entering school, checking also for gender differences. Therefore, we identified four kinds of non-social behaviours (reticent, solitary-pretend, solitary-functional, and solitary-passive behaviours) on the playground during the children's first semester at pre-school. Based on previous studies, we did not expect gender differences in the frequency of these four forms of behaviours (e.g., Coplan & Rubin, 1998; Coplan et al., 1994, 2001a, 2001b).

Second, we examined the extent to which the different kinds of non-social play were related to children's emotional competence. We hypothesized that if children show a certain kind of non-social play because they have lower emotional competence and thus cannot relate to other children in an adaptive way, there will be a relation between that kind of non-social play and children's level of emotional competence. We expected lower levels of emotional competence to be related to the two kinds of non-social play, which were described in the literature as children having more problems in their emotion regulation and peer relations, i.e., reticent and solitary-pretend play (Nelson et al., 2008; Rubin et al., 1995). We expected the two other kinds of non-social play (solitary-functional and solitary-passive behaviour) to be motivated by children's preference for that particular kind of solitary play, and thus to be unrelated to children's concurrent level of emotional competence.

Third, we examined the extent to which different kinds of non-social behaviour displayed at the beginning of the school year contributed to the prediction of children's time spent in solitude at the playground six months later. Given the social impairments in previous studies, we expected that children who had spent more time in reticent and solitary-pretend play, would also spend more time alone six months later (Choo et al., 2011; Coplan et al., 2001a, 2009). We expected that these relationships would be mediated by emotional competence.

Although the majority of studies on non-social behaviours have not addressed the effect of gender in the relations between non-social behaviour types and social-emotional functioning, some studies have shown gender differences in the outcomes associated with the engagement in different non-social behaviours (e.g., Coplan et al., 2001a; Nelson et al., 2008; Spinrad et al., 2004). Some studies showed that solitary-passive behaviour is related to more maladaptive outcomes for boys than for girls (e.g., Coplan et al., 2001a), yet other studies showed inconsistent findings regarding gender interactions (Nelson et al., 2008; Spinrad et al., 2004). For this reason, we will also focus on potential gender differences.

Method

Participants and procedure

The study was conducted with 56 boys and 41 girls (total n = 97), mean age 4 years and 8 months at Time 1 (SD 5 months; range 46–71 months). Children were attending a pre-school Institution in the Educative Region of Lisbon, Portugal. All parents gave informed consent before the start of the study. Parents filled out questionnaires on their child's emotional functioning and demographic information. Children were tested twice at school. At time 1, during the first semester, children were tested individually on their emotional competence, and observed at the playground. Testing sessions took approximately 20 min and were video recorded. Three research assistants were integrated in the preschool and started videotaping recess times, in order to familiarize the children with their presence and the cameras. After one week of observations children seemed to ignore the cameras and the assistants who were filming. Observations filmed after this first introduction week were included in the analyses. Playground observations were carried out during recess time (30 min) when children had total freedom to decide how to spend their time, i.e., the kind of activities and with whom. The playground had a paved open area (130 m²) with a rooftop and a sand area (50 m²) with two swings and a sand box. There were no additional toys at the playground. Three research assistants videotaped children following a predetermined random list of names, for periods of three minutes. A total of 608 videos were collected and each child was observed six times on average. At time 2, six months later, children's time spent in solitude was indexed twice during recess time at the school's playground, using proximity-sensing RFID badges which were attached to children's clothes. Badges were first given to children who had time to freely explore the 3 by 3 cm plastic square before going to the playground. At the outdoor recess children initiated playful interactions and apparently forgot the badges.

Materials and procedure

Kind of non-social play

Play behaviour was videotaped during outdoor recess and coded with an observation scheme. Two research assistants participated in a 40-hour training program. Training involved examining the coding manual, watching videos, coding children's behaviours, and discussion. Once suitable levels of coding agreement were achieved (K ≥ .80), assistants received a randomized list of videos to code. About 30% of the videos were double coded and ratings were compared, ensuring suitable levels of reliability (K ≥ .80). For each 15-second interval social participation (onlooking, unoccupied, solitary, parallel, group; K = .93) and cognitive quality of play (functional, pretend, exploratory, constructive; K = .81) were coded according to Rubin's (2001) Play Observation Scale. When multiple

behaviours were observed during the same 15-second interval, only the most predominant behaviour was coded. Children received a score for each non-social behaviour, based on the number of segments that the child showed that kind of non-social behaviour, divided by the total number of coded intervals. Following Coplan and colleagues' (1994) procedures, two variables were created, (1) reticent behaviour (comprised by the proportion of intervals spent in unoccupied or in onlooking behaviours); (2) solitary passive behaviour (comprised by the proportion of intervals spent in solitary-exploratory and solitary constructive behaviours). As we wanted to distinguish between functional and pretend play, two different variables were created, based on the proportion of intervals that the child showed (3) solitary-functional play and (4) solitary-pretend (proportion of intervals spent in solitary-functional and solitary-pretend play, respectively).

