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## **Understanding, expressing, and interacting: the development of emotional functioning in young children with autism**

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# CHAPTER 5.

Emotional functioning and the development of  
internalizing and externalizing problems in young boys  
with and without autism spectrum disorder

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## **ABSTRACT**

Children with Autism Spectrum Disorder (ASD) are at risk for developing internalizing and externalizing problems. However, information on early development of behaviour problems and the contributing role of emotional functioning in preschool children with ASD is scarce. This study collected data of boys with and without ASD (N=156; age 2 to 6 years) over three consecutive years (3 waves), about their internalizing and externalizing symptoms and emotional functioning (i.e., emotion control, recognition, and vocabulary), using parent-report questionnaires. No age effect was found on internalizing or externalizing problems for boys with and without ASD. Boys with ASD displayed more behaviour problems than their TD peers, and showed lower levels of emotional functioning. Better emotion control and improved emotion recognition were associated with a decrease in problem behaviours for boys with and without ASD, whereas improved emotion vocabulary was uniquely related with a decrease in externalizing problems in boys with ASD. Our findings suggest that boys with and without ASD showed similar developmental courses of internalizing and externalizing problems. However, lower levels of emotional functioning were already more pronounced in boys with ASD at a young age. This contributes to higher levels of behaviour problems.

## Introduction

Children diagnosed with an Autism Spectrum Disorder (ASD) are at high risk for comorbid conditions including internalizing problems such as anxiety and depression, and externalizing problems such as hyperactivity and aggression (Bauminger, Solomon, & Rogers, 2010; Salazar et al., 2015). The prevalence rates of having at least one psychiatric condition in addition to their core syndrome range from 70% to 90% (de Bruin, Ferdinand, Meester, de Nijs, & Verheij, 2007; Leyfer et al., 2006; Salazar et al., 2015; Simonoff et al., 2008), about three to ten times higher than in the general population (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003). Comorbid internalizing and externalizing problems start early in life. Recent research reported that in preschool and elementary school children with ASD, about 67% had generalized anxiety disorder, 15% had major depressive disorder, and 29% had oppositional defiant disorder (Salazar et al., 2015). Although internalizing and externalizing problems are well recognized in mental health profiles of children with ASD, information on their developmental trajectories, especially in early childhood, is scarce (Vaillancourt et al., 2017). Furthermore, little is known about the contribution of emotional functioning to the development of internalizing and externalizing problems in young children with ASD, although this relation has been established in typically developing (TD) children (see for a review, Trentacosta & Fine, 2010). Finding out the developing trends of behaviour problems and identifying the contributing factors are crucial for effective prevention and intervention (Simonoff et al., 2008). The present three-wave longitudinal study aimed to address this gap by examining (1) the developmental trajectories of internalizing and externalizing problems in 2- to 6-year old boys diagnosed with ASD, and (2) the developmental associations between emotional functioning and these internalizing and externalizing problems in boys with ASD, as compared to their TD peers.

Previous studies examining the development of internalizing problems such as anxiety and depression in TD samples reported an increase in early childhood (Bongers, Koot, Van der Ende, & Verhulst, 2003; Carter et al., 2010; Côté et al., 2009). The increasing trend may relate to cognitive maturation. With age children develop higher levels of emotional complexity, and become more capable to predict negative events. Without adequate coping skills, this cognitive maturity can make children more vulnerable to depressive or anxious affects (Pianta & Castaldi, 1989). For externalizing problems, previous studies showed mixed findings, reporting either a stable or decreasing pattern in the majority of TD children (Bayer et al., 2012; Fanti & Henrich, 2010; Miner & Clarke-Stewart, 2008; Olson, Choe, & Sameroff, 2017). The discrepancy may be due to the fact that different studies included

different externalizing symptoms. While all included aggressive behaviours, some also included other symptoms such as inattention, hyperactivity or emotion dysregulation.

As for the development of internalizing and externalizing problems in young children with ASD, only a few studies are available, and their findings are mixed. Cross-sectional studies comparing toddlers and preschoolers to school-aged children found an increasing trend of anxiety in children with ASD (Davis III et al., 2011; Vasa et al. 2013). This is congruent with the findings in TD children (e.g., Carter et al., 2003). To our knowledge, only one longitudinal study exists, using the Child Behaviour Check List (CBCL, Achenbach & Rescorla, 2000) for the broadband of internalizing and externalizing problems in 3- to 5-year-old children with ASD. The majority of children showed a low starting level and a declining trend for both domains (77% for internalizing and 87% for externalizing problems). Others showed however high starting levels, but the symptoms remained stable (Vaillancourt et al., 2017). While the developmental trajectory of externalizing problems reported by Vaillancourt et al. (2017) is congruent with the findings in TD children, the results of internalizing problems differ from others. This is probably because they have examined not only anxiety but also other internalizing symptoms. It should be noted that neither the cross-sectional studies nor the longitudinal study included a control group, so we cannot directly compare children with ASD to TD peers.

