Parent and child reports of child's alexithymia may not be related in typical development

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Abstract

Alexithymia, a subclinical trait involving difficulty describing and identifying emotions, is common in a number of psychiatric conditions, including autism. Alexithymia in children is sometimes measured by parent report and sometimes by child self-report, but it is not yet known how well the two measures are related. We investigated this question in a sample of 6- to 11-year-old neurotypical children and their parents ($N = 30$ dyads). Parent and child reports were not correlated, and most parents underestimated their child's level of alexithymia relative to the child's self-report. This suggests that when asked to report on the child's alexithymia, children and parents may not be reporting on the same thing. These provocative findings, however, must be considered preliminary because a post-hoc analysis showed the analyses were underpowered. Using simulations, I show that to test whether the presence or absence of a correlation best fit these data, 300 dyads would be needed.

Keywords: Alexithymia, Parent-Child Dyads, Parent report, Child report, Self-vs. Other report

Introduction

Emotions shape social interactions in fundamental ways, contributing to our ability to predict and explain the behavior of ourselves and others. Difficulties in accurately interpreting emotions are common in a number of clinical conditions, from depression and anxiety (Honkalampi et al., 2000) to eating disorders (Morie & Ridout, 2018) to autism spectrum disorder (Berthoz & Hill, 2005). One theory is that the emotional difficulties experienced by individuals across these varied conditions stem from the same source—a subclinical trait called alexithymia (literally "without words for emotions;" Sifneos, 1973).

Alexithymia in adults is measured via a self-report questionnaire; individuals respond to questions that assess how they experience emotion (e.g., using a Likert scale: "I am often confused about what emotions I am feeling;" Bagby, et al., 1994). Even among adults without a diagnosed condition, about 10% of the general population experiences high levels of alexithymia (Honkalampi et al., 2000). Adults with high levels of alexithymia describe having difficulty with the identification of and/or discrimination between emotional states (Bagby et al., 1994). For example, people with high levels of alexithymia tend to have poor emotion recognition (Grynberg et al., 2012) and spontaneously imitate emotional displays less often than those with lower levels (Sonnby-Borgstrom, 2009). High levels of alexithymia also negatively correlate with emotional intelligence (Mikolajczak et al., 2007) and with measures of empathy (e.g. Luminet et al., 2011).

Not being able to recognize emotion in others, or to match other's emotional states or facial expressions may lead to less success in social interactions. In clinical

descriptions, alexithymics are described as appearing uncomfortable or disinterested in social interactions (Berthoz et al., 2011). One theoretical proposal suggests that an inability to represent the emotional states of others—due to one's own difficulty in identifying/discriminating between emotions—leads to a breakdown in empathy, and thus failed social interactions (Bird & Viding, 2014).

One condition where alexithymia has been hypothesized to play a prominent role is autism spectrum disorder (ASD), a diagnosis characterized by (among other things) difficulties navigating the social world (APA, 2013). According to the "alexithymia hypothesis" of autism, a number of the social difficulties traditionally associated with autism may actually be better explained by alexithymia (Bird & Cook, 2013). In behavioral studies, for example, when level of alexithymia is controlled for, differences between autistic and non-autistic participants are no longer pronounced on experimental tasks like within-eye fixation (Bird et al., 2011), facial emotion recognition (Cook et al., 2012; Oakley et al., 2016), and emotional arousal (Gaigg et al., 2018)—tasks that are thought to tap into socially oriented processes. Similarly, in imaging studies comparing autistic and non-autistic participants' responses to empathy inducing stimuli, alexithymia rather than diagnostic status better explains differences in whole brain activation (Lassalle et al., 2018) and anterior insula activation (Bird et al., 2010).

Researchers have recently begun investigating how alexithymia manifests in children and how it impacts their social interactions. In some studies, children's level of alexithymia is assessed by asking parents to report on their children's putatively emotionally relevant behaviors (e.g., "How often does your child say 'I don't know' when asked why he/she is upset;" Way et al., 2010). In other studies, children's

alexithymia is measured through self-report, with participants reporting on their own internal experiences (e.g., "I find it difficult to say how I feel inside;" Rieffe et al., 2006). Interestingly, studies that measure alexithymia in children by self-report can produce apparently conflicting results with those that measure it by parent report.

For example, in Trevisan et al. (2016), autistic and non-autistic participants between 7 and 13 years of age were shown clips from animated children's movies, and researchers coded participants' spontaneous facial expressions. Higher levels of alexithymia as reported by parents were associated with less emotional expressivity. In contrast, in Wieckowski and White (2016), 9- to 12-year-old autistic and non-autistic participants watched videos of actors producing particular emotional expressions and were asked to respond with corresponding appropriate facial expressions (e.g., appearing surprised when an actor makes a surprised face). In this study, level of alexithymia by self-report was not related to performance on the facial expression task.

A common concern when measuring child-based constructs by either parent- or child-report is that the two reports may not align. By nature, parents must report on their *perception* of their child's experiences (based on the child's behavior), whereas children report on their own phenomenological experiences. Sometimes, the two reports are congruent. For example, parent and child reports of the child's depression have been found to correlate (Eg et al., 2018). Additionally, the two types of reports sometimes share a similar factor structure; in the case of the parent and child versions of a commonly used measure of the child's depression (the Children's Depression Inventory), there is evidence that they do (Cole et al., 2000). This suggests that for some measures,

parents and children report on similar constructs, and these measures could be used interchangeably or in tandem.

But there are also constructs where the parent- and child-reports of the child's experiences do not match. For example, Kalvin et al. (2019) and Lagattuta et al. (2012) found no correlation between parent and child reports of the child's level of anxiety. Likewise, parents of children diagnosed with attention deficit/hyperactivity disorder tended to over- or underestimate (relative to the child report) their child's self-esteem, mental health, and physical function (Klassen et al., 2006).