Emotional competence

Emotion Understanding was obtained with tasks for emotion recognition and emotion attribution. A composite score was computed based on these tasks which are described below.

Emotion recognition in facial expression was examined, following the protocol by Wiefferink, Rieffe, Ketelaar, De Raeve, and Frijns (2013). Two aspects of emotion recognition were assessed: discrimination and identification of facial emotion expressions. In the discrimination task, children were asked twice to place six cards, whereby they could choose between two categories. The first time, this involved happy versus unhappy faces. The second time, this involved angry versus sad faces. This discrimination task was preceded by two non-emotional sorting tasks (flowers versus cars; heads with hats versus heads with glasses), to reassure children's ability to sort cards. The cards which were placed correctly were counted.

In the identification task, children had to point to the facial expressions according to the emotion words instructed by the experimenter ('Who looks happy/sad/angry/fearful?'). The facial emotional expressions that were correctly identified were counted.

Emotion attribution in a situational context was measured using eight illustrated emotion-evoking vignettes, designed to evoke happiness, anger, fear and sadness (Wiefferink et al., 2013). Each emotion was represented twice. An example of a story is: 'Someone kicks over the tower of the boy.' Children were asked how the protagonist would feel (Question 1, verbal condition) and the protagonist's corresponding facial expression, whereby children were shown cards of a sad/angry/happy/scared face (Question 2, visual condition). Children could earn 1 point for each test answered correctly, with a maximum of 8 points for each condition (visual/verbal).

Theory of Mind was measured through a Desire Task and two False Belief Tasks. Per task, children received a maximum score of 2. A composite score was computed based on all tasks which are described below.

In the *Desire task* (Rieffe, Meerum Terwogt, Koops, Stegge, & Oomen, 2001) children were asked for their preferred food (choice between two items, i.e., ice-cream and broccoli). Next, children were presented twice with a protagonist with the same preference (Common Desire condition) and twice with a protagonist who preferred the other food item (Uncommon Desire condition). Children were asked to predict which food item the protagonist would pick (test question) and which food the boy did/did not like (control questions).

Two *False Belief Tasks* (Ketelaar et al., 2012) were used based on the common paradigm in which the main character is withdrawn from crucial information known to the child. Children were asked to predict the action of the protagonist, which could be based on his false belief or on the true belief which was only known to the participant.

Empathy was examined using the Empathy Questionnaire (Rieffe, Ketelaar, & Wiefferink, 2010), a 20-item parent report describing, using a 5-point rating scale, to what extent, over the last 2 months, children showed emotion contagion, attention to the feelings of others' and pro-social behaviour (Cronbach's $a = .80$)

Aggression was assessed using the Aggressive Behaviours Questionnaire by Dodge and Coie (1987), which includes three items assessing reactive aggression and three items assessing proactive aggression. Parents rated their children's aggressive behaviours using a 5-point rating scale (Cronbach's $a = .74$).

Solitude

Time in solitude on the playground was assessed using the proximity-sensing RFID badges, which were attached to the clothes of all children, in combination with a receiving station (i.e., Ethernet reader). This sensing system was developed by OpenBeacon Active RFID project (http://www.openbeacon.org). This RFID system measures mutual face-to-face interactions among badges (i.e., children) within a radius of approximately 1.5 m, at a sampling rate of 4 Hz (4 measurements *per* second). From the database collected, using the system, it is possible to extract multiple variables, such as number and duration of mutual face-to-face interactions. Periods in which the tags did not detect any interaction, were defined as solitary time. Different variables per child were thus obtained.

Percentage of time spent alone: Total time without registered interactions (in seconds), divided by the total recess time.

Duration of times spent alone: Total time (in seconds) spent alone by a participant, averaged by dividing it by the number of periods, between interactions, during which the participant was alone.

