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## Children with high-functioning autism and Asperger's syndrome: Can we differentiate their cognitive profiles?

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## ABSTRACT

The aim of this study was to investigate whether children with high-functioning autism (HFA) and Asperger's syndrome (AS) can be differentiated from each other and from typically developing children on their cognitive profiles. The present study included a total of 45 participants: children with autism (high-functioning autism or Asperger's syndrome) and a matched control group of typically developing children ( $n = 15$  per group). Two tasks were used to establish their cognitive profiles: the Wechsler Intelligence Scale for Children-Third Edition (WISC-III) and the NEPSY scale. Our results highlighted differentiated profiles between the children with Asperger's syndrome and those with high-functioning autism. The first ones showed strengths on verbally mediated skills as well as weaknesses on visual-motor coordination and graphomotor ability, whereas the children with HFA exhibited a profile with deficits on tasks calling upon verbal comprehension and good performances on tasks requiring visuo-spatial skills. This paper argues for a revision of AS criteria in the forthcoming DSM-V rather than a combination of the two subgroups within the autism spectrum disorders in the diagnostic manual.

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### 1. Introduction

Asperger's syndrome was introduced in the international classifications of disorders about 20 years ago. Clinical criteria to distinguish between high-functioning autism (HFA) and Asperger's syndrome (AS) were established through the publication of ICD-10 (World Health Organization, 1993) and DSM-IV (APA, 1994). Many clinicians and researchers are still wondering whether Asperger's disorder is different or not from high-functioning autism (Kaland, 2011; Macintosh & Dissanayake, 2004; Ritvo, Ritvo, Guthrie, & Ritvo, 2008; Verte et al., 2006). Asperger's syndrome has been mainly characterized by a lack of significant delay in language or cognitive development, but with autistic social impairment and patterns of restricted, repetitive and stereotyped behaviors, interests and activities. Ritvo et al. (2008) suggested that these criteria were given with the expectation that ongoing research would provide indications permitting to determine whether there are two distinct disorders, or a single one with different degrees of severity. To date, the results are contradictory, no consensus has been reached about a separation of participants with AS from ones with HFA (Klin, Pauls, Schultz & Volkmar, 2005; Matson, 2007; Matson & Wilkins, 2008; Volkmar, State & Klin, 2009), and the existence and definition of Asperger's syndrome are still debated.

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This study is aimed at contributing to the debate about the following issue: is it necessary to introduce a differentiation between HFA and AS in the international classifications of diseases? Are these disorders really distinct in terms of cognitive functions, or do they differ only by the degree of severity of symptoms, with more or less impairments in certain aspects?

In the literature, many studies have compared the adaptive behaviors, the symptom patterns and the cognitive abilities of people with autism (HFA and AS) to those with typical development. For comparative studies about their cognitive profiles, the participants have been frequently assessed by using the Wechsler Scales. In children with high-functioning autism, verbal IQ has often been found to be significantly lower than performance IQ. This difference tended to be reversed in persons with AS: their scores were better on verbal IQ than on performance IQ (Ghaziuddin & Mountain-Kimchi, 2004; Kaland et al., 2002; Klin et al., 2005; Mottron, 2004).

When performances on subtests have been compared, the individuals with AS performed better than those with HFA on the comprehension task (Ozonoff, Rogers & Pennington, 1991; Ozonoff, South, & Miller, 2000) as well as on the information-, vocabulary- and arithmetic-tasks (Ghaziuddin & Mountain-Kimchi, 2004). About the subtests designed to assess information processing speed, lower scores on “coding” in subjects with AS compared to those with HFA, were classically highlighted, it may be a specific feature to AS (Kaland, 2011; Koyama & Kurita, 2008).

However, the literature from investigations about other cognitive domains is often inconsistent. In a given field, some studies have provided convincing evidence of differences between HFA and AS participants while other studies did not.

Autistic people were “well known” to have preserved skills in the visuo-spatial domain. But, whereas some studies found no significant difference on the block design and the object assembly tasks between HFA and AS groups (Ghaziuddin & Mountain-Kimchi, 2004; Ozonoff et al., 2000; Szatmari, Tuff, Finlayson, & Bartolucci, 1990; Szatmari, Archer, Fisman, Streiner, & Wison, 1995), other papers showed that participants with HFA had better scores than those with AS on puzzle tasks (Iwanaga, Kawasaki, & Tsuchida, 2000), on the block design subtest (Mottron, 2004) and on the object assembly subtest (Ehlers et al., 1997).