In TD children, the development of internalizing and externalizing problems are associated with deficits in emotional functioning (e.g., Hill, Degnan, Calkins, & Keane, 2006; Keenan, 2000). “Emotional functioning” is an umbrella term that covers various intertwined abilities of children’s overall capacity to deal with emotion-provoking situations. Three pivotal abilities that children need to learn from early on are: how to keep their emotional arousal at an optimal level for achieving social and personal goals (emotion control); how to read and interpret others’ emotions for maintaining good interpersonal relationships (emotion recognition); and how to monitor and communicate their own and others’ emotional experiences with the adequate emotion labels (emotion vocabulary).

Emotions are functional. They prepare us to deal efficiently with environmental demands (e.g., anger and fear prepare us to fight or flight in challenging situations), signal our emotional states to others and elicit responses (e.g., sadness elicits comfort and help) (Levenson, 1999; Scherer, 2000). However, emotions are functional only when the level of arousal and duration are under control or manageable. Being overwhelmed by emotions, as indicated by elevated levels of negative emotion expressions, puts children at risk for developing behaviour problems (Cole, Martin, & Dennis, 2004). For example, persistent

expression of sadness is a sign or early symptom of depression (Horwitz & Wakefield, 2007), and excessive and intensive expressions of anger are related to externalizing behaviours such as aggression (Zeman, Shipman & Suveg, 2002). Fäsche and Friedlmeier (2015) found that in TD children aged 5 to 6 years, more positive emotion expressions were related to fewer internalizing problems, and more negative emotion expressions were related to more internalizing and externalizing problems.

Early development of behaviour problems is also related to children's ability to recognize others' emotions (see for a review, Trentacosta & Fine, 2010). Correctly identifying others' emotions is prerequisite to establishing and maintaining positive interpersonal relations. Frequent experience of unpleasant and stressful social interactions can contribute to social exclusion and the development of internal feelings such as anxiety, loneliness and sadness (Fine, Izard, Mostow, Trentacosta, & Ackerman, 2003). Besides, children who tend to attribute anger to others in ambiguous situations, and who are less able to recognize sadness in others, exhibit elevated levels of externalizing problems such as aggression (Martin, Boekamp, McConville, & Wheeler, 2010; Schultz, Izard and Ackerman, 2000).

A third index of emotional functioning is children's knowledge of emotion and mental state words. When labeling either their own or other people's emotional state, children need to reflect upon and monitor the emotional episode. This attentional process helps them understand the underlying causes and differentiate emotions (Rieffe, Oosterveld, Miers, Meerum Terwogt, & Ly, 2008). In addition, knowing emotion and mental state words enable children to communicate about emotions. Lack of emotion vocabulary can compromise their ability to cope with emotion-provoking situations and create difficult interpersonal relations, which in turn put them at risk for developing behaviour problems. In TD children, the ability to label emotions is related to fewer behaviour problems both concurrently (Schultz, Izard, Ackerman, & Youngstrom, 2001) and longitudinally (Fine et al., 2003; Izard et al., 2001).

To date, the association between emotional functioning and behaviour problems is established mainly based on findings in TD children. Only a few studies reported the links in adolescents with ASD, focusing on the role of emotion control (Rieffe, Bruine, De Rooij, & Stockmann, 2014; Bos, Diamantopoulou, Stockmann, Begeer, Rieffe, 2018). It is unclear whether the same relations exist in young children with ASD. This study aimed to examine the development of internalizing and externalizing problems, and their associations with emotional functioning in preschool boys diagnosed with ASD. We expected that boys with ASD would exhibit more internalizing and externalizing behaviours overall than their TD peers (e.g., Stewart, Barnard, Pearson, Hasan, & O'Brien, 2006). We assumed that

internalizing symptoms would increase in TD boys (e.g., Côté et al., 2009). Due to mixed findings on the developmental course of externalizing problems in TD children, no directional hypothesis was made. We also did not make directional hypotheses regarding the developmental courses of internalizing and externalizing problems in boys with ASD, because there is only one longitudinal study (i.e., Vaillancourt et al., 2017), and its findings differ from the cross-sectional studies (Davis III et al., 2011; Vasa et al. 2013). Finally, we expected that, as in TD children (Eisenberg et al., 2000; Southam-Gerow & Kendall, 2002), poor emotional functioning (emotion control, emotion recognition, and emotion vocabulary) would contribute to the development of internalizing and externalizing problems in boys with ASD.