Statistical analyses

First, descriptive data (mean and standard deviation) was gathered for boys and girls separately, on all variables. *T*-tests were conducted to test for gender

Table 1. Means and SDs on indices for non-social play, emotional competence, and time in solitude (N = 97).

	Range	Mean scores (SD)	
		Boys	Girls
Non-social play type (% of recess time)			
Reticent		27.93 (16.36)	26.49 (15.99)
Solitary-physical		1.72 (2.16)	1.30 (1.88)
Solitary-pretend*		1.62 (3.78)	.47 (1.02)
Solitary-constructive		1.59 (3.48)	.48 (1.96)
Emotional competence			
Theory of mind	1-2	1.58 (.20)	1.54 (.19)
Emotion understanding	−3 – 3	.01 (.73)	−.05 (.70)
Aggression	1-3	1.94 (.49)	1.75 (.62)
Empathy*	1-5	3.00 (.43)	2.82 (.41)
Time in solitude			
Time alone (%)		24.70 (13.82)	28.19 (13.22)
Duration of times alone		35.17 (26.20)	34.06 (21.04)

*Note. Significant gender difference p < .05.

differences. Second, Pearson's correlations were computed for both boys and girls between the indices for (i) non-social play and emotional competence, (ii) non-social play and time in solitude, and (iii) emotional competence and time in solitude. Fisher r to Z transformations were computed and tested to examine if the strength of the correlations differs for boys and girls. Pearson correlations were computed to check for collinearity between non-social play and time in solitude. Third, a multiple linear regression analysis was performed to examine the effect of non-social play on the prediction of time in solitude. Standardized residual values were examined to detect outliers. Standardized residual values with a value larger than 4 were removed from the analysis. Fourth, to examine the possible mediating effect of emotional competence in the relationship between the non-social play types and time in solitude, a Bootstrap analysis (5000 resamples) was used (Preacher & Hayes, 2004). Bootstrapped 95% confidence intervals of the indirect effects were examined to detect mediation.

Results

The mean scores of all variables are displayed in Table 1. The most common kind of non-social behaviour was reticence for both genders, while solitary-pretence and solitary-passive behaviours were the least occurring for girls and boys respectively. Boys spent more time in solitary-pretend play than girls (t(94) = 2.17, p = .034) and were rated by their parents as more empathic (t(90) = 2.00, p = .048). No other gender differences appeared.

Table 2. Pearson's correlations between indices for emotional competence and non-social play types, for boys and girls separately.

	Boys			
	Reticent	Physical	Pretend	Constructive
Emotion understanding	−.30*	.04	−.02	.15
Theory of mind	−.08	.01	.14	.31*
Empathy	−.29*	.13	−.22	−.08
Aggression	.34* †	−.08	−.13	.21*
	Girls			
Emotion understanding	−.03	−.17	.02	−.19
Theory of Mind	.13	−.15	.07	.01
Empathy	−.11	.20	−.02	−.08
Aggression	−.20 †	.06	.02	−.01

*Note. $p \leq .05$ (two-tailed).†significant gender difference in the strength of the correlation.

Relationships between solitary play forms and emotion indices at time 1

Pearson's correlations revealed no collinearity among the non-social play types. As Fisher r to Z transformations showed gender differences in the strengths of some correlations (see Table 2), further analyses were performed for boys and girls separately. Pearson's correlations on the indices for non-social play and emotional competence are displayed in Table 2.

For girls, indices for non-social play and emotional competence were unrelated. For boys, more reticent play was related to more aggression, less emotion understanding, and lower levels of empathy. More solitary-passive behaviour in boys was related to a better Theory of Mind score. No other correlations were found for boys.

Time in solitude at time 2, six months later

Pearson's correlations on the indices for non-social play and emotional competence at Time 1, with indices for time in solitude at Time 2, are shown in Table 3 for boys and girls separately. As the indices for time in solitude showed a high intercorrelation between percentage of time alone and duration of times spent alone ($r = .60$, $p < .001$), only duration of times alone was used as a dependent variable in the regression analyses, which are also displayed in Table 3.

For girls, positive associations were found between solitary-pretend play with the percentage and the duration of time alone. A negative association was found between girls' empathy and the percentage of time alone. No other significant correlations appeared. Solitary-pretend play maintained its positive contribution to the duration of time which girls spent alone when entered in a regression model, accounting for 38% of the explained variance.

No other significant regression models were found for the duration of time alone, with non-social play types as predictors. The bootstrapping, adding the emotion indices as mediating factors in the relationship between the different

Table 3. Pearson's correlations and regression analyses for non-social play types and indices of emotional competence on time in solitude, for boys and girls separately.

