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Abstract

The goal of the study was to examine the affective-cognitive components of Theory of Mind (ToM), in a community sample of 538 preschoolers, and more specifically in a subsample of 40 children diagnosed with Oppositional Defiant Disorder (ODD). The relationship between affective and cognitive ToM and some ODD clinical characteristics was examined. Children were assessed with structured diagnostic interviews and dimensional measures of psychopathology, impairment and unemotional traits. A measure based on eye-gaze was used to assess ToM. Mixed analysis of variance compared the mean cognitive versus affective scale scores and the between-subjects factor ODD. The association between ToM-scores and clinical measures was assessed through correlation models**.** Execution and reaction time to emotional and cognitive components of ToM tasks are different at age 5 in normally developing children. Oppositional Defiant children had slower response time when performing the affective mentalizing condition than children without the disorder. The correlation matrix between ToM-scores and clinical measures showed specific associations depending on the impaired ToM aspect and the psychological domain. Results may have clinical implications for the prevention and management of ODD.

Key-words

Oppositional Defiant Disorder, Preschoolers, Social cognition, Theory of Mind.

1. Introduction

Human social behavior is the unique and complex result of a set of cognitive processes involved in the way we perceive, interpret and generate social acts (Adolphs, 2001). Among those processes, Theory of Mind (ToM) has been defined as the capacity to attribute emotions, intentions and knowledge to oneself and others (Frith, 1999; Premack and Woodruff, 1978). Recently, ToM has been considered a multidimensional and emerging property, resulting from the combined action of a number of independent features (Sterc and Begeer, 2010; Tomasello et al., 2005) that partially depend on separate anatomical substrates (Abu-Akel and Shamay-Tsoory, 2011; Kalbe et al., 2010). Affective ToM refers to the inferences made regarding other people's emotions while cognitive ToM refers to our ability to make inferences about people's thoughts. Both form what is known as Cognitive Empathy (Shamay-Tsoory, 2011).

The importance of understanding other people's mental states, by associating our own experiences and emotions with theirs, is that it enables us to predict what they want and what they are about to do, and to modify our behavior accordingly (Blakemore, 2010). Atypical perception of emotions or thoughts has been found to increase vulnerability to psychopathology. More specifically, differential deficits in ToM have been related to a diverse range of disorders, such as autism (Baron-Cohen and Wheelwright, 2004), schizophrenia (Shamay-Tsoory and Aharon-Peretz, 2007) or psychopathy (Shamay-Tsoory et al., 2010).

Developmental psychology research on theory of mind has demonstrated that the ability to understand other people's mental states develops over the first four or five years of life. It is around that age when children begin to understand that other people can hold different beliefs to their own and that these may be false. At the age of 5, most children are able to successfully pass what is considered to be the hallmark of ToM: the false-belief task

(Siegal and Varley, 2002; Wimmer and Perner, 1983*)*. In the false-belief task, children are asked to understand and predict another person's wrong belief after knowing the explicit representation of the wrongness of this person's belief in relation to one's own knowledge through cartoons. It has been proposed that this explicit mentalizing, is preceded in the child's development sequence by an automatic mentalizing tendency to take account of another person's affective mental states (Happé and Fritz, 2014). Children who are good at identifying and understanding other people's positive and negative emotions should interact successfully with them, be socially responsive and develop harmonious relationships in daily life. Moreover, when children are able to infer knowledge, intentions and beliefs and to understand false beliefs, this may help them to adopt other people's cognitive perspective and adjust their own behavior (Deneault and Ricard, 2013; Nader-Grosbois, et al., 2013; Wellman, et al., 2011). Children's abilities to understand emotions play an important role in their concurrent and later academic and social success, (Denham et al., 2012; Hughes, et al., 2000) and social and emotional aspects of preschoolers have recently been considered by researchers as crucial for concurrent and later well-being and mental health.