Even when parent- and child-reports do match, there is some evidence that they may match more in aggregate, rather than on an individual level. For example, parents and children have been found to agree more on the rate of change for symptoms of depression, rather than the level of depressive symptomatology experienced at any given time (Cole et al., 2002). In that study, latent growth curves were fit to multiple parent and child reports of the Child's Depression Inventory. Correlations between parent and child's slopes (rates of symptom change) were more strongly correlated than were their intercepts (ratings of symptomatology at a given timepoint).

As children's level of alexithymia is sometimes measured by parent report and sometimes by self-report, it is essential to understand how closely the two measures are related. If both are measuring the same (or even related) construct(s), one would expect them to be correlated—that is, the higher the parent's report of the child's alexithymia, the higher the child's self-report of alexithymia. If the two are not related, then this may help to explain some discrepancies in the literature like the one noted above—where Trevisan et al. (2016) found that the child's level of alexithymia by parent report was

related to their emotional expressivity but Wieckowski and White (2016) found that child's level of alexithymia by self-report was not.

To our knowledge, only one study has directly compared parent and self-report of the child's alexithymia, and it found that the two were not related. In Griffin et al. (2016), autistic and non-autistic 8- to 13-year-olds and their parents each completed standardized questionnaires reporting on the child's level of alexithymia. Results showed no correlation between parent report and self-report in either autistic or non-autistic children.

The study here had two goals. First, we sought to replicate Griffin et al.'s (2016) finding of no relation between parent and self-report of child's alexithymia, and to investigate a question that was not explicitly addressed in that study—namely, whether parents consistently over- or under-estimated their child's alexithymia relative to the child's own rating. Second, we conducted an exploratory investigation of whether two parent self-reported characteristics predicted their ratings of their child's alexithymia. If a parent has higher levels of alexithymia themselves (as measured by self-report), they may not be well-attuned to their children's emotions nor be very well-calibrated reporters of their children's experience of emotion (e.g., Bird & Viding, 2014). Additionally, given the overlap between measures of alexithymia and autism symptomatology in adults (e.g., Aaron et al., 2015; Berthoz et al., 2013; Gökçen et al., 2016) and similarities in clinical descriptions between the two (e.g., Berthoz et al., 2011; Grynberg et al., 2018), it is possible that elevated levels of autism symptomatology could also be related to a parent's ability to report on their child's emotional experiences. Thus, parents with elevated levels of alexithymia or autism symptomatology may not be as calibrated with their child's self-report of alexithymia as are parents with low levels of these factors.

Methods

Participants

Thirty parent-child dyads participated in the study: 12 dyads (40%) consisted of mother-son pairs, 17 (57%) were mother-daughter, and 1 (3%) was father-son. The average age of the children was 8 years, 7 months (*range:* 6;0-11;11). The average age of the parents was 40.2 years (*range:* 33-49). Dyads were recruited as part of a larger study on parent-child interactions in autism, the clinical group for which has yet to be collected, and the results of which will be presented elsewhere. Our sample size was determined by power analyses for this larger study and was similar to that reported in Griffin et al. (N = 32). Participants were typically developing, primarily white, from middle-class backgrounds, and were recruited from a database of families who had previously expressed interest in participating in research in child development. This study was carried out in accordance with the recommendations of and approved by the Institutional Review Board for Social and Behavioral Sciences at the University of Virginia. All subjects gave written informed consent in accordance with the Declaration of Helsinki.

Procedure

Parent data. Parents completed the following questionnaires.

The Children's Alexithymia Measure (CAM; Way et al., 2010). The CAM is a 14-item questionnaire in which parents report on their perceptions of their children's alexithymia. Parents use a four-point Likert scale to rate the frequency with which their child engages in certain behaviors such as "Says 'forget it' or 'leave me alone' when asked about his/her feelings." Higher scores are indicative of greater levels of alexithymia, although there is no "cut-off" to indicate clinical relevance. The maximum

score is 42. The CAM has been found to have good internal reliability (r = .92; Way et al., 2010).

20-Item Toronto Alexithymia Scale (TAS-20; Bagby, et al., 1994). The TAS-20 is a 20-item questionnaire that assesses adults' perceptions of their own experience of emotion. Respondents rate on a five-point Likert scale how strongly they agree with statements such as "I am able to describe my feelings easily" and "I don't know what's going on inside me." The maximum score is 100. Individuals who score above 61 are considered "alexithymic," those below 51 "non-alexithymic," and scores between 51 and 61 are considered "borderline-alexithymic." Scores on the TAS-20 were treated as continuous. The TAS-20 has demonstrated good internal reliability overall (r = .86) and across subscales ($.71 \leq r \leq .80$; Parker et al., 2003).

The Autism-Spectrum Quotient (AQ; Baron-Cohen et al., 2001). The AQ is a 50-item questionnaire designed to quantify level of autism symptomatology in adults with or without a formal diagnosis of autism spectrum disorder. Participants report via a four-point Likert scale about how strongly they agree with statements about their own behaviors (e.g., "I prefer to do things with others rather than on my own"). The maximum score is 50. Scores above 32 are considered clinically relevant. The AQ has been found to have good test-retest reliability (r = .7, p = .02), and good internal consistency within sub-domains (Baron-Cohen et al., 2001).

As this was part of a larger study, parents completed additional measures that are not reported here, including a developmental history/demographic information form and a parent report measure of their child's autistic symptomology (Autism Spectrum Quotient-Child Version [Child-AQ]; Auyeung, et al., 2008). Parents were presented

questionnaires in a packet and were explicitly asked to complete them in the following order: History Form, CAM, Child-AQ, TAS-20, and Adult-AQ. This order was used to ensure parent's perceptions of their child's experiences were not influenced by their responding to similar questions about themselves.

