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## Superior nonverbal intelligence in children with high-functioning autism or Asperger's syndrome

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### ABSTRACT

Some early studies showed discordance in cognitive strengths and weaknesses in individuals with high-functioning autism (HFA) or Asperger's syndrome (AS). The present study administered the French version of Colored Raven's Progressive Matrices in 14 children with HFA/AS and in 26 chronological age matched peers with typical development. We found a trend of superior nonverbal performance in Raven's Test in our HFA/AS participants compared to controls, and this "superiority" achieved statistical significance in the HFA/AS subgroup with a  $FIQ \geq 90$ . Superior fluid intelligence seemed to exist in individuals both with HFA and with AS. A complementary use of both the Raven's Test and the Wechsler Intelligence Scales seems to be important for exploring the domain-specific as well as multidimensional profiles in individuals with autism.

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### 1. Introduction

Autism is characterized by impairments in social interaction, verbal and nonverbal communication, restricted repetitive and stereotyped patterns of behavior, interests, and activities (APA, 1994). Mental retardation (MR) is associated to more than half of individuals with autism, although the reported rate of MR in autism varies in different studies. Chakrabarti and Fombonne (2001, 2005) reported a rate of normal intellectual functioning only up to 33% of their subjects with autistic disorder while this rate rose up to 92% in PDD-NOS and 100% in Asperger's syndrome (AS).

Higher IQ in children with autism has been found to predict a better prognosis (Ben-Itzhak & Zachor, 2007), so an appropriate estimation of the intellectual level is important for treatment consideration (e.g., choosing a more appropriate intervention method). Recently, the reliability of standard IQ assessment in people with autistic disorder was challenged since the most widely used IQ batteries (Wechsler Intelligence Scales) require competence in language which is well-known to be a core impairment in autism (but not for AS people) thus could have underestimated the real intellectual level of individuals with autism (Dawson, Gernsbacher, Mottron, & Soulières, 2007). These authors found that the score of a nonverbal psychometric test – the Raven's Test – "could be on average, 30 percentile points, and in some cases more than 70 percentile points, higher than scores on the Wechsler scales of intelligence". However, the degree of such "underestimation" still needs to be well studied and defined. For example, Bölte, Dziobek, and Poustka's study (2009) confirmed the above-mentioned discrepancy but to a much lesser degree than reported in Dawson et al.'s study and only for their autistic participants with a Wechsler IQ < 85. Thus, the scores in nonverbal psychometric tests as Raven's seem to be comparables with scores in Wechsler Intelligence Scales, at least in relatively high-functioning

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**Table 1**  
Descriptive characteristics of participants in HFA/AS group and control group.

	Groups	
	HFA/AS	Control
N	14	26
Mean age (S.D.)	9; 07 (1; 01)	9; 08 (0; 11)
Mean FIQ – WISC-III (S.D.)	96.36 (21.85)	Normal intelligence

people with autism. That means, in these high-functioning individuals, a higher Wechsler IQ level could be associated to a better performance in tests measuring fluid intelligence.

A recent study using the Raven's Test has found superior fluid intelligence in children with AS compared to matched controls (Hayashi, Igarashi, Kashima, & Kato, 2008), contradicting the previously reported "high verbal IQ and relatively low performance IQ" profile in AS people (Cichetti, Klin, Rourke, Sparrow, & Volkmar, 1995) and indicating probably the limits of the Wechsler scales of intelligence in evaluating fluid intelligence. Discordance also exists for findings in HFA people: on one side, they have been found to show generally higher Wechsler's performance IQ than verbal IQ (see reviews by Allen, Courchesne, Ene, Hanson, & Lincoln, 1998); on the other side, a nonverbal learning disability profile has also been reported in 18% of their HFA participants (Goldstein, Kojkowski, Minschew, & Williams, 2008). Thus, the level and the nature of fluid intelligence in HFA/AS people still need to be further documented, not only for getting a better matching strategy in research works (Motttron, 2004) but also for diagnostic issue and intervention consideration.

The present study aims to compare the nonverbal intelligence between children with high-functioning autism (HFA) or Asperger's syndrome (AS) and chronological age matched typically developed peers, using the Raven's Progressive Matrices test (Court, Raven, & Raven, 2003). As a widely used nonverbal psychometric measure of abstract reasoning (fluid intelligence), the Raven's Test has been claimed to be more suitable for estimating the intellectual level of individuals with autism (Dawson et al., 2007) and as above-mentioned, significantly correlated with scores in Wechsler Intelligence Scales (Bölte et al., 2009). Since there is still no consensus to date for separating AS people from HFA ones (Matson, 2007; Matson & Wilkins, 2008; Calhoun, Crites, & Mayes, 2001; Klin, State, & Volkmar, 2009; Volkmar & Woodbury-Smith 2009), our clinical group included both.

## 2. Methods

### 2.1. Participants

Fourteen boys with HFA ( $n = 9$ ) or AS ( $n = 5$ ) were recruited from the Regional Autism Center of Brittany in the Department of Child and Adolescent Psychiatry, University Hospital of Brest (CRA de Brest, Service de Pédopsychiatrie, CHU de Brest). All of these HFA/AS children were involved in a study exploring cognitive style in high-functioning people with autism (Chen, Lazartigues, Lemonnier, & Planche, 2008). They have all been assessed by one or two psychiatrists on ADI-R (Lord, Le Couteur, & Rutter, 1994) and have met the ICD-10/DSM-IV criteria for autistic disorder or Asperger's syndrome. All of these clinical participants had a WISC-III full-scale IQ above 65.<sup>1</sup> The mean full-scale IQ of the clinical group was 96.36 (S.D. = 21.85). Further information about the clinical aspects of the HFA/AS group has been reported elsewhere (Chen et al., 2008).

26 chronological age matched children with typical development were recruited from an ordinary school in Brest. According to teachers' reports, all of them had normal intelligence without any learning difficulty. None of them had known history of neurological or psychiatric disorders or developmental retardation. None of their first-degree family members had a pervasive developmental disorder. As shown in Table 1, there was no significant difference between these two groups on chronological age ( $p = 0.744$ ).

All of our participants had normal or corrected to normal vision. Informed and written consents were obtained from their parents.

### 2.2. Measures and data analysis

The French version of Colored Raven's Progressive Matrices (36 items) was administered in a quiet testing room. It contains 36 items divided into three parts. Number of correct responses was transformed into percentile score according to the child's chronological age and then a whole group rank (compared to other 39 participants) was attributed to each participant for statistical analysis.

Data were analyzed using the Statistical Package for the Social Sciences Program (SPSS 16.0). We compared firstly the percentile rank between the HFA/AS group and the control group. Then two HFA/AS IQ subgroups were also introduced to see the distribution structure of fluid intelligence in HFA/AS individuals. Subgroup-1 ( $IQ < 90$ ) consisted of 7 participants with a mean age of 10; 0 years (S.D. = 1; 0) and FIQ of 81.0 (S.D. = 8.1) while subgroup-2 ( $IQ \geq 90$ ) consisted of 7 participants

<sup>1</sup> Since the Wechsler scales of intelligence could have underestimated the real intellectual level of people with autism (Dawson et al., 2007), especially for those with an  $IQ < 85$  (Bölte et al., 2009), we used here a cut-off score of 65.

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