In that context, general deficits in social cognition are also associated with developmental disorders (Korkmaz, 2011), such as conduct problems (Gilmour et al., 2004; Mandy et al., 2013; Oliver et al., 2011; Yoon, et al. 2000). These findings may account for why children with conduct problems have difficulty properly understanding the possible consequences of their behavior for other people, which may explain why they have less self-regulation and inhibition during social situations. Furthermore, the findings may explain children with conduct problems' lack of understanding and response to other people's non-verbal cues (Hughes et al., 2000). Problems with discriminating and/or responding to others or to one's own emotions of distress, fear or sadness have been considered nuclear in conduct disorders, especially in children showing callous unemotional (CU) traits (Happé and Frith,

4 2014). Major deficits in emotional processing are associated with impaired social functioning and more severe symptomatology and a lack of socioemotional competence, which has been proposed as a risk factor for developing Conduct Disorders (CD) when Oppositional Defiant Disorder (ODD) is present (Mandy et al., 2013). Some studies have suggested that ToM could be part of the explanation of externalizing behavior in children and have pointed out deficits in their understanding of mental states, notably of beliefs (Fahie and Symons, 2003; Happé and Frith, 1996; Renouf et al., 2010a; Renouf et al., 2010b) and of causes and consequences of emotions (Hughes et al., 1998). Jones, Happé, Gilbert, Burnett, and Viding (2010), in a study with children aged between 9 and 16, concluded that psychopathic tendencies are associated with difficulties in resonating with other people's distress in contrast to children affected by Asperger Disorder, who are characterized by a difficulty knowing what other people think.

Different studies have also focused on schoolchildren with clinical ADHD (Bühler et al., 2011; Donno et al., 2010; Ha et al., 2011) or behavioral problems in community samples (Poletti and Adenzano, 2013). Former preliminary studies suggest that certain ToM impairments are present in developmental psychiatric disorders, specifically in conduct disorder, indicating that neurodevelopment alterations are somewhat related to the development of ToM ability. In view of the stated relationship between ToM and social adjustment, it would be important to study the possible links between ToM affective and cognitive components and clinical profile in specific behavioral problems such as ODD, which is one of the most prevalent conduct disorders in preschool years (Ezpeleta et al., 2014).

Several studies performed with different age/sex samples (Burke et al., 2010; Stringaris and Goodman, 2009) consistently report the existence of two major dimensions in this disorder: Negative affect/Irritable and Headstrong or Oppositionist. Specific associations

with DSM-IV disorders were found for each dimension. Irritable dimension was associated with anxiety disorders, whereas Headstrong was associated with disruptive disorders, including aggressive and non-aggressive CD symptoms. Also, Negative affect was associated with anxiety disorders and non-aggressive CD symptoms, oppositional behavior with disruptive disorders and aggressive CD symptoms, and antagonistic behavior with disruptive disorders and, in boys, mood disorders. These ODD dimensions correlated with specific scales of psychopathology, temperament and executive functioning (Ezpeleta et al. 2012).

To our knowledge, only one study (Dinolfo and Malti, 2013) has examined global ToM in a community sample of 67 preschoolers using puppets and found a negative association between ODD symptoms and interpretative understanding. Crucially, it is not known whether children with ODD present impaired affective and/or cognitive ToM. As far as we know, no study to date has described the typical pattern of development of cognitive and affective ToM in children presenting ODD in early years. Therefore, our first goal was to study the affective-cognitive aspects in ToM, in a large community sample of preschool children. More specifically, we wanted to study ToM profiles in preschool children diagnosed with ODD. Specific relationships between affective and cognitive ToM and clinical characteristics associated with ODD and their dimensions, symptoms severity and functioning were also examined.

We hypothesized different functioning for the affective and cognitive components of ToM as assessed with an eye-gaze task in normally developing children, with more difficulties for the recognition of cognitive tasks, general poorer execution of ToM tasks in the ODD subsample, and poorer functioning related to poorer ToM execution. We also expected different associations between affective and cognitive responses and different clinical measures for symptoms severity, different empathy traits and dimensions of ODD. We hypothesized higher severity symptoms in children with difficulties in affective tasks and a

preschoolers 6 worse outcome in affective tasks for those presenting symptoms related to irritable-ODD dimension.

2. Method

2.1 Participants

The data correspond to a longitudinal study of behavioral problems in preschool children (Ezpeleta et al., 2014). The design included a two-phase sampling procedure, with an initial random sample of 2,283 children selected from the census of preschoolers (3 years old) in Barcelona in the 2009-10 academic year. The proportion of participants in the first (screening) phase was 58.7% (*N*=1,341 families), and no differences emerged for sex (*p*=.95) when comparing participants and refusals. However, the proportion of refusals was statistically higher for families in low socioeconomic groups (*p*<.001). The screening for including children in the second phase was carried out with the parental version of the Strengths and Difficulties Questionnaire for 3 and 4 years old (SDQ^{3-4} ; Goodman, 1997). A random sample including 30% of children with negative scores in the screening and all the children with a positive screening score was invited to continue with the longitudinal research. The final second phase sample included 89.4% of the families asked to continue (*N*=622 children), and no statistical differences were found when participants and refusals were compared by sex (*p*=.82) or type of school (*p*=.85).