Child self-report of alexithymia. We presented children with an adapted version of the Alexithymia Questionnaire for Children (here referred to as the TAS-C; Rieffe et al., 2006). The TAS-C was adapted from the TAS-20 described above (Bagby et al., 1994), and was standardized on a sample of 9- to 15-year-olds in Holland. The TAS-C has been found to have good internal consistency for two scales: difficulty identifying feelings and difficulty describing feelings, but not for externally oriented thinking (Rieffe, et al., 2006). Despite this, in order to replicate previous studies using the TAS-C, we used the measure in its entirety. It has previously been used with participants as young as 6 years (Savarese et al., 2018). Although the TAS-C was designed to be completed by children independently, given that our youngest participants were six years old and may not have been able to read independently, a researcher read the items aloud. Additionally, we were concerned that some of the TAS-C items were syntactically complex and/or used terminology that could be unfamiliar to our American participants (e.g., the use of "television programmes" and "films" as opposed to "T.V. shows" and "movies"). Thus, we changed the wording of 17 of the 20 items. The revised instrument is shown in Appendix A.

Children were seated at a table next to a researcher, who began the session with four questions designed to familiarize children with the instrument's Likert scale. The researcher showed children a scale with three 2.7 x 2.4-inch rectangles with different

amounts of shading (Figure 1), and explained that "not like me" corresponded to the rectangle that was not shaded, "sometimes like me" to the rectangle with 50% gray shading, and "a lot like me" to the black rectangle. Children received four training items designed to elicit answers across the scale (e.g., if a child's favorite and least favorite foods were pizza and broccoli, training items included "I really like to eat pizza" and "I really like to eat broccoli," eliciting "a lot like me" and "not like me" responses). The researcher then read aloud the items shown in Appendix A, and children pointed to their responses using the scale.

Children's responses were coded twice, once by the researcher during the session, and independently by a coder from videotape. The coders agreed on 100% of responses.

We also piloted a measure on which children reported on their parent's level of alexithymia. Several participants either failed to complete this portion of the session or answered in patterned ways for the parent report portion, and so we do not report data from this pilot measure here.

Results

Data were analyzed with R (version 3.5.1) using the RStudio interface (version 1.1.456).

Descriptive statistics

To investigate whether there were any outliers in our data, we first examined the distributions for the CAM, TAS-20, AQ, and TAS-C. There was only one outlier: One parent's report of their child's level of alexithymia yielded a score more than 3 standard deviations above the sample's mean. While our interpretation of our results remained the same whether this dyad was included or excluded, we chose to exclude them in order to

prevent this score from having undue influence on our analyses. Thus, our final sample size was 29 dyads.

Table 1 shows the descriptive statistics for parent and child age, and participants' scores on our measures. As expected given that this was a typically developing sample, participants did not reach clinical thresholds for alexithymia or autism: On the parent self-report of alexithymia (TAS-20), all but one parent scored in the "non-alexithymic" range (< 51); on the parent self-report of autism symptomatology (AQ), all parents scored below the "clinically relevant" cutoff of 32. Finally, there are no cutoff scores available for parent report of child's alexithymia (CAM) or child's self-report of alexithymia (TAS-C); however, parents and children tended to report scores that were less than half of the maximum possible.

Comparing the children's self-report of alexithymia to previous work

We first conducted an analysis to confirm that results from our child self-report measure of alexithymia were comparable to results from earlier studies that used the measure on which ours is based. Recall that Rieffe et al. (2006) created the TAS-C by adapting the adult self-report measure (TAS-20), rewording items and collapsing the Likert scale child participants used from five choices to three. As noted earlier, we made slight changes to the wording of several of the items used by Rieffe et al. and administered the instrument orally rather than by paper and pencil.

To confirm that these changes did not meaningfully alter the instrument, we tested whether the two versions yielded similar distributions of scores. We used as our comparison case a study by Griffin et al. (2016), who used the original TAS-C with a sample of British 8- to 12-year-old children, and who confirmed that it had been

administered without modification (C. Griffin, personal communication, January 31, 2019). We applied a bootstrapping procedure to the child data reported in Griffin et al., creating 10,000 random distributions using the mean, standard deviation, and size of the neurotypical sample reported in their study (M = 16.50, SD = 5.38, N = 32). Each bootstrapped distribution was compared to the distribution obtained on our adapted measure (M = 16.17, SD = 5.75, N = 29) using a Kolmogorov-Smirnov test. The bootstrapped distribution differed significantly from the obtained distribution on just 53 of the 10,000 simulations, or 0.53% of the time. In other words, our adapted child self-report alexithymia measure yielded a distribution very similar to the one obtained in Griffin et al., suggesting that our modifications in wording and delivery did not meaningfully alter the nature of the assessment.

Comparing Parent and Child Report of Child Alexithymia

Our primary goal was to determine how well parent report of their child's alexithymia (CAM) matched the child's self-report (TAS-C). Figure 2 shows a scatterplot of the relationship. As the figure shows and consistent with the findings reported by Griffin et al. (2016), there was no significant correlation between the two measures, $r(28) = -0.14$, 95% CI [-.48, .23], $p = .46$. These two instruments, ostensibly measuring the same construct, were not related. Furthermore, we also conducted an equivalence test to determine whether our detected effect was significantly different from what may be considered a meaningful effect (Lakens et al., 2018). In other words, should these two measures be measuring the same construct, one might expect them to be correlated with one another, even weakly (e.g. $r = \pm.20$). Using the TOSTER package (Lakens, 2018) in R our results suggested that our observed correlation of $r = -.14$, when compared to a

theoretically expected small correlation coefficient ($r = \pm.20$), was neither significantly different from zero, nor statistically equivalent to zero, $p = .456$. Thus, we are unable to draw conclusions regarding whether or not our detected correlation is meaningful.

Crucially, however, these analyses are underpowered. With our sample size of 29 dyads, we would be capable of detecting a correlation of .50 or greater, with a power of .80. We observed a correlation, however, of only .14. According to a post-hoc power analysis, our probability of rejecting the null hypothesis—that our detected correlation of .14 is no different from zero—is quite low ($\beta = .11$). To adequately power such an analysis—that is, to detect a correlation of .14 with .80 power—would actually require a sample of approximately 400 dyads.

Unfortunately, however, the correlational approach we used does not capture the underlying structure of the items that make up the instruments we were comparing. That is, the parent-report CAM included 14 items, which were simply summed to create a total score; the child-report TAS-C included 20 items, which were separately summed to create a total score. The correlation operated on the total scores for each of the 29 dyads, treating each item equally—even though some items may be more important to the construct it contributes to than others.