## **Methods**

### ***Participants and procedure***

This study was a part of a larger-scale longitudinal investigation into the social-emotional development of toddlers and preschoolers with limited access to the social learning environment, including children with hearing loss, children with Developmental Language Disorder, and children with ASD (Ketelaar, Wiefferink, Frijns, Broekhof, & Rieffe, 2015; Rieffe & Wiefferink, 2017; Broekhof et al., 2015).

The total sample of the larger project included 73 children with ASD (65 boys) and 418 TD children (226 boys). Since there were too few girls with ASD, we used the data of 59 boys with ASD aged 22 to 71 months (*Mean* 54.73, *SD* 11.69) and 97 TD boys aged 22 to 78 months (*Mean* 51.04, *SD* 15.25) at Time 1. Participants of the larger project were included if parental reports were available for the included questionnaires on at least one time point (see Supplementary Table 1, for available data at each time point).

Boys with ASD were recruited via a specialized institution for diagnostics and treatment of children with ASD (the Center for Autism in Leiden, the Netherlands). TD boys were recruited from day-care centers and mainstream primary schools. Inclusion criteria for the ASD sample were: (1) the child received ASD diagnosis according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) (American Psychological Association, 1994) based on the Autism Diagnostic Interview-Revised (Lord, Rutter, & Lecouteur, 1994) set by a qualified child psychologist or psychiatrist at Time 1, (2) the parents confirmed three years later that the child retained the ASD diagnosis, (3) IQ scores above 70, and (4) no additional DSM-IV-TR diagnosis. Inclusion criteria for the TD sample were (1) IQ scores above 70, and (2) no DSM-IV-TR diagnosis.



Information regarding IQ scores in the ASD sample were retrieved from school files, or through testing at the Centre for Autism. Hence, various intelligence tests were used, including the Snijders-Oomen Nonverbal Intelligence Tests (SON-R), Wechsler Intelligence Scale for Children (WISC III), Wechsler Preschool and Primary Scale of Intelligence (WPPSI), and the Dutch version of Wechsler Nonverbal Scale of Ability (WNV-NL). TD boys were tested by the SON-R. Parents also filled in Social Responsive Scale (Constantino & Gruber, 2005) at Time 3 to report on children's social abilities.

For three consecutive years (mean duration between Time 1 and Time 2 = 13.30 months,  $SD = 2.84$ ; between Time 2 and Time 3 = 11.93 months,  $SD = 1.54$ ), parents were asked to complete questionnaires concerning the social-emotional development of their child as well as a list of background information. Permission for this study was granted by the Ethical Committee of Leiden University and the Center for Autism (P08.140/SH/sh). All parents provided written informed consent.

## Materials

**Internalizing and externalizing problems.** The Early Childhood Inventory-4 (ECI-4) is a parent-report questionnaire that is validated and widely used to assess DSM-IV symptoms (Sprafkin, Volpe, Gadow, Nolan, & Kelly, 2002). The questionnaire consists of 108 items that can be scored in two ways: (1) screening cutoff (dichotomous), and (2) symptom severity (dimensional, ranging from "0 = never" to "3 = very often"). We used the severity scores of the subscales for Major Depressive Disorder (6 items) and Generalized Anxiety Disorder (12 items) as indices of internalizing problem severity, and the subscales for Peer Conflict (10 items), Oppositional Defiant Disorder (8 items), and Conduct Disorder (10 items) as indices of externalizing problem severity. The final scores for internalizing and externalizing problem severity were calculated by the sum of the scores of the corresponding ECI-4 subscales. A higher score indicated more severe symptomatology. We combined scales within each domain for two considerations. First, little is known about early development of internalizing and externalizing problems in young children with ASD. As a first step, it is informative to start with examining the general trends of the two large domains. Second, in young children, specific symptoms within the same domain often cannot be distinguished from each other and possibly represent the same underlying disorder (Wichstrøm & Berg-Nielsen, 2014). Internal consistency of internalizing problems ranged from acceptable to good across time (TD:  $0.869 < \alpha < 0.874$ ; ASD:  $0.639 < \alpha < 0.894$ ), and externalizing problems were good across time for

both groups (TD:  $0.868 < \alpha < 0.889$ ; ASD:  $0.895 < \alpha < 0.962$ ; see also Supplementary Table 2 for the internal consistency for all measures per time point per group).