Moreover, many studies have been conducted on executive functions in autism in the last two decades; the majority of them have stated that, in comparison with typically developing subjects, individuals with autism perform poorly in tasks involving multiple executive – control processes simultaneously (Kenworthy, Yerys, Anthony, & Wallace, 2008). Clinicians and family members usually agree that individuals with autism have difficulties efficiently mobilizing executive functions in their daily life. Children with autism have difficulties with planning, cognitive flexibility or set-shifting and working memory (Pennington et al., 1997; Ozonoff & Jensen, 1999; Ozonoff et al., 2004; Bishop & Norbury, 2005; Verte, Geurts, Roeyers, Oosterlaan, & Sergeant, 2005). In most of the studies no difference was found between participants with HFA and those with AS. For example, Manjiviona and Prior (1999) showed that individuals with autism could not be distinguished from those with Asperger’s disorder on the Tower of London task, which is currently proposed in executive functioning assessments. In contrast, in another study (Rinehart, Bradshaw, Moss, Brereton, & Tonge, 2006), executive functioning in children with Asperger’s disorder was found to be particularly vulnerable to a lack of visual cueing and concrete rules. This finding led the authors to suggest that qualitative differences in executive dysfunction between HFA, AS and matched control groups may implicate differential disruption within the fronto-striatal circuitry. Recent series of experiments have further investigated executive functioning in young, normally intelligent children with autism and Asperger’s disorder using a visual-spatial Stroop-like task and a local–global set-shifting task. Achievements at both tasks highlighted a dissociation in executive ability between the autism and Asperger’s disorder groups (Rinehart, Bradshaw, Tonge, Brereton, & Bellgrove, 2002). Although global deficit in executive functions has often been described in autism, with no difference between the clinical groups, qualitative and subtle differences in executive dysfunction may exist between HFA and AS groups.

The pattern of symptoms of individuals with autism also included deficits in sensory and motor functioning. Some kind of motor delay or coordination deficit has been evidenced in both HFA and AS disorders (Baranek, Parham, & Bodfish, 2005; Ghaziuddin, Butler, Tsai, & Ghaziuddin, 1994; Iwanaga et al., 2000; Jansiewicz et al., 2006). But while Miller and Ozonoff (2000) reported no significant difference on a manual dexterity task between AS and HFA groups, Gillberg and Gillberg (1989) and Klin, Volkmar, Sparrow, Cichetti, and Rourke (1995) observed a higher rate of motor problems (e.g. clumsiness, manual dexterity, fine and global coordination) in children with AS than in those with HFA. Clinical observations suggested that clumsiness was a feature liable to help in distinguishing between Asperger disorder and high-functioning autism (Tantam, 1988). Motor clumsiness appeared in the ICD-10 as a symptom often found in AS (but this eventual deficit has never been mentioned in the description of autism) and no mention of motor clumsiness was made in the DSM-IV for autism or Asperger’s disorder.

In the sensory domain, Ghanizadeh (2011) showed that children with autistic disorder had more tactile sensory seeking behaviors than children with Asperger’s disorder. Moreover, the tactile discrimination and sensory perception capabilities expressed by children with autistic disorder would be less than those displayed by participants with Asperger’s disorder.

In the last decades, many studies have been aimed at characterizing the core features of autistic disorders or at identifying the difference(s) between AS and HFA. The brief review of the literature presented here often shows contradictory results among the studies. Each study usually considered a particular field of investigations and failed to clearly identify a profile characteristic of AS compared with HFA. In the present study the validity of the distinction between AS and HFA is questioned by taking into account the global nature of the functioning. This led us to select two batteries of tasks covering different domains. Then the performances of the participants from each group were analysed by considering not only their scores, but also the developed strategies that underlie and explain the performances. We also took into account specific characteristics of the proposed tasks, i.e. the required cognitive mechanisms and the types of materials involved in their accomplishment.

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