An alternative approach is structural equation modelling (SEM), a method which allows one to assign a latent (i.e. unobserved) and theoretically based structure to the data. In other words, one is able to take observed data and represent it with an unobserved structure that may better explain it. Rather than operating across summed scores, SEM can weight items differently based on how much they contribute to whatever unobserved variable is associated with them. For example, suppose one item on a questionnaire tends

to differentiate between members of different groups (i.e. members of one group have high scores, and members of another have low) That item would load onto an unobserved variable more strongly than an item for which everyone, regardless of group, responds similarly.

As an exploratory analysis, we analyzed the data we collected using SEM. We constructed an unobserved (latent) variable representing the parent's perception of their child's alexithymia, based on the observed items from the CAM. We also constructed an unobserved (latent) variable representing the child's perception of their own alexithymia, based on the observed items from the TAS-C.

Additionally, SEM allows for hypothesis testing via model comparison: One is able to compare two models with different underlying structures to determine which model better explains the observed data. Often, these models differ by exactly one parameter. For example, one might compare a model where two latent factors are related to a model where they are not. This is the approach we took.

We compared a model[1] (called the full model, Figure 4) where the latent factor representing parent's perception of their child's alexithymia covaried with a latent factor representing children's perception of their own alexithymia. This was compared to a

[1] The primary difference between these two models is that the null model has one fewer freely estimated parameter. Each constrained parameter corresponds to a loss of one degree of freedom, which itself corresponds with a predictable loss in model fit. If the difference in fit between the two models is significantly greater than that which would be expected by this predicted loss in fit, then the full model is said to fit significantly better than the null.
The base structure for both of our full and null models were exactly the same. All items of the CAM loaded only onto the parent factor, and all items on the TAS-C loaded only onto the child factor. Each factor's variance was constrained to equal one. The full and null model differed on exactly one parameter: in the full model, the two latent factors shared a covariance term. In the null model, this parameter was constrained to equal zero.

second model (the null model, Figure 5) where these two latent factors were constrained to be unrelated. If the full model better explains the data, one could say that parent perceptions and children's perceptions of the child's alexithymia, as measured by the CAM and TAS-C, are related. However, if there is no difference between the full and null models, parent perceptions and children's perceptions of the child's alexithymia, as measured by the CAM and TAS-C, are unrelated. We found that the difference in fit between the full and null models was in the range of what would be expected by chance ($\Delta\chi^2 = .441$, $p > .05$). This suggests that, as with the correlational approach, the construct parents report on via the CAM is unrelated to the construct children report on via the TAS-C.

Importantly, however, this SEM analysis was also underpowered: The covariance between the CAM and TAS-C was estimated to equal -.134, but the standard error was estimated to be .211. Thus, the 95% confidence intervals of the covariance parameter were -.547 and .280, crossing 0, this means that we failed to find a significant effect, again likely due to a lack of power. To remedy this, one would need to collect data from additional dyads.

To calculate how many additional dyads would be needed, we conducted a series of data simulations via the SEM framework. Using a data generating function in the OpenMx SEM package (Neale et al., 2016) in R, we generated 100 data observations that came from a distribution not different from our original sample of 29 dyads. A model identical to our full model described above was then fit to this generated data, estimating the covariance parameter and its standard error. This process was repeated 500 times.

Each iteration generated a new dataset, fit a model, and estimated the covariance parameter, its standard error, and 95% confidence intervals.

At the conclusion of the simulation, we calculated the percentage of confidence intervals obtained from the simulation that crossed zero. This statistic represents our power to detect a covariance of such size as that estimated from a sample of 100 dyads. For example, if in 250 of the 500 simulations, the confidence intervals crossed zero, one would say that with 100 participants, one would have a power of .50 (250/500). This process—creating loops of data generation, fitting and analyzing a model, constructing and storing confidence intervals, and calculating the power for that sample size—was repeated such that generated data would contain an additional 50 observations, until a power greater than .95 was reached. Based on this power simulation, it appears that 300 dyads[2] would be sufficient to be confident that the true value of the parameter we're estimating is different from zero, based on data simulated from our current sample.

We also investigated whether parents tended to under- or over-report their child's alexithymia (relative to the child's report). As Figure 2 shows, most parents reported low levels of alexithymia in their children: More than half of CAM scores were less than or equal to 5 (the range of possible scores was 0 to 42). Children's TAS-C self-report scores covered a larger range, from 4 to 25 (the range of possible scores was 0 to 40). To analyze the discrepancy between CAM and TAS-C scores, we converted them to a common scale. For example, a child who scored 20 of 40 possible on the TAS-C received a score of 0.50; a parent who reported their child's level of alexithymia was 10 of 42

[2] Note that when we conducted this simulation with the 30th dyad, excluded for being an outlier, this power simulation indicated that 150 dyads would be necessary.

possible on the CAM received a score of 0.24. The adjusted TAS-C score was subtracted from the adjusted CAM score to obtain a discrepancy score for that dyad. A negative discrepancy score indicates that the parent under-estimated their child's level of alexithymia relative to the child self-report, and a positive discrepancy score indicates that the parent over-estimated.

Figure 3 shows the distribution of discrepancy scores. As expected given the analysis above, parents tended to under-estimate their children's alexithymia: The average discrepancy score was -0.26 (*SD* = .20), which, even when controlling for child age and gender, represents a significant difference from 0, $t(26) = -2.27$, 95% CI [-.75, -.05], $p < .05$, $d = .421$. Indeed, discrepancy scores were negative for 27 of 29 (93%) dyads.

Relation between parent report of child alexithymia and parent factors

Our second goal was to investigate whether the parent factors we measured (TAS-20 and AQ) were related to parents' estimation of their child's level of alexithymia (CAM). All three variables were positively correlated, though after Bonferroni correction ($p = .05/3 = .017$), none of them were significant: the CAM and TAS-20, $r(28) = .37$, 95% CI [.0023, .65], $p = .05$; the CAM and AQ, $r(28) = .31$, 95% CI [-.065, .61], $p = .10$; and the TAS-20 and AQ, $r(28) = .41$, 95% CI [.046, .67], $p = .03$.