**Emotion control and emotion recognition.** The Emotion Expression Questionnaire is a 35-item parent-report questionnaire that measures a child's emotion expressions (Rieffe, Ketelaar, & Wiefferink, 2010). In the current study we used three scales: (1) Negative Emotion Expression Scale (12 items) as a measure for emotion control, which indicates the frequency, intensity and duration of children's negative emotion expressions, including sadness, fear and anger (example item: "How often does your child experience fear?"), and the extent to which they can calm themselves or be calmed by their parents (example item: "Is your child easily calmed down when angry?"); (2) Positive emotion expression scale (6 items), which indicates the intensity and frequency of children's happiness and joy (example item: "How often does your child experience joy?"); and (3) Emotion Recognition Scale (6 items) which indicates the extent to which the child can recognize others' emotions (example item: "Does your child know when you are happy?"). Parents rated each item on a 5-point scale ranging from "1 = (almost) never" to "5 = (almost) always". For both groups, the internal consistency of the Negative Emotion Expression Scale was sufficient across time (TD:  $0.679 < \alpha < 0.802$ ; ASD:  $0.633 < \alpha < 0.825$ ). The internal consistency of the Emotion Recognition Scale ranged from sufficient to good (TD:  $0.758 < \alpha < 0.798$ ; ASD:  $0.878 < \alpha < 0.908$ ). The internal consistency of the Positive Emotion Expression Scale was sufficient for the ASD sample ( $0.673 < \alpha < 0.780$ ). However, the internal consistency was questionable for the TD sample at Time 1 ( $\alpha = 0.655$ ) and Time 3 ( $\alpha = 0.600$ ), and unacceptable at Time 2 ( $\alpha = 0.398$ ). It is unclear what caused the poor internal consistency, and we excluded this measure from the subsequent analyses.

**Emotion vocabulary.** The Emotion Vocabulary Questionnaire is a parent report that measures children's knowledge of emotional words (Ketelaar, Wiefferink, Frijns, Broekhof, & Rieffe, 2015). Parents rated whether their child knew and used 20 emotion and mental state words (0 = no/ 1 = yes). We used two scales: Basic Emotion Vocabulary (4 items: happy, angry, fearful and sad) and Mental State Vocabulary (5 items: dream, think, know, forget, and want). A total score for each subscale was calculated. A higher score indicated better emotion vocabulary. For the ASD sample, the internal consistency of Basic Emotion Vocabulary ( $0.748 < \alpha < 0.831$ ) and Mental State Vocabulary ( $0.752 < \alpha < 0.824$ ) ranged from sufficient to good. For the TD sample, the internal consistency of both scales ranged from sufficient to good at Time 1 and Time 2 (Basic Emotion Vocabulary:  $0.749 < \alpha < 0.865$ ; Mental State Vocabulary:  $0.697 < \alpha < 0.827$ ). However, the internal consistency of both scales at Time 3 were poor for the

TD sample (Basic Emotion Vocabulary:  $\alpha=-0.360$ ; Mental State Vocabulary:  $\alpha=0.134$ ). This was because the TD sample showed a near-ceiling effect at Time 3 (Table 2), which resulted in little variance in the scoring of some items.

### *Statistical analyses*

Statistical analyses were performed using the statistical software package for social sciences version 21.0 (SPSS Inc., Chicago). Graphs were made by R (R Core Team, 2014; GGplot2 package). To test for group differences in demographic features, emotional functioning and behaviour problems at the three time points, independent *t*-tests were used. Linear Mixed Models (LMM) were used to assess (1) the developmental trajectory of internalizing and externalizing problems, and (2) contributing factors for the change in internalizing and externalizing problem severity. The advantage of LMM is that it allows for data hierarchies, such as observed in longitudinal data. Within a longitudinal data set, time points are nested within participants and multilevel modeling can account for this type of data dependency. Furthermore, LMM can handle missing data.

We used a formal model-fitting procedure. We started with an unconditional means model that only includes a fixed and random intercept, to allow for individual differences at starting points. Second, the unconditional means model was compared to additional models that tested the grand mean trajectory of age. These models were created by adding two polynomial terms (linear and quadratic) for age (centered around 22 months [age of the youngest child]) to the unconditional means model. Moreover, we included a random-slope effect of age into the best-fitting age model, but this did not improve model fit. Third, group and the interaction between group and age were included, to examine whether the developmental trajectory of internalizing and externalizing problems differed between boys with and without ASD.

Next, we tested whether levels of emotional functioning were associated with development of internalizing and externalizing problems. To do so, we included baseline level and subsequent change (TP1 – TP1; TP2 – TP1; TP3 – TP1) of negative emotion expressions, emotion recognition, and emotion vocabulary (basic and mental states) to the best fitting age model. Last, we added interaction terms between variables of emotional functioning and group. In the results, we report the results of the best fitting model. Akaike Information Criterion values (AIC) and Bayesian Information Criterion (BIC) were used to compare the unconditional means model with other models to test which model best explained the data. Preferred models should have significantly lower AIC and BIC values. For the LMM

analyses, we corrected for multiple comparisons by considering an alpha of .025 as significant.

