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Boys with autism spectrum disorders show superior performance on the adult Embedded Figures Test

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ABSTRACT

Weak central coherence is frequently studied using the Embedded Figures Test (EFT) yielding mixed and ambiguous results. In this study, the performance of 36 boys (9–14 years) with Autism Spectrum Disorders (ASD) is compared with that of 46 typical peers using both the children's and the adult version of the EFT. Only in the adult version did the ASD group outperform the controls in terms of accuracy. Corrected for age and pIQ, a subgroup of boys with Autistic Disorder (AD) showed superior perceptual processing capacities, while the performance of boys with PDD-NOS and Asperger Syndrome was in between that of those with AD and the controls. The findings strongly suggest that children and adolescents with ASD will only show superior results on visual-perceptual tests if the task complexity and thus their sensitivity is sufficiently high to challenge typically developing age-matched peers.

1. Introduction

Typically developing and mentally handicapped children process meaningful and patterned information better than they do random and meaningless stimuli. People with autism profit less from meaning or Gestalt, but on the other hand show a remarkable ability to detect a target in visual search tasks (Almeida, Dickinson, Maybery, Badcock, & Badcock, 2010a; Almeida, Dickinson, Maybery, Badcock, & Badcock, 2010b; Jarrold, Gilchrist, & Bender, 2005; Kaldy, Kraper, Carter, & Blaser, 2011; O'Riordan, Plaisted, Driver, & Baron-Cohen, 2001; O'Riordan, 2004; O'Riordan & Plaisted, 2001; Plaisted, O'Riordan, & Baron-Cohen, 1998). In their now classic research note on autism, Shah and Frith (1983) were the first to show that children with autism possess a striking ability to detect hidden, embedded elements in a larger complex figure.

Yet, the experimental evidence of this salient ability is mixed. In their extensive review of studies on vision in Autism Spectrum Disorders (ASD), Simmons et al. (2009) discussed all studies published at the time in which either the children's or the adult version of the Embedded Figures Task (EFT) or both versions were used. They judged the balance of evidence to favor a superior performance by people on the autism spectrum. More recently, however, White and Saldaña (2011) reviewed another 16 studies exploiting the EFT and concluded that findings were inconsistent. Moreover, in their own study featuring two large samples of high-functioning children with ASD, they found their two groups to perform similarly to the groups of typically developing (TD) children. A closer examination of the White and Saldaña (2011) review learns that of the 14 studies of which the accuracy scores were listed, 11 studies showed that the percentage of correctly executed trials for

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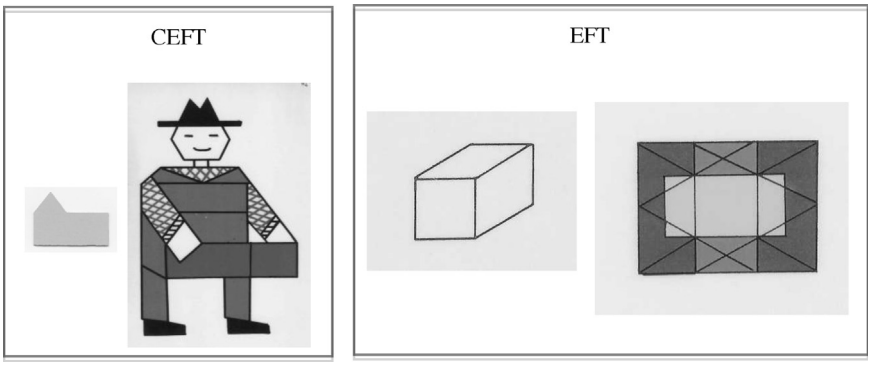

Fig. 1. Embedded Figures Tests. Examples of the stimulus cards depicting one of the simple geometric forms (depicted left in each panel) to be identified and traced in one of the complex figures of the children's (CEFT – left panel) and the adult version of the test (EFT – right panel).

the TD participants exceeded 75%; in five studies the accuracy rate even exceeded the 85% mark. Such high scores for controls easily lead to ceiling effects, making it more difficult to detect a statistically significant superior performance in the clinical group. In children with ASD superior visual–perceptual abilities might then only become manifest if the difficulty of the task is sufficiently high to challenge the controls (see Schlooz et al., 2006).

The present study was set up to test this idea. To try and avoid ceiling effects as much as possible, we presented a boys-only clinical and control group with the most complex figures of the Children's EFT only. In addition to these still relatively easy tasks, we also had both groups complete the adult version of the EFT, whose figures and forms are more abstract than those of the CEFT (see Fig. 1), rendering the task more difficult, which, we assumed, was more likely to prevent ceiling effects from occurring.

In the instructions about the norm scores of the CEFT Witkin and colleagues (Witkin, Oltman, Raskin, & Karp, 1971) point to the strong effect of age on its performance results. To control for any such age-dependent effects, we kept the window of chronological and mental age as small as possible. In our analyses of our clinical group of high-functioning boys with ASD, we furthermore looked separately at the boys diagnosed with Autistic Disorder (AD) and a subgroup consisting of boys with milder ASD, i.e. Pervasive Developmental Disorder Not Otherwise Specified (PDDNOS) and Asperger Syndrome (AS), which will be referred to as the Pervasive Developmental Disorder (PDD) group. We made this distinction between AD and PDD firstly to be able to compare the results with those reported in the original study of Shah and Frith (1983), in which the clinical group consisted of children with autism only. Secondly, we hoped the distinction would also help us identify potential performance differences for the boys with diagnoses at the mild and more severe end of the autism spectrum. And finally, the distinction allowed us to examine the effects of age and intelligence on EFT performance in greater detail.

We expected the boys with ASD to perform similarly to their typically developing peers on the CEFT but to show superior performance on its adult version. We further expected the AD group to reach higher scores on the EFT than the PDD group.

2. Method

2.1. Participants

For reasons of availability and comparativeness, the children we recruited for our trial were all male and in a comparable stage of life, i.e. between young childhood and the start of adolescence (9–14 years) and functioning as can be expected at that age or given their diagnosis. The boys with ASD were recruited from the outpatient Clinic of Child Behavioral Neurology and the Academic Center for Child and Adolescent Psychiatry of the University Medical Center Nijmegen and an associated outpatient child psychiatric clinic. The controls, all typically developing boys, were recruited from a local primary school. Exclusion criteria were the use of medication and abnormal mental functioning. In all children mental functioning was assessed with the Dutch Version of the Wechsler Intelligence Scale for Children – Revised (WISC-RN; Wechsler, 1974), with children with a pIQ below 75 being excluded. Informed consent was appropriately obtained, with all children and their parents consenting to participate in the study.

Buitelaar and colleagues (Buitelaar & van der Gaag, 1998; Buitelaar, van der Gaag, Klin, & Volkmar, 1999) defined limiting scoring rules for PDD-NOS based on ICD10/DSM-IV criteria. We adhered to these rules when selecting our clinical group. Experienced clinicians, child psychiatrists and child psychologists examined eligible children with ASD both independently and together, resulting in 36 participants fulfilling the DSM-IV diagnostic criteria for ASD (APA, 1994). Fifteen boys were diagnosed with AD and 21 with PDD, of whom five were diagnosed with Asperger Syndrome and 16 with PDD-NOS. The controls ($n = 46$) were screened with the Child Behavior Checklist (CBCL) and the Teacher Report Form (TRF; Achenbach, 1991). Boys with a clinical score on any of the subscales were excluded from the study. The chronological ages for all three groups and the outcomes on the WISC-RN (Wechsler, 1974) are listed in Table 1.