We conducted a linear regression predicting CAM score by the TAS-20, AQ, and the interaction between TAS-20 and AQ, covarying child age and child gender. The three variables of interest were scaled using z-transformations. The resulting model was not significantly different from the null model, $F(5,23) = 1.65$, $p = .19$, adjusted $R^2 = .10$, and neither the TAS-20, AQ, nor the interaction were significant predictors (see Table 2 for

coefficients and 95% CIs). Thus, parents' self-reported levels of alexithymia and autism symptomatology did not predict their ratings of their typically developing children's alexithymia.

Discussion

Our study had two goals. The first was to investigate whether there was a relationship between a widely used parent measure of their child's level of alexithymia (CAM) and the child's self-report of their own level of alexithymia (TAS-C). If the two measures are tapping into the same construct, one would expect them to be correlated. We did not find them to be correlated, replicating the findings of Griffin et al.(2016), and analyses revealed that most parents under-estimated their child's level of alexithymia relative to the child's own report. Such findings may help to explain why some studies find a relation between pediatric levels of alexithymia and performance on emotionally relevant tasks (Trevisan et al., 2016) while others do not (Wieckowski & White, 2016): It may depend, at least in part, on who the reporter is.

Crucially, however, this finding must be considered in light of two important limitations. First, the data reported here were collected as part of a larger study investigating parent-child relations in autism; the goal was not to investigate questions about parent vs. child report of child's alexithymia. Our sample size was similar to that used in the study by Griffin et al. (2016), which also reported no correlation between parent and child reports of the child's alexithymia. However, as was described above, our analyses (and those of Griffin et al.) were underpowered.

A second limitation was that the correlational approach we used may not have captured the underlying structure of the items that make up the instruments we were

comparing. To remedy this, we employed an SEM analysis, though this too was underpowered. Thus, we conducted a power simulation to determine how many dyads would be needed for a sufficiently powered SEM model.

There are a few important caveats to this simulation. First, each simulated data set was generated to fit the model derived from our original sample of 29 participants. Had data from more initial participants been collected, the model and generated data may have estimated different parameters for the covariance and/or its standard error. Also, ours was a neurotypical, low-alexithymia sample. It is possible that a nonlinear relationship exists between parent and child reports of alexithymia (i.e. evident in those who score in the clinical ranges on these instruments, but not among those who do not). If that were the case, the number of dyads necessary to reliably detect (or fail to detect) a correlation between parent and child reports may be different for a sample including respondents who fall at more extreme ends of these distributions.

If a sample of 300 dyads were collected, a possible result would be that the full model fits significantly better than the null, and thus one would say that parent and child perceptions of the child's alexithymia, as measured by the CAM and TAS-C respectively, are related. Alternatively, it is possible that the full and null models would still be not significantly different from one another. This would thus suggest that the parent and child perceptions of the child's alexithymia, as measured by the CAM and TAS-C, are unrelated.

If the SEM analyses with a sample of 300 dyads were to show that the parent and child perceptions of the child's alexithymia were not related, there could be at least three explanations. The first may have to do with the instruments themselves: items on the

parent reported CAM focus primarily on the child's behaviors (e.g., "Physically removes self from situations when asked to talk about feelings" and "Uses few words to describe most of his/her feelings"); only a few questions pertain to parent perceptions of the child's internal experiences (e.g., "Has difficulty saying he/she feels sad/happy even though he/she looks sad/happy"). In contrast, most items on the child-reported TAS-C ask explicitly about the child's introspective experience of emotion (e.g., "If I am upset, I don't know if I am sad, scared, or angry;" "If I'm angry, I often don't know why;" and "It's hard for me to say how I really feel inside, even to my best friend"). The behaviors that parents report on when completing the CAM are presumably intended to serve as indications of the kinds of internal experiences the child him/herself reports on the TAS-C. However, the CAM items may not, in fact, be very good proxies for children's responses to TAS-C items.

A second explanation could be that children did not understand the scale or items on the TAS-C, in which case their responses would be uninterpretable (and would not be expected to relate meaningfully to responses from their parents). We think this is unlikely as we provided pre-training on how to use the scale, and because Rieffe et al. (2006) found that the original version of the TAS-C had the same factor structure as the TAS-20 and correlated with scores of somatic complaints (a measure of the instrument's predictive validity). Likewise, we found that our sample's total TAS-C scores did not significantly differ from that collected by Griffin et al. (2016), who used the original, unmodified TAS-C. This suggests that our sample, despite having received a modified instrument and delivery method, did not answer in a way discrepant from previous samples.

A final explanation is that parents were not accurately reporting on their children's behaviors. We attempted to explore this possibility by investigating whether parents' self-reported levels of alexithymia and autism symptomatology were related to their reports of their children's alexithymia—the second goal of the present work. We were interested in whether parents' level of alexithymia was related to their ability to report on their child's level of alexithymia because one of the difficulties associated with higher levels of alexithymia is in recognizing and interpreting how others feel (Bird & Viding, 2014; Grynberg et al., 2018; Moriguchi et al., 2006). Thus, parents higher in alexithymia might have more difficulty reporting on their child's level of alexithymia. Because previous work has found a relation between alexithymia and autism symptomatology in adults (e.g., Aaron, et al., 2015; Berthoz et al., 2013; Gökçen et al., 2016; but also see Hobson et al., in press), we also considered the possibility that parents higher in autism symptomatology would have more difficulty reporting on their child's level of alexithymia. We found no relation between parent levels of alexithymia and autism symptomatology, and neither predicted parent report of child alexithymia.