Results

Table 1 shows descriptive characteristics of the samples. The two samples did not differ in age at Time 1,  $t(145.78) = 1.698, p = .092$ . Boys with ASD had a lower IQ than TD boys at Time 1,  $t(119) = 3.881, p < .001$ . They scored higher than TD boys in Social Responsiveness Scale at Time 3,  $t(114) = -8.46, p < .001$ . Parents of boys with ASD reported lower socioeconomic status:  $t(141) = 2.36, p = .020$ , which has been found in many studies on children with ASD (e.g., Kogan et al., 2008).

Table 1: Demographic characteristics of participants.

|  | Total study population at Time 1 |    |                |    |
|--|----------------------------------|----|----------------|----|
|  | N = 156                          |    |                |    |
|  | ASD                              | N  | TD             | N  |
| Age <sup>a</sup>                         |                                  | 59 |                | 97 |
| Mean – age in months (SD) at Time 1      | 54.73 (11.69)                    |    | 51.04 (15.25)  |    |
| Range – age in months                    | 22-71                            |    | 22-78          |    |
| Socio-economic Status <sup>b</sup> (SD)* | 4.20 (1.41)                      | 56 | 4.89 (1.85)    | 87 |
| IQ (SD)***                               | 100.50 (16.61)                   | 50 | 111.68 (14.85) | 71 |
| SRS at Time 3 (SD)***                    | 1.62 (0.67)                      | 52 | 0.60 (0.62)    | 64 |

ASD: autism spectrum disorder; TD: typically developing; SD: standard deviation; SRS: Social Responsive Scale.

<sup>a</sup>Age did not differ between groups at Time 2 or Time 3.

<sup>b</sup>The highest level of education of each parent and their net household income were categorized on a scale ranging from zero to five. Socio-economic status was calculated by averaging these three scores.

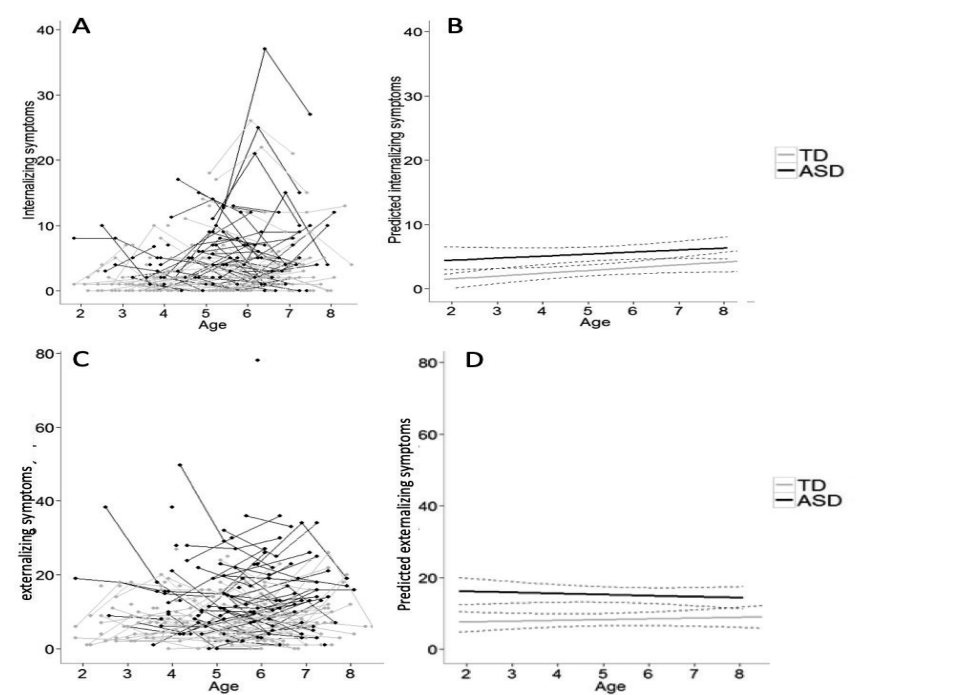
\*  $p < .05$ , \*\*\*  $p < .001$

Table 2 depicts the total scores and standard deviations of predictor and outcome measures at three time points. Boys with ASD showed more internalizing and externalizing problems than their TD peers at all time points. They also showed lower emotional functioning than TD peers at all time points. Yet, the LMM analyses only confirmed a group

difference for externalizing problems ( $t(330.59)=8.97, p<.001$ ), but not for internalizing problems ( $t(331.40)=2.36, p=.11$ ).