	Time alone (%)		Duration of times alone		
	r	r	R^2_{adj}	b	p
Boys					
Non-social play type			−.08		.926
Reticent	−.12	−.11		−.12	.479
Solitary-physical	.03	.08		.09	.589
Solitary-pretend	.20	−.04†		.04	.795
Solitary-constructive	−.14	.00		.03	.849
Emotional competence					
Emotion understanding	.19	.26			
Theory of mind	.24	.11			
Empathy	−.06	−.03			
Aggression	.13†	.00			
Girls					
Non-social play type			.38		.003
Reticent	.01	.06		.07	.71
Solitary-physical	−.07	.11		.04	.80
Solitary-pretend	.40*	.68* †		.68	.001
Solitary-constructive	−.14	−.09		−.05	.73
Emotional competence					
Emotion understanding	−.08	.04			
Theory of mind	.24	.06			
Empathy	−.41*	−.09			
Aggression	−.37†	−.20			

*Note. $p \leq .05$ (two-tailed).†Significant gender difference in the strength of the correlation.
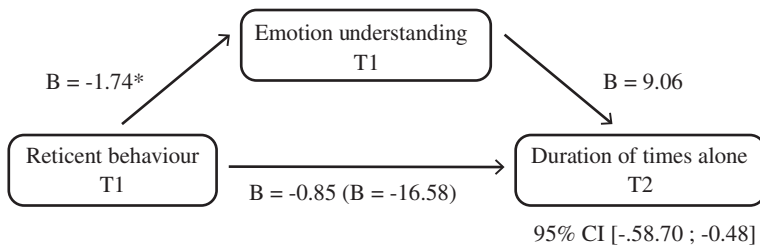
Figure 2. Mediation effect of emotion understanding between boys' reticent behaviour and mean duration time alone.
*Note. *$P < .05$.

forms of solitary play and percentage and duration of solitary time six months later, did not amount to significance.

For boys, neither correlations nor regression models were significant. Yet, after bootstrapping, the contribution of reticent behaviour to the prediction of the duration of times spent alone was mediated by boys' emotion understanding (Figure 2). In other words, reticent behaviour influenced the mean duration of times alone six months later through emotion understanding.

Discussion

Starting pre-school comes with its fair share of challenges. For a pre-schooler, the new environment filled with unfamiliar teachers and kids can be overwhelming. It is expected that the child will get along with the other kids, and being alone on the playground while peers are readily available is viewed with concern by parents and teachers. The outcomes of our study showed that young pre-schoolers, in their first semester, indeed spend quite some time alone on the playground.

Rather than playing alone, reticent behaviours were most common; the new pre-schoolers rather watched others while being unoccupied themselves, for more than a quarter of their free time (27% on average). This frequency and the lower frequency of solitary-passive (1% on average), contrast with previous studies that showed lower frequencies of reticent behaviour and higher frequencies of solitary-passive behaviour (e.g., Coplan et al., 2001a). On the contrary of the majority of researches on non-social behaviours, this study took place during outdoor free play, where children have more physical space available and a sparser distribution of children. It is well established in the literature that physical environment impacts upon children's behaviour (e.g., Abbas & Othman, 2010; Read, Sugawara, & Brandt, 1999). Although most of these studies have been focusing classroom features, there is some preliminary evidence suggesting that the contextual features of the playground (i.e., indoors versus outdoors) influence children's play behaviours (Bar-Haim & Bart, 2006; Hirose, Koda, & Minami, 2012; Nelson et al., 2008). As hypothesized by Spinrad and colleagues (2004), an outdoor recess might refrain less socially motivated children to actively initiate interactions with peers, and therefore spending more time observing others. The contextual differences may also explain the low frequencies of solitary-passive behaviour. As argued by Rubin (1982) this form of play is encouraged by teachers as it helps to maintain the order, and therefore numerous constructive objects and toys are available in the classroom. On the contrary, at the outdoor playground no manipulatives were provided, giving less opportunity for solitary-passive play.

In this study we found no gender differences regarding the levels of emotional competence, except for empathy. Surprisingly, boys were rated by their parents as more empathic than girls, whereas the common finding at a later age is that girls are more empathic than boys. When we examined these gender differences at item level, we noticed that boys exceeded girls on only three items, two including laughing (i.e., 'When my child sees other children laughing, he/she starts laughing too'; 'When adults laugh, my child tries to get near them'). In contrast, previous studies – showing either no gender differences or girls scoring higher than boys – almost exclusively focused on empathic responses to negative emotions (e.g., Eisenberg et al., 1996; Moreno, Klute, & Robinson, 2008; Zahn-Waxler, Robinson, & Emde, 1992).