The sample corresponds to the third follow-up (5-year-old children), ***N***=574 (290 boys, 50.5%). No statistical differences for sex (*p*=.24) or socioeconomic status (*p*=.12) were found between the sample remaining in the study and those children dropped during follow-up. The Yoni was available for *N*=561 children at this follow-up, but 23 participants were excluded due to potential difficulties understanding the task, as reflected by a high percentage of correct scores (lower than 50%) for the physical items (cut-off for considering responses

preschoolers 7 reliable; Shamay-Tsoory and Aharon-Peretz, 2007). Therefore, the final sample for the analysis included *N*=538 children. Table 1 includes the descriptive, sociodemographic and clinical characteristics of the participants. Children with an intellectual disability or pervasive developmental disorders were excluded.

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2.2 Measures

Yoni (Shamay-Tsoory and Aharon-Peretz, 2007) is an implicit (Nosek et al., 2011) computer-based ToM task (programmed using E-prime), designed to differentially assess cognitive versus affective ToM through the ability to judge mental state on the basis of simple verbal and eye gaze cues and facial expressions, that requires minimal verbal or executive demands. Each of the 98 items presents a face named Yoni in the middle with four colored pictures in the corners. The pictures show either faces or examples of a semantic category (animals, fruit…). An incomplete sentence about which image Yoni is referring to is also presented, and the subject has to work out which of the four stimuli best fills the gap in the sentence. The items belong to one of three types of category (items): (i) physical (14); cognitive (36); affective (48), with first and second order items in each category, with 8 first order items for the physical categories (Phy1) and 12 first order items in the cognitive (Cog1) and affective (Aff1) categories, and 6, 24 and 36 of second order for physical (Phy2), cognitive (Cog2) and affective (Aff2) categories, respectively. Answers in the physical category require basic analysis of physical attributes (ex. Who is closer to…?). Choices in the other two categories require mental inferences based on verbal cues in the sentences, eye gaze or facial expressions. In half of the conditions, Yoni's eyes point at one of the four stimuli (the correct answer) and, in the other half, they are pointing straight ahead. Children were instructed to show the correct answer by clicking the computer mouse as fast as they could;

preschoolers 8 thus, higher scores indicate better ToM. Physical conditions were used to check the understanding of the task. Children with less than 50% success in those items were excluded from the analysis. In the first order stimuli, Yoni's mental state with regard to one of the other four pictures must be inferred: ex. Yoni is thinking of…. (Cognitive); Yoni loves… (Affective). The second order items imply more complex interaction between Yoni and one of the other four images' mental states, which in these items are always faces. Thus, Cog 2 requires an understanding of other people's beliefs and desires (Yoni is thinking of the toy that X wants), and AFF2 involves understanding one's own emotions with regard to someone else's (Yoni loves the toy that X loves). For all items, accuracy and response time (RT) were registered. Online Table S1 contains the distribution of the Yoni scores stratified by children's sex. The Yoni paradigm was selected as a measure of ToM following previous studies, which demonstrate that this task assesses affective and cognitive aspects of ToM and that individuals with lesions in regions that mediate ToM and cognitive empathy (Shamay-Tsoory and Aharon-Peretz, 2007), as well as subjects who have deficits in empathy (Shamay-Tsoory et al., 2010), show impaired performance in the task. The simple eye-gaze task makes it easy to apply to preschoolers. Table S1 (supplementary material) contains the correlations of TOM with another well-established indirect measure of social cognition, the *Social and Communication Disorders Checklist (SCDC; Skuse et al., 1997)* in the own sample of the study. The correlation-matrix shows that convergent-discriminant validity was good. SCDC was completed by teachers at children's age 5.

The *Child Behavior Checklist* (CBCL $1^{1/2}$-5; Achenbach and Rescorla, 2000) was used to measure, behavioral and emotional problems dimensionally at age 5. The CBCL $1^{1/2}$-5 includes a set of 99 items with 3 response options (0: not true, 1: somewhat or sometimes

9 true, 2: very true or often true), plus one open-ended item for adding problems that are not listed on the form. Raw scores were analyzed for the ODD - DSM-oriented scale, as well as for the original syndrome scales. Internal consistency measured with Cronbach's alpha in the sample was .78 for oppositional defiant disorder scale.