Table 2. Total scores, standard deviations (SD) and statistics (group comparisons) of outcome and predictor measures for TD and ASD group at three time points.

|                             |              | TD    |      |    | ASD   |       |    |                 |          |
|-----------------------------|--------------|-------|------|----|-------|-------|----|-----------------|----------|
|                             |              | Total | SD   | N  | Total | SD    | N  | <i>t</i> -value | <i>P</i> |
| <b>Time 1</b>               |              |       |      |    |       |       |    |                 |          |
| Internalizing               |              | 2.57  | 4.08 | 91 | 5.05  | 3.79  | 57 | 3.573           | <.001    |
| Externalizing               |              | 7.95  | 5.84 | 91 | 15.92 | 13.25 | 57 | 4.287           | <.001    |
| Negative Emotion expression |              | 27.23 | 5.43 | 92 | 33.14 | 6.88  | 57 | 5.508           | <.001    |
| Emotion recognition         |              | 23.98 | 3.32 | 92 | 17.39 | 5.49  | 57 | 8.184           | <.001    |
| Emotion vocabulary          | Basic        | 3.73  | 0.85 | 92 | 3.01  | 1.31  | 57 | 3.695           | <.001    |
|                             | Mental state | 3.88  | 1.35 | 92 | 2.81  | 1.66  | 57 | 4.107           | <.001    |
| <b>Time 2</b>               |              |       |      |    |       |       |    |                 |          |
| Internalizing               |              | 3.51  | 4.83 | 63 | 7.61  | 8.16  | 47 | 3.071           | .003     |
| Externalizing               |              | 8.49  | 6.69 | 63 | 13.88 | 8.81  | 47 | 3.653           | <.001    |
| Negative Emotion expression |              | 27.06 | 5.64 | 63 | 32.90 | 6.52  | 48 | 5.052           | <.001    |
| Emotion recognition         |              | 24.34 | 4.48 | 64 | 17.86 | 5.53  | 48 | 6.851           | <.001    |
| Emotion vocabulary          | Basic        | 3.84  | 0.58 | 63 | 3.27  | 1.27  | 48 | 2.876           | .006     |
|                             | Mental state | 4.51  | 1.13 | 63 | 3.42  | 1.75  | 48 | 3.763           | <.001    |
| <b>Time 3</b>               |              |       |      |    |       |       |    |                 |          |
| Internalizing               |              | 3.29  | 4.38 | 49 | 5.98  | 6.85  | 43 | 2.271           | .026     |
| Externalizing               |              | 7.84  | 5.91 | 49 | 13.84 | 9.17  | 43 | 3.673           | <.001    |
| Negative Emotion expression |              | 28.17 | 5.30 | 57 | 33.08 | 7.68  | 43 | 3.594           | .001     |
| Emotion recognition         |              | 24.67 | 3.36 | 57 | 18.18 | 5.66  | 43 | 6.673           | <.001    |
| Emotion vocabulary          | Basic        | 3.96  | 0.19 | 57 | 3.49  | 1.05  | 43 | 2.928           | .005     |
|                             | Mental state | 4.75  | 0.47 | 57 | 3.93  | 1.53  | 43 | 3.403           | .001     |



**Figure 1.** Longitudinal graphic representation of age at three time points and respectively internalizing and externalizing problems. **Figure 1A. 1C.** Participants are represented by individual lines. Participants measured only once are represented by points. **Figure 1B. 1D.** Predicted values for respectively internalizing, externalizing problems based on the optimal fitting model.

Table 3. Estimates (standard errors) of the LMM for the predictors at Time 1, and for the slopes (Change) of the predictors on internalizing and externalizing problems.

|               | Internalizing problems |                | Externalizing problems |             |
|---------------|------------------------|----------------|------------------------|-------------|
| Fixed effects |                        |                |                        |             |
| Intercept     | -7.50 (2.68)           |                | -3.84 (7.66)           |             |
| Age           | 0.04 (0.02)            |                | -0.02 (0.03)           |             |
| Group         | 1.51 (0.92)            |                | 16.06 (10.23)          |             |
|               | Time 1                 | Change         | Time 1                 | Change      |
| NEE           | 0.30 (0.06)***         | 0.24 (0.06)*** | 0.49 (0.15)**          | 0.10 (0.14) |

|    |               |              |                 |              |              |
|----|---------------|--------------|-----------------|--------------|--------------|
| ER |               | 0.04 (0.09)  | -0.29 (0.09)*** | -0.21(0.25)  | -0.01 (0.22) |
| EV | Basic         | -0.30 (0.41) | -0.40 (0.36)    | 0.89 (1.22)  | 1.16 (0.81)  |
|    | Mental states | 0.28 (0.31)  | 0.31 (0.26)     | -0.07 (0.82) | -0.01 (0.59) |

**Interactions**

|                          |   |   |              |                |
|--------------------------|---|---|--------------|----------------|
| Group x NEE              | - | - | -0.14 (0.22) | 0.14 (0.18)    |
| Group x ER               | - | - | -0.52 (0.33) | -0.27 (0.28)   |
| Group x EV basic         | - | - | -1.63 (1.58) | -3.38 (1.15)** |
| Group x EV mental states | - | - | 2.22 (1.11)  | -0.37 (0.75)   |

LMM: linear mixed models; NEE: negative emotion expression; ER: emotion recognition; EV: emotion vocabulary.