Note, however, that these analyses of parent individual differences contributing to their reporting of their child's alexithymia was also underpowered: A post hoc analysis showed a power of just .58, suggesting we may have failed to detect an effect had one truly existed. Further analyses indicate that in order to detect an effect size equal to that observed here with a power of .95, one would need a sample of at least 61 dyads. Clearly, if future work addressing the relation between parent and child reports of the child's alexithymia included the 300+ dyads that the earlier power analyses suggested would be

needed, an investigation of how parent alexithymia and autism symptomatology relate to their reports of the child's alexithymia would be sufficiently powered.

In addition to parent alexithymia and autism symptomatology, there are a number of other parent-based factors that might also influence their reports of the child's alexithymia. Future work may wish to account for, for example, parental symptoms of depression. As noted in the introduction, high levels of alexithymia are observed in a number of other diagnoses, including depression (Honkalampi et al., 2000). Higher levels of maternal depression have been associated with lower scores on parental sensitivity (NICHD, 1999), which could impact their sensitivity towards their child's emotions. An important question would therefore be to determine whether any discrepancies in parent versus child reports are predicted by parental alexithymia and/or depression.

If parent and child reports of the child's alexithymia are unrelated (or are only weakly related), there are a number of practical implications. First, it would suggest that the two ways of measuring alexithymia ought to be used in research and clinical settings in theoretically driven ways, rather than simply for ease or convenience of administration. Second, it implies that failing to match the assessment to the information needed could have negative therapeutic implications. For example, if one were interested in addressing the child's apparent distress and frustration over difficulties expressing emotion, using the parent's perception of their child's emotional experiences, via the CAM, would be called for. But, if one were interested in helping the child understand their emotional experiences and needed to gauge therapeutic progress, measuring the child's construct of their alexithymia via the TAS-C would be appropriate. Crossing these, however, could lead to clinicians having an inaccurate understanding of a client's progress. Thus,

practitioners will want to carefully select which assessment to use, ensuring the intervention is associated with the proper source of information.

Limitations

There were a number of limitations to this study. First, as has been noted, ours was a small, homogenous sample. Future studies should recruit a larger, more diverse sample, especially with parents and children with higher levels of alexithymia. Here, we have provided a power simulation, as well as framework for analyzing such a question with a larger sample and have provided plausible explanations for findings in either direction.

Second, researchers interested in investigating the relationship between parent and child reports of child alexithymia should consider using instruments where the same questions are asked of both reporters (see also Griffin et al., 2016). This could help determine whether any discrepancies between reports arise because parents are being asked to report on a separate construct from what children are being asked to report on, or if parents' perceptions of their children's internal states truly do not align with their children's actual experiences.

Finally, our study collected only questionnaire data as a means of determining whether parents' perceptions of their children's experiences are different from children's self-reports of those experiences. Future work on this topic should include observational measures that characterize the parent-child dyad, such as using free-play paradigms that can be coded for parental sensitivity. When using parent/child reporting discrepancies as the sole metric of interest, it becomes impossible to determine whether any apparent discrepancies are the result of instrumentation or more generalized parental insensitivity.

Including an additional measure such as a behavioral paradigm could help tease apart this distinction, allowing one to have more confidence in whether the instrument or parental sensitivity led to observed discrepancies.

Conclusions

This study investigated how well calibrated parent and child reports of the child's level of alexithymia were. In our sample of neurotypical children and parents, we found that the two measures were not correlated, that parents significantly underestimated their children's alexithymia, and that parent's estimations of the child's alexithymia were not predicted by any parent-based factor we measured. However, our study was limited by a small sample size. We described an analytic framework for investigating the relation between the two measures using a larger sample size. While we are unable to make conclusive claims on the basis of our underpowered results, future work may show that whether researchers and clinicians ought to use parent or child report to measure children's level of alexithymia will depend on their goal: Some questions may be better addressed by assessing the child's perception of their difficulties interpreting emotion, and other questions may be better addressed by assessing the parent's perception of the child's difficulties. Regardless, our findings suggest that the two measures are not interchangeable.

Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Table 1. Descriptive Statistics

Statistic	Mean	St. Dev.	Min	Max
Parent Age	40.17	4.97	33	49
Child Age	8.55	2.01	6	11
TAS- 20	36.38	7.66	24	52
CAM	5.86	4.98	0	18
TAS-C	16.17	5.75	4	25
AQ	14.72	5.50	6	24
Parent-Child Discrepancy	-0.26	0.2	-0.6	0.23

Note. 20 Item-Toronto Alexithymia Scale (TAS-20; Bagby, Parker, Taylor, 1994) Children's Alexithymia Measure (CAM; Way et al., 2010); Toronto Alexithymia Scale-Child version (TAS-C; Rieffe, Oosterveld, Terwogt, 2006); Autism Spectrum Quotient (AQ; Baron-Cohen, Wheelwright, Skinner, Martin, Clubley, 2001). Parent-child discrepancy represents the child's adjusted self-report of alexithymia (actual/total score) subtracted from the parent's adjusted report of the child.

Table 2. Regression Results

	Dependent variable:
	CAM
Child Gender (Male)	0.392 (-0.378, 1.161)
Child Age	-0.089 (-0.296, 0.118)
TAS-20	0.281 (-0.131, 0.693)
AQ	0.177 (-0.274, 0.628)
TAS-20 * AQ	0.200 (-0.409, 0.810)
Constant	0.525 (-1.365, 2.414)
Observations	29
R^2	0.264
Adjusted R^2	0.103
Residual Std. Error	0.947 (df = 23)
F Statistic	1.646 (df = 5; 23)

Note: Values depicted opposite model predictors are presented in the format: ß (95% confidence intervals of ß).