The *Diagnostic Interview of Children and Adolescents for Parents of Preschool Children and Young Children (DICA-PPYC)*. This instrument (Ezpeleta et al., 2011) was used to assess, on a yearly basis, children's psychopathology according to DSM-IV-TR taxonomy (American Psychiatric Association, 1994). The adaptation and validation for the Spanish preschool population showed sound psychometric properties. Parents answered the interview.

Inventory of Callous-Unemotional traits (ICU, Frick, 2004). This includes 24 items coded on a 4-point Likert-type scale (0: *not at all true* to 3: *definitely true*) and covers three dimensions: callousness (11 items), which attempts to measure the degree to which the child is unaware of other people's feelings and does not care about behaving in a socially acceptable way, uncaring (8 items), indicating the degree to which the child worries about accomplishing duties and the acceptance of mistakes and their consequences, and unemotional (5 items), dealing with the child's difficulties sharing emotions or openly expressing feelings. The Spanish version to be answered by teachers on a yearly basis was used (Ezpeleta et al. 2013). Cronbach's alpha values were between good (.75 for callousness) to excellent (.89 for uncaring). Data belong to assessment of 5-year-olds.

The *Children's Global Assessment Scale* (CGAS; Shaffer et al., 1983) is a global measure of functional impairment, rated by the interviewer based on information from the diagnostic interview. Scores range from 1 (maximum impairment) to 100 (normal functioning). The cut-off point to consider impairment is CGAS<70. Data also correspond to age 5.

The *Behavior Rating Inventory of Executive Function for Preschool Children* (BRIEF-P; Gioia et al., 2000) measures executive functions, with 63 items and 3 response options (0: *never* to 2: *very often/always*), and was completed by teachers when children were 3 years old. Executive functions have been considered to be a collaborator system for ToM processing and necessary to sustain performance (Siegal and Varley, 2002). Also, the underlying problems for children with ADHD as regards social or disruptive behavior appear to be not so much a sociocognitive deficit as a failure to regulate their own behavior (Hughes et al., 2000). We therefore controlled the children's execution in this area. For this study, we used the ISCI global index (sum of the items included in inhibitory and emotional control scales), the FI index (sum of shift and emotional control scales) and the EMI index (sum of working memory and plan-organize scales). The Spanish version of the instrument was used in this study (Ezpeleta et al., 2015). Cronbach's alphas were excellent in the sample, .94 for ISCI, .91 for FI and .96 for EMI.

Kaufman Brief Intelligence Test (*K-BIT;* Kaufman, 1994). This instrument is meant to be a quick measure of intelligence, which has been proved to be independent of ToM deficits (Shamay-Tsoory et al., 2007). Both the Matrix Abstract Reasoning and Vocabulary subtests of the Spanish version were used. Children were assessed at the age of 4.

2.3 Procedure

The project was approved by the ethics review committee of the authors' institution. Families were recruited at the schools and gave written consent. All families of children from P3 (first level of preschool, 3-year-olds) in the participating schools were invited to answer the SDQ^{3-4}. Families who agreed and met the screening criteria were contacted by telephone and interviewed at the school for each assessment. Interviewers were trained and were blind to the screening group. After the interview, parents and teachers filled in the questionnaires.

preschoolers 11 Children performed the YONI task in a separate room with a different researcher, blind to the parent's interview results.

2.4 Statistical Analysis

The analysis was carried out with SPSS20 for Windows. Due to the multistage sampling design, which includes a selection based on the results of a screening test, the analyses were carried out using the Complex-Samples package, assigning to each child a weight equal to the inverse of the probability of selection in the second phase of the study. All of the analyses were adjusted by the covariates presence of other comorbidities different to ODD disorders, laterality, K-BIT-verbal and BRIEF scores. Children's sex was not included as a covariate, due to the lack of association between this variable and the mean YONI scores (there was no significant relationship and effect-sizes for differences, through Cohen's- *d* coefficient, were poor).

Mixed Analysis of Variance (ANOVA) programmed into the General Linear Model module (GLM) of Complex-Samples compared the mean Yoni scores for the intra-subjects factor YONI-scale (cognitive versus affective) and the between-subjects factor ODD (present vs absent). GLM constitutes a generalization of multiple linear regression and incorporates a number of different statistical models, such as T-TEST, F-TEST, ANOVA, ANCOVA, MANOVA, MANCOVA, linear regression. It allows the hypothesis to be tested in two ways: multivariate or as several independent univariate tests. In this work, the univariate procedure was used in the form of ANOVA analyses. Effect sizes were estimated through Cohen's- *d* coefficient (small effect was considered for |*d*| 0.30, moderate for |*d*| 0.50 and good for |*d*| 0.80).

