Psychiatry Research 258 (2017) 351–357

Contents lists available at ScienceDirect

Psychiatry Research

journal homepage: www.elsevier.com/locate/psychres

Recognition of peer emotions in children with ADHD: Evidence from an animated facial expressions task

Aiste Jusyte[a,1,*], Marco Daniel Gulewitsch[b,1], Michael Schönenberg[b]

[a] LEAD Graduate School & Research Network, University of Tübingen, Germany
[b] Department of Clinical Psychology and Psychotherapy, University of Tübingen, Germany

ARTICLE INFO

Keywords:
Social cognition
Emotion recognition
Children
ADHD

ABSTRACT

A growing body of literature suggests that ADHD is associated with emotion recognition impairments that may be linked to deficient interpersonal functioning. However, our understanding of the mechanisms underlying these recognition impairments is extremely limited. Here, we used dynamic stimuli to investigate whether impaired emotion recognition in children with ADHD may be associated with impairments in perceptual sensitivity. Participants (ADHD: $N = 26$; Controls: $N = 26$) viewed video sequences of neutral faces slowly developing into one of the six basic emotional expressions (angry, happy, fearful, sad, disgusted and surprised) and were instructed to indicate via a button press the precise moment at which they were able to correctly recognize the emotional expression. The results showed that compared to controls, children with ADHD exhibited lower accuracy rates across all emotional expressions while there was no evidence for impaired perceptual sensitivity. Thus, the study provides evidence for a generalized categorization impairment across all emotional categories and is consistent with developmental delay accounts of ADHD. Future studies are needed in order to further investigate the developmental course of social cognition deficits in ADHD.

1. Introduction

Attention Deficit/Hyperactivity Disorder (ADHD) is characterized not only by impairments in executive function, motivation, and behavioral inhibition problems (Barkley, 1997; Nigg et al., 2005; Sonuga-Barke, 2005), but also by marked deficits in the social domain. For instance, children with ADHD are less liked, less accepted, and more likely to be rejected by their peers (Hoza, 2007; Johnston et al., 1985; Nijmeijer et al., 2008; Sibley et al., 2010). These social functioning impairments often persist well into adulthood. For instance, patients experience interpersonal problems at work, with significant others, and are more likely to commit criminal offenses (Barkley et al., 1996; Hansen et al., 1999; Mannuzza et al., 1989).

An accurate reception of verbal and nonverbal communication signals represent a core competency that is vital for normal social development, adaptive emotion regulation skills, and appropriate social functioning in general (Izard et al., 2001; Lansford et al., 2010). Impairments in emotion processing have not only been linked to a number of psychiatric conditions, such as depression (Müller et al., 2016), anxiety (Staugaard, 2010), and antisocial personality disorder (Schönenberg and Jusyte, 2014), but have also been associated with poor academic performance outcomes (Lansford et al., 2010). Studies on children and adolescents with ADHD have provided evidence for impaired recognition of negative facial expressions that signal disapproval or threat, such as anger, fear, and sadness (Cadesky et al., 2000; Da Fonseca et al., 2009; Ludlow et al., 2014; Miller et al., 2011; Norvilitis et al., 2000; Schönenberg et al., 2015; Serrano et al., 2015; Sjöwall et al., 2013; Yuill and Lyon, 2007). This is consistent with theoretical accounts that link impaired recognition of facial cues (i.e., fearful, angry, sad facial emotions) with inadequate interpersonal responding and externalizing-spectrum disorders which are frequently comorbid with ADHD, such as the antisocial personality disorder, conduct disorder, and psychopathy (Blair and Coles, 2000; Dawel et al., 2012; Marsh and Blair, 2008). Furthermore, previous studies also demonstrate that emotion recognition deficits are associated with the severity of interpersonal problems in high-risk groups (Kats-Gold et al., 2007) and children with diagnosed ADHD (Pelc et al., 2006).

Despite these insights, important issues regarding the developmental course of these impairments as well as their underlying mechanisms remain unresolved. Some authors have argued that this is simply a result of the inattentiveness (Barkley, 1997), a notion that has been challenged by evidence linking ADHD specifically to emotion

* Corresponding author.
E-mail address: aiste.jusyte@uni-tuebingen.de (A. Jusyte).
[1] Equal contributions.

http://dx.doi.org/10.1016/j.psychres.2017.08.066
Received 16 March 2017; Received in revised form 14 July 2017; Accepted 23 August 2017
Available online 25 August 2017
0165-1781/

Table 1
Demographic and diagnostic sample description.

		ADHD (N = 26)	CTL (N = 26)	Statistics
Demographics	Age	11.68 (1.65)	11.73 (1.30)	$t(50) = 0.13$; n.s.
	Females	9	13	$X^2_{(1)} = 26$; n.s.
CPRS dimensional (t-scores)	Inattention	68.15 (4.20)	47.00 (5.46)	$t(50) = -15.65^{***}$
	Hyperactivity/Impulsivity	65.77 (5.79)	47.69 (7.86)	$t(50) = -9.44^{***}$
DSM-IV diagnoses according to CPRS	ADHD Combined	13	–	–
	ADHD Inattentive	10	–	–
	ODD	16	–	–
	CD	15	–	–
CBCL DSM-oriented scales (t-scores)	Affective problems	63.39 (9.16)	54.73 (7.79)	$t(50) = 3.67^{**}$
	Anxiety problems	63.27 (10.11)	54.65 (5.67)	$t(50) = 3.79^{***}$
	Somatic problems	62.65 (11.53)	52.65 (4.62)	$t(50) = 4.11^{***}$
	ADHD problems	70.31 (8.26)	53.88 (6.95)	$t(50) = 7.75^{***}$
	Oppositional problems	61.73 (8.20)	52.42 (4.59)	$t(50) = 5.05^{***}$
	Conduct problems	63.62 (9.16)	52.23 (4.53)	$t(50) = 5.68^{***}$
CBCL global dimensions (t-scores)	Externalizing	62.08 (12.11)	45.39 (8.99)	$t(50) = 5.64^{***}$
	Internalizing	63.96 (10.67)	51.46 (10.36)	$t(50) = 4.29^{***}$
	Total score	67.00 (11.08)	48.77 (9.14)	$t(50) = 6.47^{***}$