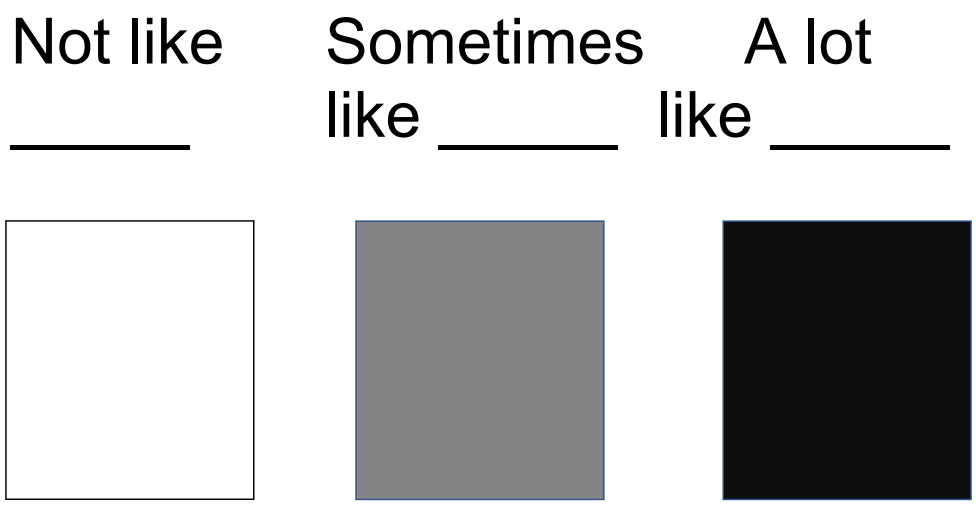

Figure 1. TAS-C answering sheet. This figure was printed in a landscape orientation on an 8.5x11 sheet of paper, and laminated. Child participants were shown the sheet and instructed to point to the box underneath whichever response was "the right answer for [them]." When the children reported on themselves, the blank line next to each response was filled in with the word "me."

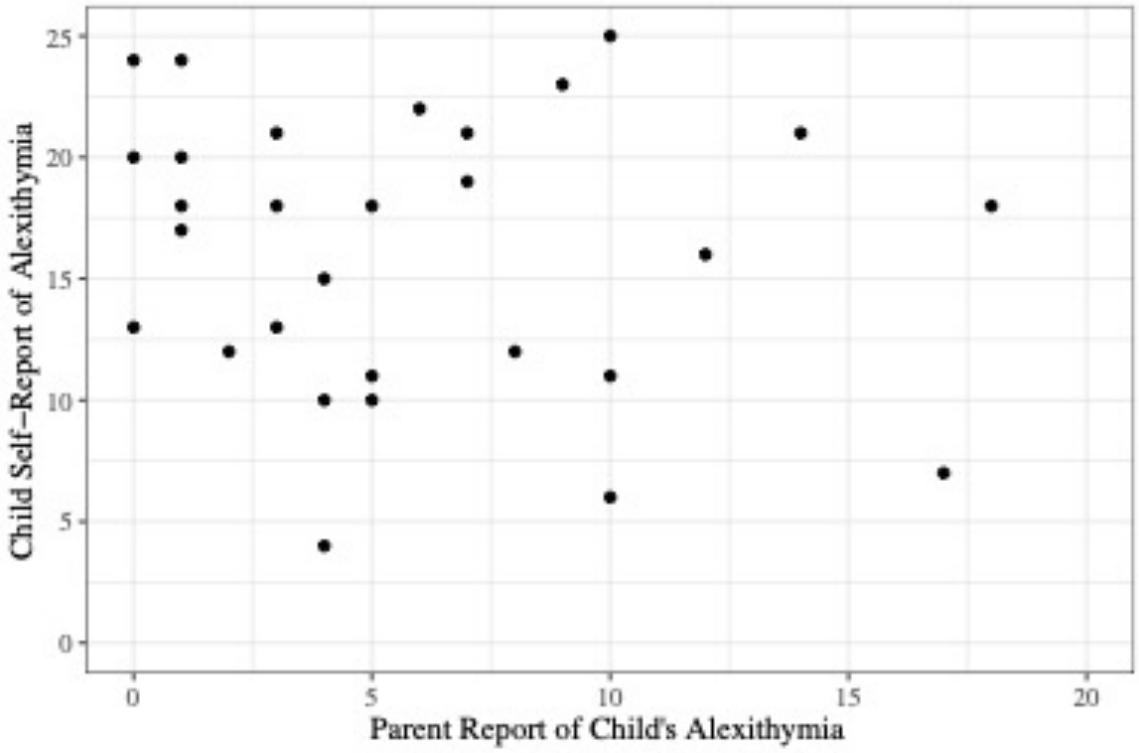

Figure 2. Scatterplot depicting parent report of child alexithymia on the CAM plotted against child self-report scores of alexithymia on the TAS-C.