Partial correlations adjusted by other comorbidities different to ODD, KBIT-vocabulary BRIEF-GEC score and laterality assessed the association between YONI-scores

and the other clinical measures (moderate effect size was considered for |*r*| 0.15, good for |*r*| 0.30 and large for |*r*| 0.50).

3. Results

Table 2 presents the results of the mixed ANOVA that compares the three Yoni mean scores (dependent variables, physical, cognitive and affective scales), adjusted by the K-BIT verbal measure, laterality, BRIEF-GEG score and other comorbidities different to ODD. The first columns of this table include the adjusted Yoni means, followed by the comparison of these means and the post comparisons. These analyses have been carried out on the complete sample of children. The means for physical tasks were statistically significantly higher than the means for cognitive and affective tasks (p<.001 for all comparisons), and effect size was moderate to good (|d|>0.50), except for the physical *versus* cognitive comparison for the first order scales and physical *versus* emotional for the first order scales and the time spent in the second-order scale. The mean scores for affective tasks were statistically higher than the mean scores for cognitive tasks (except for the percentage of correct items in the first order scale), although the effect size of the mean differences was low for all comparisons (|d|<0.50). Differences between sexes were not found (Table S1 on line).

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Table 3 presents the results of the mixed ANOVA comparing the mean scores for the Yoni cognitive and affective tasks (dependent variables). This modeling included as within-subject the task type (cognitive-affective) and as between-subjects the diagnostic subtype (ODD present-absent). The lack of significant Group×Task interaction indicates that the contrast comparing cognitive-affective scores is not statistically different for diagnostic subtypes ODD present/absent. The main effects for the task were therefore estimated and

interpreted. Results show a general tendency of the ODD subjects to have lower accuracy and slower RT. The effect sizes were statistically significant but small in practice ($|d|<0.50$).

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Table 4 includes partial correlations (adjusted by other comorbidities different to ODD, KBIT-vocabulary BRIEF-GEC score and laterality) between Yoni-scores and ODD related measures, functional impairment and ICU-scores for ODD sample (n=40). Significant correlations with moderate to good effect size ($|r|>.30$) are interpreted. No significant correlations were present for the Non-ODD sample.

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The relationship between functional impairment (assessed through CGAS total score) and Yoni-values indicated positive correlation-coefficients between performance in ToM tasks and the total daily functioning: high accuracy in ToM tasks was associated with better functioning. RT was not related to the impairment level measured through the CGAS.

Positive correlations were found between the number of ODD-symptoms and the ODD-irritability dimension and the RT in ToM task, indicating that higher severity in both ODD-measures was related to a slower RT. ODD-headstrong dimension showed a different relationship pattern: the performance in ToM tasks related positively with headstrong-level (the higher the execution in ToM, the higher the headstrong-level), while RT showed negative associations (slower RTs are related to lower headstrong-levels).

For the CBCL-DSM-ODD scale, performance in ToM tasks negatively correlated with the ODD-measure, indicating that better ToM scores are related to lower ODD-levels. Positive

preschoolers 14 correlations between RT 1-order scales and CBCL-DSM-ODD measures indicate that children with higher RT ToM are also the most ODD-affected.

Patterns in the relationship between ICU and Yoni-scores showed that: a) higher levels of callousness are related to lower execution in the 2-order ToM tasks; b) higher unemotional levels corresponded to lower RT in 1-order scales and to lower performance in 2-order affective scale; c) higher levels of uncaring are related to lower performance and lower RT for total and cognitive scales; and d) higher levels in the ICU-total scale are correlated with lower execution in the 2-order ToM scales.

4. Discussion

Execution and reaction time to emotional and cognitive components of ToM tasks are different at age 5 in normally developing children, and as expected the affective component was more developed than the cognitive. Compared with their peers, children presenting ODD did not show clear differences in execution or RT when performing mentalizing conditions. Even so, distinct impaired ToM aspects correlated with different clinical indicators of ODD. Our results support the view that ToM components are at least partially independent.

At this age normally developing children execute items related to affective aspects of ToM better. This is true for execution and for reaction time (RT). Emotion recognition could be more intuitive than that of cognition and probably more adaptive in the first years of life. Actually, Deneault and Ricard (2013) showed that children's social adjustment is better predicted by their knowledge of emotion than by their understanding of beliefs. This view of ToM as an emerging property was also supported in a study with adolescents by Sebastian et al. (2012). In this line of research, no other studies with preschoolers can be compared, but the idea of considering ToM as resulting from the combined action of a number of features provides a framework for the future study of its constituent elements (Sterck and Begeer,

preschoolers 15 2010). The lack of differences between sex as regards ToM execution and RT is also aligned with the results of other authors studying theory of mind at preschool age (Wellman et al., 2011).