Boys and girls showed different patterns regarding the association between emotional competence and solitary behaviour. In boys, reticent behaviour was related to more aggression, less empathy, and less emotion understanding, which supports the view that emotional immaturity might underlie reticent behaviour (Coplan et al., 2001a). Nevertheless, reticent behaviour at the beginning of the school year was unrelated to children's playground solitude six months later, so children seem to catch up when the year proceeds.

Unexpectedly, solitary-passive behaviour was related to a better Theory of Mind in boys, suggesting that these boys do not lack social understanding, yet are less prone as their peers to social interaction. However, solitary-passive behaviour was also related to more aggression in boys, which might explain why these boys were rated less socially competent by both their peers and teachers in previous studies (Coplan et al., 2001a; Nelson et al., 2005).

Overall, these early non-social behaviours in boys were unrelated to later social solitude at the playground. This outcome is in line with the study of Ladd et al. (1988), who showed a higher variation of solitary play behaviours over the school year, compared to social play behaviours. Possibly, a priori socially disinterested children learn to appreciate the benefits and the joy of being with peers, refraining from their tendency for being alone. In addition, the social environment in pre-school provides children with an important context within which they can improve their emotional skills.

In girls, solitary-pretend play was very uncommon (.46% of their recess time), but nevertheless related to more playground solitude six months later. Unexpectedly, their emotional competence was unrelated to this finding. So albeit these girls seem to have sufficient emotional competence, they may be at risk of social exclusion. Again, future studies could look more closely into the underlying factors. This finding supports the position put forward by Nelson and colleagues (2008), that solitary-pretend play and solitary-functional play should not be combined into one measure.

Finally, the results also suggest a gender-specific peer socialization style, as girls' empathy was negatively associated with the amount of time spent alone six months later, whereas no significant relation was found for boys. It seems plausible that children who are less empathic would spend more time in solitude; either by their own choice because they do not feel connected to other children, or because their lack of empathy leads to rejection by their peers. However children might perceive empathy in boys and girls differently. According to the model of Rose and Rudolph (2006), parents promote a different socialization of boys and girls; parents tend to reinforce empathy and self-disclosure in girls, whereas independence and physical competence are the most stimulated features in boys. As children are raised within these patterns they learn to value these gender-specific characteristics in their peers. Indeed, studies with adolescents showed that empathy was positively associated with girls' peer acceptance and social influence, yet it was negatively related to boys' peer acceptance and

unrelated to boys' social influence (Huang & Su, 2014; Oberle, Schonert-Reichl, & Thomson, 2010). Thus, being emotionally responsive towards others might be more desirable among girls and therefore might explain why girls who were rated as less empathic, spent more time alone.

Suggestions for future studies

Future studies should gather data over a longer time period and assess both emotional competence and solitary behaviour at all time points in order to examine the role of empathy in girls; and the role of solitary-passive play in boys. Moreover, an important addition to the current design would also be to capture peers' responses to the child's solitude (e.g., using Gazelle's (2008) Peer Interaction Observation System) in order to better understand whether children are avoiding social interactions, or being actively excluded and/or ignored by their peers. Also indices on children's social roles by means of peer nomina-tions (i.e., peer-popularity, bully, victim, defender, and so on) could increase our understanding of the causality underlying non-social behaviour; and its effect on children's emotional competence and social interactions. Specifically, it would be important to examine the extent to which peer status can predict changes in pre-schoolers' solitude over the school year.

Conclusion

The outcomes of this study show that non-social behaviours at the beginning of the pre-school years do not necessarily evolve into later solitude. Reticent behaviour was the most common form of non-social play, but unrelated to later solitude in the peer group. The only kind of non-social play that was related to more solitude six months later, was solitary-pretend play, but only for girls, and irrespective of their level of emotional competence. Thus this atypical and non-social behaviour should warn teachers and parents, as this might set the pathway for even further social exclusion.

In boys who entered preschool, non-social behaviours were related to more aggression and other problems in the domain of emotional competence, which could explain their initial solitude. Importantly however, this did not seem to result in solitude within the peer group six months later, and thus does not seem to jeopardise their social development. In other words, these solitary boys might still learn to improve their emotional repertoire, and learn how to initiate and sustain social interactions with their peers.