\*\* $p < .025$ . \*\* $p < .005$ . \*\*\* $p < .001$

Figure 1A-B depicts the developmental trajectories of internalizing problems. The LMM analyses showed that internalizing problems increased with age (Age:  $t(331.57)=2.08$ ,  $p=.04$ ), but after correcting for multiple comparisons the age effect became non-significant. The groups did not differ in the developmental patterns of internalizing problems (Group x Age:  $t(304.70)=0.35$ ,  $p=.73$ ). Figure 1C-D depicts the developmental trajectories of externalizing problems. LMM analyses showed no age effects (Age:  $t(309.76)=0.44$ ,  $p=.66$ ). There was no difference in the developmental patterns of externalizing problems between groups (Group x Age:  $t(314.69)=0.35$ ,  $p=.73$ ).

The LMM with only predictors (scores at Time 1 and change scores) fitted the data best for internalizing problems (see Supplemental Table 3). As shown in Table 3, an increase in negative emotion expressions and more negative emotion expressions at Time 1 was related to an increase in internalizing problems. Furthermore, an increase in emotion recognition was related to a decrease in internalizing problems. For externalizing problems, the best fitting model was the model with predictors and interaction terms (see Supplemental Table 3). For boys both with and without ASD, more negative emotion expressions at Time 1 were associated with an increase in externalizing problems.

Interestingly, there was an interaction effect of Group and Basic Emotion Vocabulary (change scores): whereas improvement in basic emotion vocabulary was related to a decrease in externalizing behaviors in boys with ASD ( $B = -2.17$ ,  $t = -2.52$ ,  $p = 0.01$ ), a non-significant relation was found in TD boys ( $B = 1.14$ ,  $t = 1.15$ ,  $p = 0.14$ ).

**Discussion**

This longitudinal study was among the first to examine the development of internalizing and externalizing problems and contributing factors in boys aged 2 to 6 years, with and without ASD. Our main findings are: First, boys with ASD exhibited more severe internalizing and externalizing problems, and lower emotional functioning than TD boys at the three different time points. Second, we did not find an age effect on internalizing or externalizing problems for boys with and without ASD. Third, for boys with and without ASD, more negative emotion expressions (i.e., lower emotion control) at Time 1 and increased negative emotion expressions were associated with increased internalizing problems; improved emotion recognition was associated with decreased internalizing problems; and more negative emotion expressions at Time 1 were associated with increased externalizing problems. Fourth, improved emotion vocabulary was uniquely associated with decreased externalizing problems in boys with ASD.

The literature of TD children suggested that internalizing problems such as symptoms of anxiety and depression increased with age. Our multilevel analyses confirmed this age effect. However, after correcting for multiple comparisons the age effect was no longer significant. We suggest that this result should be interpreted with caution, as for exploratory studies correcting for multiple comparisons may be less desirable, and subsequent studies with pre-planned hypotheses are needed before ruling out the age effect (Althouse, 2016). For externalizing problems, we did not find any age effects. Although both stable and decreasing patterns for externalizing symptoms have been reported in the literature, our finding is consistent with those studies that examined symptoms related to Oppositional Defiant Disorder and Conduct Disorder, such as physical aggression, non-compliance, and irritability, all reporting no age effect in early childhood (Campbell et al., 2006; Carbonneau, Boivin, Brendgen, Nagin & Tremblay, 2016; Ezpeleta, Granero, de la Osa, Trepát & Domènech, 2015).

Remarkably, we found that boys with ASD did not differ from TD boys regarding the developmental courses. Yet, the problems seem to be more pronounced in them. This indicates that internalizing and externalizing problems start early in children with ASD (Bryce & Jahromi, 2013; Matson, Fodstad, Mahan, & Sevin, 2009; Georgiades et al., 2011), and are persistent or even increasing over time (Davis III et al., 2011; Mayes, Calhoun, Murray & Zahid, 2011).

Furthermore, we found that as in TD children, lower levels of emotional functioning in boys with ASD contributed to higher levels of internalizing and externalizing problems. First,



poor emotion control, as indicated by elevated levels of negative emotion expressions, was associated with increased internalizing and externalizing problems in boys with and without ASD. For internalizing symptoms, this association involved both the levels of emotion control at the first time children were tested, as well as the change scores, whereas only levels of emotion control at Time 1 were related to more externalizing symptoms. These outcomes stress the importance to address problems in the domain of emotion control at the earliest age, and they seem to indicate that boys this young can already be at risk for internalizing problems which go often unnoted when they grow older. Similar relations have been found in TD children (e.g., Eisenberg et al., 2000) and in adolescents with ASD (e.g., Rieffe et al., 2011; Bos et al., 2018). Our study indicates that the relation also exists in the younger age group with ASD, and even more importantly, persists over time.