The above-mentioned differential functioning between ToM components increases when conduct problems are present. It can still be said that the difference of means achieved poor to moderate effect size with children, and statistical differences between ODD subsample and non-ODD sample did not emerge when diagnosis was categorically considered. Results show moderately significant differences regarding time of execution, with ODD children presenting a slower reaction and hence greater difficulty when it comes to making decisions involving ToM stimuli. This general difficulty processing social stimuli replicates results of previous studies with ODD or behaviorally problematic children (Dinolfo and Malti, 2013; Donno et al., 2010; Ha et al., 2011).

The importance of proper ToM in daily functioning is highlighted by data. A poor ability to read and manage social clues is associated with poorer global functioning. Severity of ODD measured by the amount of symptoms in a dimensional manner was related to a slower response to social information cues and, in the particular case of dimensional measures, to poorer performance. These difficulties could make children affected by ODD less responsive and flexible when faced with situations that require interaction or prediction of other people's reactions.

Specifically, the ODD-irritable pattern of symptoms seems to lead to slower reactions to social stimuli. The characteristics of this dimension - becoming angry with other people, being easily annoyed and losing one's temper - could be related to the difficulty to understand other people's emotions and thoughts easily and intuitively. The insecure, doubtful and slow responses of these children could also be related to the anxiety that is usually associated with this ODD pattern (Ezpeleta et al. 2012; Stringaris and Goodman, 2009). The ODD-

headstrong group of symptoms, defying rules, annoying and blaming others or arguing with adults, was associated in our study with better responses to affective ToM tasks and reaction time. The idea that children with ODD-headstrong symptoms could execute affective ToM tasks better may initially seem counterintuitive, but recent studies have reported that increased neural responses to affective stimuli may accompany conduct problems without callous-unemotional traits (Sebastian et al, 2012). The authors support the idea that greater amygdala reactivity to emotional stimuli and reduced activity in emotional regulation could be the neural bases that explain why some children with conduct problems, those with low levels of Callous Unemotional traits (CU), may react aggressively, even when minimally provoked.

The differences found between children in relation to their CU traits and their results in ToM tasks are also in line with former studies that found different etiologies, functioning and prognostic in relation to CU presence (Adolphs, 2001). Different patterns of amygdala activity in children with conduct problems might reflect different emotional vulnerabilities. It has been proposed that situations involving affective ToM entail more self-reflection in comparison with a greater detachment involved in cognitive ToM. Thus, the brain areas that are more connected to amygdala, which are also involved in CU, appear to be more relevant (Shamay-Tsoory, 2011). We also found heterogeneous links between specific aspects of ToM and specific characteristics of ODD in line with Deneault and Ricard (2013) or Nader-Grosbois et al. (2013).

Our results are in line with the idea that developmental disorders show certain distinct deficits in different components (Happé and Frith, 2014). The use of dimensional measures and instruments, which not only allow diagnostic decisions but also disaggregate results in order to better address specific interventions with the possibility of measuring different components, enables detection of those differential characteristics and thus improves specific interventions addressing multiple and specific risk factors. Behavioral problems in

preschoolers can be the precursors of long-term antisocial behavior, and it is therefore important to detect them and intervene at an early stage. In order to determine guidelines for efficient prevention and intervention in childhood, we need a better understanding of how the distinct dimensions of ToM could lead to differentiate specific profiles of children with externalizing behavior disorders (Denham et al., 2012).

More effort is needed to study whether specific mentalizing errors are associated with specific psychiatric problems. Social interaction plays a critical role in early brain development, and it is therefore important to be able to assess its components at early ages and design specific programs, since reversibility is possible during this sensitive period of learning (Blakemore, 2010). Many social abilities clearly emerge early but continue to show changes and developments throughout childhood (Moor et al., 2012), and the idea of critical periods in social development is not overwhelmingly supported (Happé and Frith, 2014). Social emotional competence and empathy would be useful components for interventions aimed at reducing behavioral problems.