A noteworthy contribution of this study was the measurement of children's behaviour in their natural environment without compromising ecological validity. Particularly, the use of RFID devices enabled the quantification of spa-tial proximity in a short period of time, and minimized the effect which the awareness of being observed may have on children's behaviour. However, being

spatially close does not necessarily imply social interaction and for that reason there may be false positives. Nevertheless, collecting intense and continuous data, and escaping from the subjectivity of a coder, has great potential and may mark a new methodological era in the field of children's behaviours and interactions.

Acknowledgements

Disclosure statement

References

Abbas, M. Y., & Othman, M. (2010). Social behavior of preschool children in relation to physical spatial definition. *Procedia-Social and Behavioral Sciences, 5*, 935–941. doi:10.1016/j.sbspro.2010.07.213

Asendorpf, J. B. (1991). Development of inhibited children's coping with unfamiliarity. *Child Development, 62*, 1460–1474. doi:10.1111/j.1467-8624.1991.tb01618.x

Atzmueller, M., Doerfel, S., Hotho, A., Mitzlaff, F., & Stumme, G. (2012). *Face-to-face contacts at a conference: Dynamics of communities and roles*. Paper presented at the Proceedings of the 2011 international conference on Modeling and Mining Ubiquitous Social Media, Boston.

Bar-Haim, Y., & Bart, O. (2006). Motor function and social participation in kindergarten children. *Social Development, 15*, 296–310. doi:10.1046/j.1467-9507.2006.00342.x

Cattuto, C., Van den Broeck, W., Barrat, A., Colizza, V., Pinton, J.-F., & Vespignani, A. (2010). Dynamics of person-to-person interactions from distributed RFID sensor networks. *PLoS ONE, 5*, e11596. doi:10.1371/journal.pone.0011596

Chen, X., DeSouza, A. T., Chen, H., & Wang, L. (2006). Reticent behavior and experiences in peer interactions in Chinese and Canadian children. *Developmental Psychology, 42*, 656–665. doi:10.1037/0012-1649.42.4.656

Choo, M. S., Xu, Y., & Haron, P. F. (2011). Subtypes of nonsocial play and psychosocial adjustment in Malaysian preschool children. *Social Development, 21*, 294–312. doi:10.1111/j.1467-9507.2011.00630.x

Coplan, R. J., & Arbeau, K. A. (2009). Peer interactions and play in early childhood. In K. H. Rubin, W. M. Bukowski, & B. Laursen (Eds.), *Handbook of peer interactions, relationships, and groups* (pp. 143–161). New York, NY: The Guildford Press.

Coplan, R. J., & Armer, M. (2007). A 'multitude' of solitude: A closer look at social withdrawal and nonsocial play in early childhood. *Child Development Perspectives, 1*, 26–32. doi:10.1111/j.1750-8606.2007.00006.x

Coplan, R. J., DeBow, A., Schneider, B. H., & Graham, A. A. (2009). The social behaviours of inhibited children in and out of preschool. *British Journal of Developmental Psychology, 27*, 891–905. doi:10.1348/026151008X396153

Coplan, R. J., Gavinski-Molina, M. H., Lagacé-Séguin, D. G., & Wichmann, C. (2001a). When girls versus boys play alone: Nonsocial play and adjustment in kindergarten. *Developmental Psychology, 37*, 464–474. doi:10.1037//0012-1649.37.4.464

Coplan, R. J., & Rubin, K. H. (1998). Exploring and assessing nonsocial play in the preschool: The development and validation of the preschool play behavior scale. *Social Development, 7*, 72–91. doi:10.1111/1467-9507.00052

Coplan, R. J., Rubin, K. H., Fox, N. A., Calkins, S. D., & Stewart, S. L. (1994). Being alone, playing alone, and acting alone: Distinguishing among reticence and passive and active solitude in young children. *Child Development, 65*, 129–137. doi:10.1111/j.1467-8624.1994.tb00739.x

Coplan, R. J., Wichmann, C., & Lagacé-Séguin, D. G. (2001b). Solitary-active play behavior: A marker variable for maladjustment in the preschool? *Journal of Research in Childhood Education, 15*, 164–172. doi:10.1080/02568540109594957

Denham, S. A., Blair, K. A., DeMulder, E., Levitas, J., Sawyer, K., Auerbach-Major, S., & Queenan, P. (2003). Preschool emotional competence: Pathway to social competence? *Child Development, 74*, 238–256. doi:10.1111/1467-8624.00533