Note. The data represented in the table refers to means and standard deviations for each measure (in parentheses). ADHD = attention-deficit/hyperactivity disorder; ODD = oppositional defiant disorder, CD = conduct disorder; CTL = healthy controls; CBCL = Child behavior Checklist; CPRS = Conners' Parent Rating Scale-Revised; DSM = Diagnostic and Statistical Manual of Mental Disorders.
n.s. = non-significant.
* = significant at $p < 0.05$.
** = significant at $p < 0.01$.
*** = significant at $p < 0.001$.

categorization but not object categorization tasks (Rapport et al., 2002; Yuill and Lyon, 2007). Emotion recognition deficits may also be rooted in an impaired perceptual sensitivity toward facial expressions. To date, the perceptual sensitivity hypothesis has only been investigated to a limited extent, as available evidence stems from studies that only examined broad emotional categories (Cadesky et al., 2000; Da Fonseca et al., 2009; Friedman et al., 2003; Ludlow et al., 2014; Shin et al., 2008) using full-blown static stimuli (for a review, see Bora and Pantelis, 2016). However, in order to capture perceptual sensitivity, it is necessary to employ tasks that manipulate the intensity of facial expressions, which can be achieved by blending neutral and emotional expression. This procedure allows for the determination of the perceptual strength of an emotional display that is necessary for correct categorization.

Only two previous studies have tackled this issue using blends between neutral and emotional stimuli (Schönenberg et al., 2015; Schwenck et al., 2013). One recent study investigated perceptual sensitivity in adults with ADHD using an animated morph task (Schönenberg et al., 2015). In this paradigm, participants with ADHD and healthy controls initially viewed neutral faces which slowly developed into full-blown emotional expressions. Participants were asked to indicate via a button press the precise moment at which they were able to correctly recognize the emotional expression. The results showed that compared to healthy controls, adults with ADHD exhibited a delayed recognition onset of fearful and sad facial expressions, indicating that impairments in perceptual sensitivity may lie at the root of previously reported recognition deficits in ADHD. However, a similar investigation of children with ADHD that also used dynamic emotional stimuli yielded no evidence of impairments (Schwenck et al., 2013). Although it is difficult to judge the source of conflict between these two studies, one could argue that the type of stimulus material plays a role, since both studies were carried out using adult faces. While these stimuli may correspond to the age of the adult participants' peer group, this definitely does not apply for children and adolescents. Since research has repeatedly shown increased emotion recognition accuracy for members of the same age group (Rhodes and Anastasi, 2012), the use of adult stimuli in the majority of previous studies with ADHD children could be problematic.

Therefore, the aim of the current study was to investigate whether emotion recognition deficits widely reported in children and adolescents with ADHD are associated with impairments in perceptual sensitivity. For this purpose, we employed an experimental paradigm to assess perceptual sensitivity and recognition accuracy for all six basic emotional expressions displayed by child models. Based on previous literature, we expected children with ADHD to exhibit both an impaired categorization performance and deficient perceptual sensitivity, particularly for the negative emotion emotional expressions (angry, sad, and fearful). Specifically, we expected that children with ADHD would exhibit a lower accuracy for negative emotional expressions and would require more perceptual intensity for correct categorization.

2. Methods

2.1. Participants

Twenty-six children with ADHD were recruited from the university's outpatient clinic of the Department for Clinical Psychology and Psychotherapy. Inclusion criteria were: 1) 10–14 years of age, 2) current diagnosis of ADHD. Exclusion criteria were: 1) comorbid autism-spectrum disorder, 2) mental retardation, 3) insufficient knowledge of the German language. Interested patients deemed eligible for participation were contacted and invited to participate in the study. The ADHD diagnosis was additionally validated prior to the study using the German Version of the Conners Parent Rating Scale 3 (CPRS; Lidzba et al., 2013), with all participants scoring a *t*-value > 65 (Conners, 1997). In addition, the parent rating version of Child Behavior Checklist 6/18 (CBCL; Döpfner et al., 2014) was employed to obtain a more thorough psychopathological description. Two participants were medicated with methylphenidate for the management of ADHD symptoms at the time of testing.

Twenty-seven healthy control participants were recruited via the Department's internal database and newspaper advertisements, specifying that we sought interested individuals with no known psychiatric disorders. Inclusion criteria were: 1) 10–14 years of age, 2) no indication of a psychiatric disorder according to the CBCL, no current psychiatric diagnosis or treatment, 3) sufficient German language skills, 4) no indication of current ADHD or conduct disorder symptoms in CPRS. One recruited participant was excluded due to high scores on the CPRS. Thus, the final control sample consisted of 26 participants. The ADHD and control groups did not differ in terms of age or gender ratio (see