To the best of our knowledge, this is the first study about the differential association between affective and cognitive aspects of ToM in preschoolers and specifically in ODD. Our study has several strengths, including a large sample, the use of well-validated clinically relevant measures and the inclusion of implicit measures with the child as an informant. We do, however, acknowledge the small sample of children with ODD and the fact that high SES was slightly overrepresented. The study generates certain clinical implications for assessment and intervention regarding children with ODD. The results, similar to other studies (Hughes et al., 2000), stress the relevance of a continuum approach to study disruptive disorders, considering their heterogeneity. The study also highlights the importance of including an assessment of the role of emotions and mentalizing in the assessment process of ODD, which has usually been considered and studied under the label of conduct problems.

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Table 1

Descriptives for total sample (n=538)

		Count; %
Sociodemographics		
Sex	*Male*	268; 49.8%
Mono-parental family	*Yes*	32; 5.9%
[1]Socioeconomic status	*High*	172; 32.0%
	Mean-high	181; 33.6%
	Mean	72; 13.4%
	Mean-low	86; 16.0%
	Low	27; 5.0%
Ethnic	*Caucasian*	488; 90.7%
	Black	1; 0.2%
	Hispanic	29; 5.4%
	Oriental	4; 0.7%
	Other	16; 3.0%
Birthplace	*Catalonia*	519; 96.5%
[2]*DSM disorders-impairment*		
Disruptive disorders		59; 9.09%
Attention-deficit-hyperact.		26; 3.82%
Oppositional defiant dis.		40; 6.28%
Conduct disorder		3; 0.34%
Depression (includes minor)		2; 0.23%
Anxiety		62; 10.5%
Number of disorders		
None		330; 64.4%
One		133; 22.5%
Two		52; 9.4%
Three		14; 2.6%
Four or more		9; 1.0
[3]Impairment (CGAS<70)		69; 11.3%

Note. [1](Hollingshead, 1975). [2]Assessed through the DICA-PPY interview (weighted prevalences). [3]Assessed through the Children's Global Assessment Scale (CGAS).

Table 2

Comparisons of mean YONI scores for physical, affective and cognitive tasks (total sample, n=538)

	Adjusted means			*Task*		Physical – Cognitive				Physical – Affective				Cognitive – Affective			
	Phys.	Cogn.	Affect.	F_2	*p*	*MD*	*SE*	*p*	|*d*|	*MD*	*SE*	*p*	|*d*|	*MD*	*SE*	*p*	|*d*|
% Correct: total	89.4	65.5	68.3	6.49	.002	23.95	0.687	**<.001**	**1.64**††	21.15	0.617	**<.001**	**1.52**††	-2.80	0.377	**<.001**	0.18
Time: total	5272.8	6451.3	6207.7	6.09	.002	-1178.5	47.35	**<.001**	**0.82**††	-934.9	42.83	**<.001**	**0.67**†	243.6	36.91	**<.001**	0.16
% Correct: 1 order	93.4	87.4	88.1	0.15	.862	5.98	0.977	**<.001**	0.33	5.26	0.970	**<.001**	0.29	-0.73	0.389	.063	0.03
Time: 1 order	4732.0	5419.5	5157.9	0.71	.490	-687.5	80.83	**<.001**	0.34	-426.0	53.76	**<.001**	0.25	261.5	76.86	**.001**	0.12
%Correct: 2 order	84.2	54.5	61.7	4.69	.009	29.65	0.862	**<.001**	**1.55**††	22.51	0.798	**<.001**	**1.21**††	-7.14	0.500	**<.001**	0.45
Time: 2 order	5994.0	6967.2	6557.6	3.30	.037	-973.3	63.25	**<.001**	**0.59**†	-563.7	64.19	**<.001**	0.35	409.6	38.29	**<.001**	0.26

Note. Results obtained in mixed ANOVA adjusted by KBIT-verbal score, laterality, BRIEF-GEG score and other comorbidities different to oppositional-defiant-disorder.

Phys: physical. Cogn: cognitive. Affect: affective.

ODD: oppositional defiant disorder. MD: mean difference (pairwise difference, contrast). |*d*|: Cohen's-d coefficient measuring effect size for adjusted MD. Interpretation for effect-size: poor |*d*|<0.30, small |*d*| 0.30, moderate |*d*| 0.50 and large |*d*| 0.80.

Bold: significant result (.05 level). †Moderate (|*d*| 0.50) to ††large effect size (|*d*| 0.80).