Dodge, K. A., & Coie, J. D. (1987). Social-information-processing factors in reactive and proactive aggression in children's peer groups. *Journal of Personality and Social Psychology, 53*, 1146–1158. doi:10.1037/0022-3514.53.6.1146

Eisenberg, N., Fabes, R. A., Murphy, B., Karbon, M., Smith, M., & Maszk, P. (1996). The relations of children's dispositional empathy-related responding to their emotionality, regulation, and social functioning. *Developmental Psychology, 32*, 195–209. doi:10.1037/0012-1649.32.2.195

Fabes, R. A., Martin, C. L., Hanish, L. D. (2009). Children's behaviors and interactions with peers. In K. H. Rubin, W. M. Bukowski, & B. Laursen (Eds.), *Handbook of peer interactions, relationships, and groups. Social, emotional, and personality development in context* (pp. 45–62). New York, NY: The Guilford Press.

Gazelle, H. (2008). Behavioral profiles of anxious solitary children and heterogeneity in peer relations. *Developmental Psychology, 44*, 1604–1624. doi:10.1037/a0013303

Harrist, A. W., Zaia, A. F., Bates, J. E., Dodge, K. A., & Pettit, G. S. (1997). Subtypes of social withdrawal in early childhood: Sociometric status and social-cognitive differences across four years. *Child Development, 68*, 278–294. doi:10.1111/j.1467-8624.1997.tb01940.x

Hart, C. H., Yang, C., Nelson, L. J., Robinson, C. C., Olsen, J. A., Nelson, D. A., & Wu, P. (2000). Peer acceptance in early childhood and subtypes of socially withdrawn behaviour in China, Russia, and the United States. *International Journal of Behavioral Development, 24*, 73–81. doi:10.1080/016502500383494

Hirose, T., Koda, N., & Minami, T. (2012). Correspondence between children's indoor and outdoor play in Japanese preschool daily life. *Early Child Development and Care, 182*, 1611–1622. doi:10.1080/03004430.2011.634065

Huang, H., & Su, Y. (2014). Peer acceptance among Chinese adolescents: The role of emotional empathy, cognitive empathy and gender. *International Journal of Psychology, 49*, 420–424. doi:10.1002/ijop.12075

Ketelaar, L., Rieffe, C., Wiefferink, C. H., & Frijns, J. H. (2012). Social competence and empathy in young children with cochlear implants and with normal hearing. *The Laryngoscope, 123*, 518–523. doi:10.1002/lary.23544

Ladd, G. W., Price, J. M., & Hart, C. H. (1988). Predicting preschoolers' peer status from their playground behaviors. *Child Development*, *59,* 986–992. doi:10.2307/1130265

Luckey, A. J., & Fabes, R. A. (2005). Understanding nonsocial play in early childhood. *Early Childhood Educational Journal, 33*, 67–72. doi:10.1007/s10643-006-0054-6

Mesman, J., Bongers, I. L., & Koot, H. M. (2001). Preschool developmental pathways to preadolescent internalizing and externalizing problems. *Journal of Child Psychology and Psychiatry, 42*, 679–689. doi:10.1017/S0021963001007351

Moreno, A. J., Klute, M. M., & Robinson, J. L. (2008). Relational and individual resources as predictors of empathy in early childhood. *Social Development, 17*, 613–637. doi:10.1111/j.1467-9507.2007.00441.x

Nelson, L. J., Hart, C. H., & Evans, C. A. (2008). Solitary-functional play and solitary-pretend play: Another look at the construct of solitary-active behavior using playground observations. *Social Development, 17*, 812–831. doi:10.1111/j.1467-9507.2008.00470.x

Nelson, L. J., Rubin, K. H., & Fox, N. A. (2005). Social withdrawal, observed peer acceptance, and the development of self-perceptions in children ages 4 to 7 years. *Early Childhood Research Quarterly, 20*, 185–200. doi:10.1016/j.ecresq.2005.04.007

Oberle, E., Schonert-Reichl, K. A., & Thomson, K. C. (2010). Understanding the link between social and emotional well-being and peer relations in early adolescence: Gender-specific predictors of peer acceptance. *Journal of Youth and Adolescence, 39*, 1330–1342. doi:10.1007/s10964-009-9486-9

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers, 36*, 717–731. doi:10.3758/BF03206553