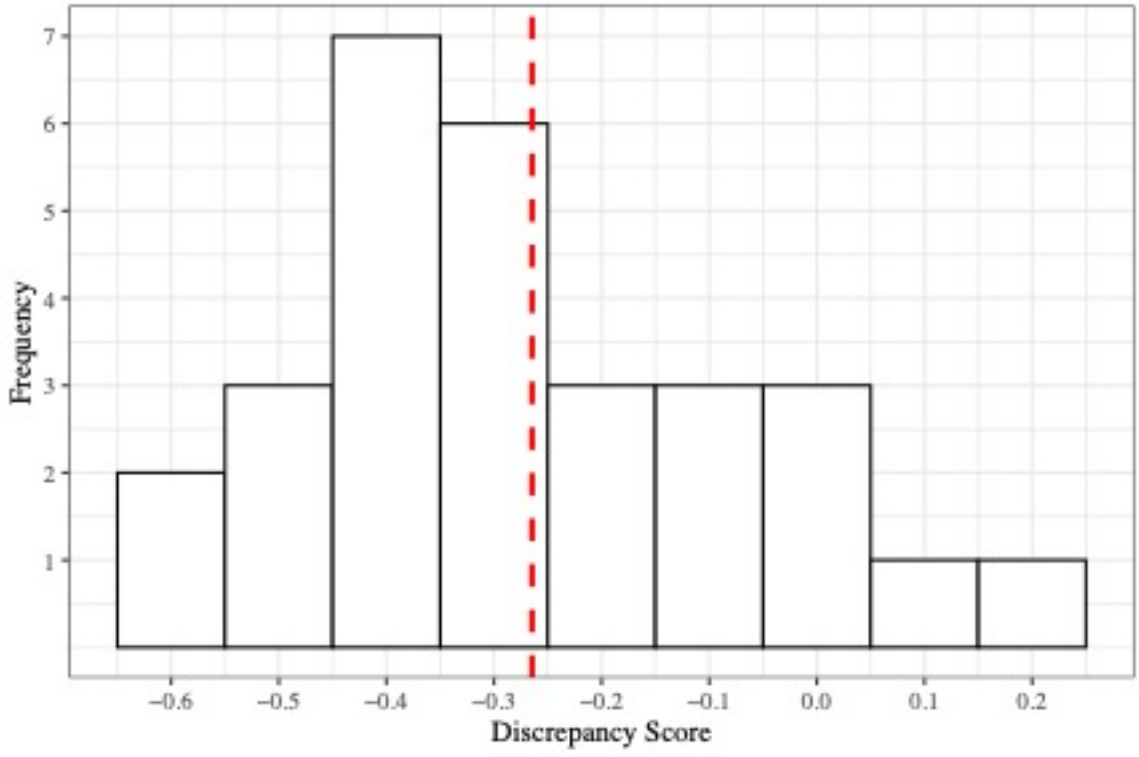

Figure 3. Histogram depicting the distribution of parent-child discrepancy score. Red dashed line indicates mean of the distribution.

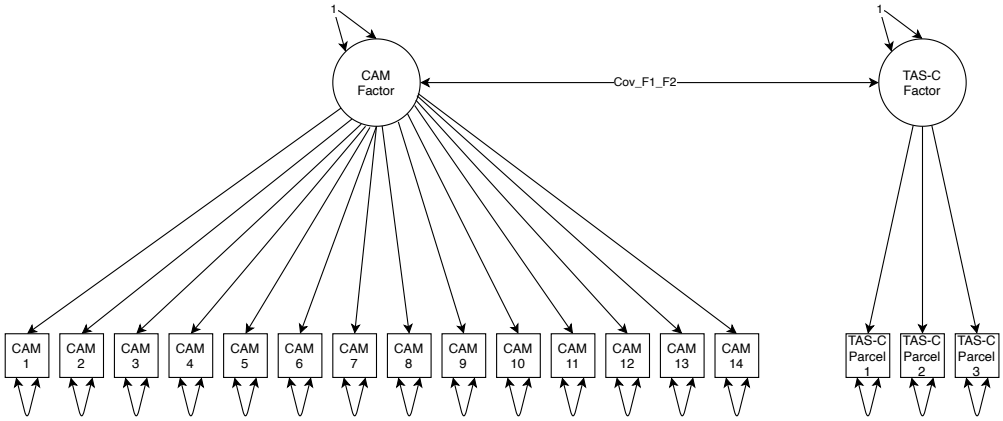

Figure 4. The full model used in the SEM simulation and power analysis. Note that individual items on the TAS-C could only be answered via a three-point Likert scale, and thus responses were ordinal. For ease of interpretation and due to the limited number of degrees of freedom in this model, we created three parcel variables representing the 20 items on the TAS-C (Matsunaga, 2008). Parcels were comprised of items that load onto the three subscales of the original Toronto Alexithymia Scale (TAS). In this model, latent factor variances were set to one so that all factor loadings were allowed to be freely estimated.

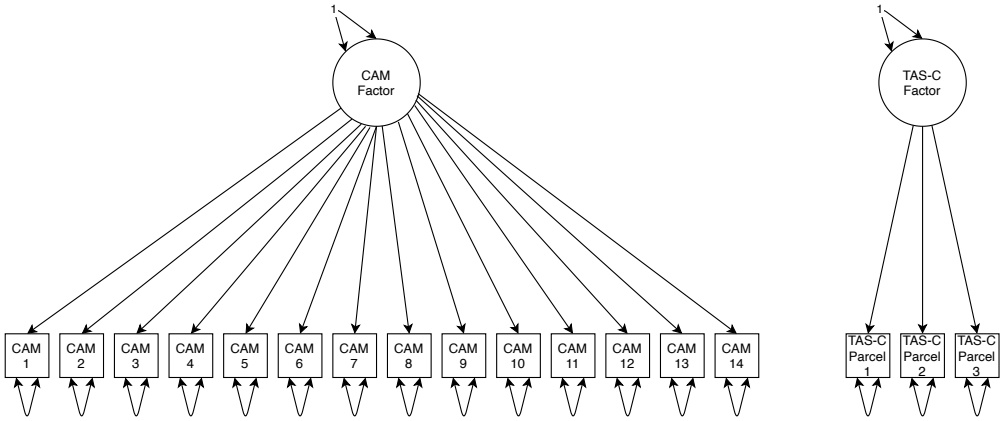

Figure 5. The null model. This model is exactly the same as the full model except for the absence of precisely one parameter: the covariance between the two latent factors.

Appendix A.

Items of modified version of TAS-C used in current study:

1. I am confused about the way I feel inside a lot of the time.
2. It is hard for me to say how I feel inside.
3. I feel things in my body that other people don't understand.
4. It is easy for me to say how I feel inside.
5. If I have a problem, I want to know where it comes from and not just talk about it.
6. If I am upset, I don't know if I am sad, scared, or angry.
7. I am often unsure about things that I feel in my body.
8. I like seeing things happen instead of thinking about why they happen.
9. Sometimes I can't find the words to say how I feel inside
10. It is important to understand how you feel inside.
11. It is hard for me to say how I feel about other people.
12. Some people tell me I should talk more about how I feel inside.
13. I don't know what's going on inside me.
14. If I'm angry I often don't know why.
15. I like to talk to people about things they do instead of how they feel.
16. I like watching funny t.v. shows, more than t.v. shows about people's problems.
17. It is hard for me to say how I really feel inside, even to my best friend.
18. I don't have to talk or do something with another person to feel close to them.

19. When I want to do something about my problems, thinking about how I feel helps.

20. I don't like movies where I have to concentrate to understand the story.