Table 3

Comparison of mean scores for Affective and Cognitive items and diagnostic group (with and without ODD)

	Adjusted means				Mixed ANOVA					
	ODD=No; *n*=498		ODD=Yes; *n*=40		Group×Task		Mean difference cognitive-affective			
YONI task →	Cognitive	Affective	Cognitive	Affective	*F*	*p*	MD	SE	*p*	|*d*|
% Correct: total	65.73	68.50	61.92	65.14	0.086	.770	-2.99	0.762	**<.001**	0.20
Time: total	6470.7	6233.3	6183.4	5854.1	0.376	.540	283.4	74.612	**<.001**	0.19
% Correct: 1 order	87.86	88.41	80.75	83.95	2.857	.091	-1.88	0.784	**.017**	0.09
Time: 1 order	5440.2	5172.1	5133.6	4962.0	0.095	.758	219.9	0.158	.158	0.10
%Correct: 2 order	54.67	61.87	52.51	58.87	0.171	.679	-6.78	1.010	**<.001**	0.43
Time: 2 order	6986.0	6587.0	6708.3	6151.4	1.031	.310	477.9	77.379	**<.001**	0.30

Note. Results obtained in mixed ANOVA adjusted by K-BITverbal score, laterality, BRIEF-GEG score and other comorbidities different to oppositional-defiant-disorder.

ODD: oppositional defiant disorder. Group×task: first-order interaction parameter.

|*d*|: Cohen's-d coefficient measuring effect size for adjusted mean difference. Bold: significant result (.05 level).

Interpretation of effect-size: poor |*d*|<0.30, small |*d*| 0.30, moderate |*d*| 0.50 and large |*d*| 0.80.

Table 4

Partial correlations between YONI and other clinical measures related to ODD (sample of children with ODD, n=40)

	#ODD Total symptoms	ODD Irritable dimension	ODD Headstrong dimension	CBCL DSM-ODD	Impairment. CGAS total	ICU Callous-ness	ICU Unemo-tional	ICU Unca-ring	ICU Total score
%correct-total	.09	-.02	**.18***	**-.38***	**.38***	-.14	-.13	-.11	-.15
Time-total	**.40***	**.50***	**-.20***	.07	-.04	.08	-.06	**-.15***	-.05
%correct-cognitive	.03	.05	.01	**-.43***	**.32***	-.13	-.07	**-.21***	-.17
Time-cognitive	**.42***	**.51***	**-.17***	.11	.00	.04	-.13	**-.21***	-.13
%correct-affective	.10	-.01	**.19***	**-.31***	**.31***	-.12	-.11	-.07	-.12
Time-affective	**.38***	**.48***	**-.20***	.01	-.06	.08	-.02	-.14	-.03
%correct-cogn;1order	-.15	-.01	-.06	**-.52***	**.36***	**.17***	.02	.04	.11
Time-cogn;1order	**.15***	**.17**	-.10	**.32***	.02	.03	**-.16***	-.06	-.09
%correct-affect;1order	-.07	-.02	.07	**-.31***	**.27***	.04	.07	-.01	.05
Time-affect;1order	**.30***	**.30***	-.12	**.26***	-.11	-.01	**-.16***	-.11	-.13
%correct-cogn;2order	.15	.09	.07	**-.28***	**.23***	**-.33***	-.13	**-.35***	**-.34***
Time-cogn;2order	**.46***	**.57***	**-.18***	-.01	-.01	.03	-.09	**-.24***	-.12
%correct-affect;2order	**.18***	.00	**.22***	**-.24***	**.26***	**-.19***	**-.20***	-.09	**-.20***
Time-affect;2order	**.36***	**.48***	**-.20***	-.09	-.03	.11	.03	-.13	.01

Note. ODD: oppositional defiant disorder.

CBCL-DSM-ODD: Child Behavior Cheklist, DSM-oriented scale for oppositional defiant disorder.

CGAS: Children's Global Assessment Scale

ICU: Inventory of Callous-Unemotional Traits.

*Bold: significant correlation (.05 level). Bold: good to large effect-size (|*r*| .30).

Interpretation for effect-size: moderate (|*r*| 0.15), good (|*r*| 0.30) and large (|*r*| 0.50).

Table S1 (supplementary)

Pearson's correlation between YONI and SCDC-total score

	Total sample (*n*=538)	ODD sample (*n*=40)
% correct-total	**-.180***	**-.329***
mean react.-total	.011	.105
% correct-cognitive	**-.175***	**-.435***
mean react.-cognitive	-.001	.084
% correct-affect	**-.156***	-.264
mean react.-affect	.013	.120

Note. ODD: oppositional defiant disorder.

*Bold: significant correlation (.05 level). Bold: good to large effect-size (|*r*| .30).

Interpretation for effect-size: moderate (|*r*| 0.15), good (|*r*| 0.30) and large (|*r*| 0.50).