Second, improvement in emotion recognition decreases the risk of developing internalizing problems in boys with and without ASD. Social interactions are full of emotional exchanges, and when a child cannot decipher how others feel, the social world may appear unpredictable and confusing. This could lead to fear and frustration in children, especially in children with ASD (Bellini, 2004). We did not find a longitudinal relation between emotion recognition and externalizing behaviours. Note that in our study, parents reported on children's recognition of multiple emotions. Possibly, deficits in recognizing certain emotions such as anger and sadness are particularly relevant to externalizing problems (Fine, Trentacosta, Izard, Mostow, & Campbell, 2004). As mentioned before, TD children who tended to attribute anger to ambiguous situation and who had decreased accuracy in recognizing sadness in others showed more externalizing symptoms (Martin et al., 2010; Schultz et al., 2000). Future research could examine whether this would also apply to children with ASD.

Third, improved emotion vocabulary was uniquely related to a decrease of externalizing problems in boys with ASD. However, we did not find a main effect of emotion vocabulary on developing internalizing or externalizing problems. This was unexpected, because previous studies showed that the ability to label and communicate about emotions was related to better social competence and fewer behaviour problems in TD children (e.g., Fine et al., 2003; Izard et al., 2001) and in children with other communication problems (e.g., Ketelaar et al., 2015). Possibly, our measure did not fully reflect children's capacity when they grew older, as TD boys showed a near-ceiling effect at Time 3. To study the relation, future research could use instruments that measure more complex emotion vocabulary.

Nonetheless, our findings highlight the need to help children with ASD to improve their emotion vocabulary. At this young age, engaging in emotion talk with parents and caregivers is an important pathway for children to acquire knowledge of emotion words (Grazzani, Ornaghi, Agliati, & Brazzelli, 2016; Rieffe & Wiefferink, 2017). Children do not learn emotion words in isolation, but in the context of a wealth of information about emotional situations. The social impairments related to ASD leave children with ASD less opportunity for social learning, which is crucial for developing not only emotion vocabulary, but also other aspects of emotional functioning such as emotion control and emotion recognition (Saarni, 1999).

This study has its strengths, in using a three-wave longitudinal design and measuring a clinical sample at an early stage of the diagnosis of ASD. However, there are also limitations. First, our study examined the broadband internalizing and externalizing symptoms. Considering the high comorbidity rates of symptoms within each category and the very young age of our sample, studying broadband symptoms is a good start point for us to understand their development. Nonetheless, grouping symptoms together may mask the unique development of more discrete differentiated symptoms, and future studies should further look into this. Second, our sample included only high-functioning children and only boys. Thus, caution is warranted when generalizing our findings to other populations with ASD. For example, our findings differ from Vaillancourt et al. (2017), which reported a declining trend for both internalizing and externalizing problems in young children with ASD. Their sample is more heterogeneous which included girls and low-functioning children with ASD. Also, it bears mentioning that we did not have IQ data of 15% and 25% of our sample with ASD and TD, respectively. Third, all variables were measured with parent questionnaires, which increased the risk of common-method variance bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Adding observational tasks in future studies could strengthen the outcomes of our study. Besides, the Emotion Vocabulary Questionnaire had poor internal consistency for the TD children at Time 3. Using an observational task to record children's use of emotion words in daily emotional conversations could be a more valid and reliable measure for checking children's emotion vocabulary. We also had to remove the measure of positive emotions from our analyses due to the low internal reliability in TD children. A good emotion control is indicated not only by appropriate expressions of negative emotions but also by appropriate expressions of positive emotions. Children with ASD are known to display less positive expressions than TD peers (Hirschler-Guttenberg, Golan, Ostfeld-Etzion, & Feldman,

2015). Future studies should examine to what extent positive emotion expressions contribute to the development of behavior problems in children with and without ASD.

Despite the limitations, this study made significant contributions to the existing knowledge. We found that the developmental courses of internalizing and externalizing problems in early childhood did not differ between boys with and without ASD. However, these problems were more pronounced in boys with ASD. This highlights the importance of addressing the underlying problems with emotional functioning at the earliest age possible. At this young age, the parent–child relationship is of crucial importance for the development of emotional functioning. Especially, children with ASD might need extra parental support and scaffolding to improve their emotion control and recognition. As a recent study showed in TD children, parents need to be able to adapt their levels of support depending on the child's needs (Spruijt, Dekker, Ziermans, & Swaab, 2018). Furthermore, emotional functioning requires not only early and sensitive interactions between caregivers and their children but also opportunities for incidental learning, that is, unintentional learning by overhearing and observing others. Future studies should also address how a rich social environment could benefit children with ASD, without becoming overwhelming or bringing social withdrawal.

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