Read, M. A., Sugawara, A. I., & Brandt, J. A. (1999). Impact of space and color in the physical environment on preschool children's cooperative behavior. *Environment and Behavior, 31*, 413–428. doi:10.1177/00139169921972173

Rieffe, C., Ketelaar, L., & Wiefferink, C. H. (2010). Assessing empathy in young children: Construction and validation of an Empathy Questionnaire (EmQue). *Personality and Individual Differences, 49*, 362–367. doi:10.1016/j.paid.2010.03.046

Rieffe, C., Meerum Terwogt, M., Koops, W., Stegge, H., & Oomen, A. (2001). Preschoolers' appreciation of uncommon desires and subsequent emotions. *British Journal of Developmental Psychology, 19*, 259–274. doi:10.1348/026151001166065

Rieffe, C., Netten, A., Broekhof, E., & Veiga, G. (2015). The role of the environment in children's emotion socialization; the case of deaf or hard of hearing (DHH) children. In M. Marschark & H. E. T. Knoors (Eds.), *Educating deaf students: Creating a global evidence base* (pp. 369–388). London: Oxford University Press.

Rose, A. J., & Rudolph, K. D. (2006). A review of sex differences in peer relationship processes: Potential trade-offs for the emotional and behavioral development of girls and boys. *Psychological Bulletin, 132*, 98–131. doi:10.1037/0033-2909.132.1.98

Rose-Krasnor, L., & Denham, S. (2009). Social-emotional competence in early childhood. In K. H. Rubin, W. M. Bukowski, & B. Laursen (Eds.), *Handbook of peer interactions, relationships, and groups* (pp. 162–179). New York, NY: The Guildford Press.

Rubin, K. H. (1982). Nonsocial play in preschoolers: Necessarily evil? *Child Development, 53*, 651–657. doi:10.2307/1129376

Rubin, K. H. (2001). *The play observation scale (POS)*. College Park, MD: University of Maryland

Rubin, K. H., Burgess, K. B., Kennedy, A. E., & Stewart, S. L. (2003). Social withdrawal in childhood. In E. J. Mash & R. A. Barkley (Eds.), *Child psychopathology* (pp. 372–406). New York, NY: The Guildford Press.

Rubin, K. H., Coplan, R. J., & Bowker, J. C. (2009). Social withdrawal in childhood. *Annual Review of Psychology, 60*, 141–171. doi:10.1146/annurev.psych.60.110707.163642

Rubin, K. H., Coplan, R. J., Fox, N. A., & Calkins, S. D. (1995). Emotionality, emotion regulation, and preschoolers' social adaptation. *Development and Psychopathology, 7*, 49–62. doi:10.1017/S0954579400006337

Spinrad, T. L., Eisenberg, N., Harris, E., Hanish, L., Fabes, R. A., Kupanoff, K., … Holmes, J. (2004). The relation of children's everyday nonsocial peer play behavior to their emotionality, regulation, and social functioning. *Developmental Psychology, 40*, 67–80. doi:10.1037/0012-1649.40.1.67

Stehlé, J., Charbonnier, F., Picard, T., Cattuto, C., & Barrat, A. (2013). Gender homophily from spatial behavior in a primary school: A sociometric study. *Social Networks, 35*, 604–613. doi:10.1016/j.socnet.2013.08.003

Stehlé, J., Voirin, N., Barrat, A., Cattuto, C., Isella, L., Pinton, J.-F., … Lina, B. (2011). High-resolution measurements of face-to-face contact patterns in a primary school. *PLoS ONE, 6*, e23176. doi:10.1371/journal.pone.0023176

Wiefferink, C. H., Rieffe, C., Ketelaar, L., De Raeve, L., & Frijns, J. H. (2013). Emotion understanding in deaf children with a cochlear implant. *Journal of Deaf Studies and Deaf Education, 18*, 175–186. doi:10.1093/deafed/ens042

Wiefferink, C. H., Rieffe, C., Ketelaar, L., & Frijns, J. H. M. (2012). Predicting social functioning in children with a cochlear implant and in normal-hearing children: The role of emotion regulation. *International Journal of Pediatric Otorhinolaryngology, 76*, 883–889. doi:10.1016/j.ijporl.2012.02.065

Zahn-Waxler, C., Robinson, J. L., & Emde, R. N. (1992). The development of empathy in twins. *Developmental Psychology, 28*, 1038–1047. doi:10.1037/0012-1649.28.6.1038