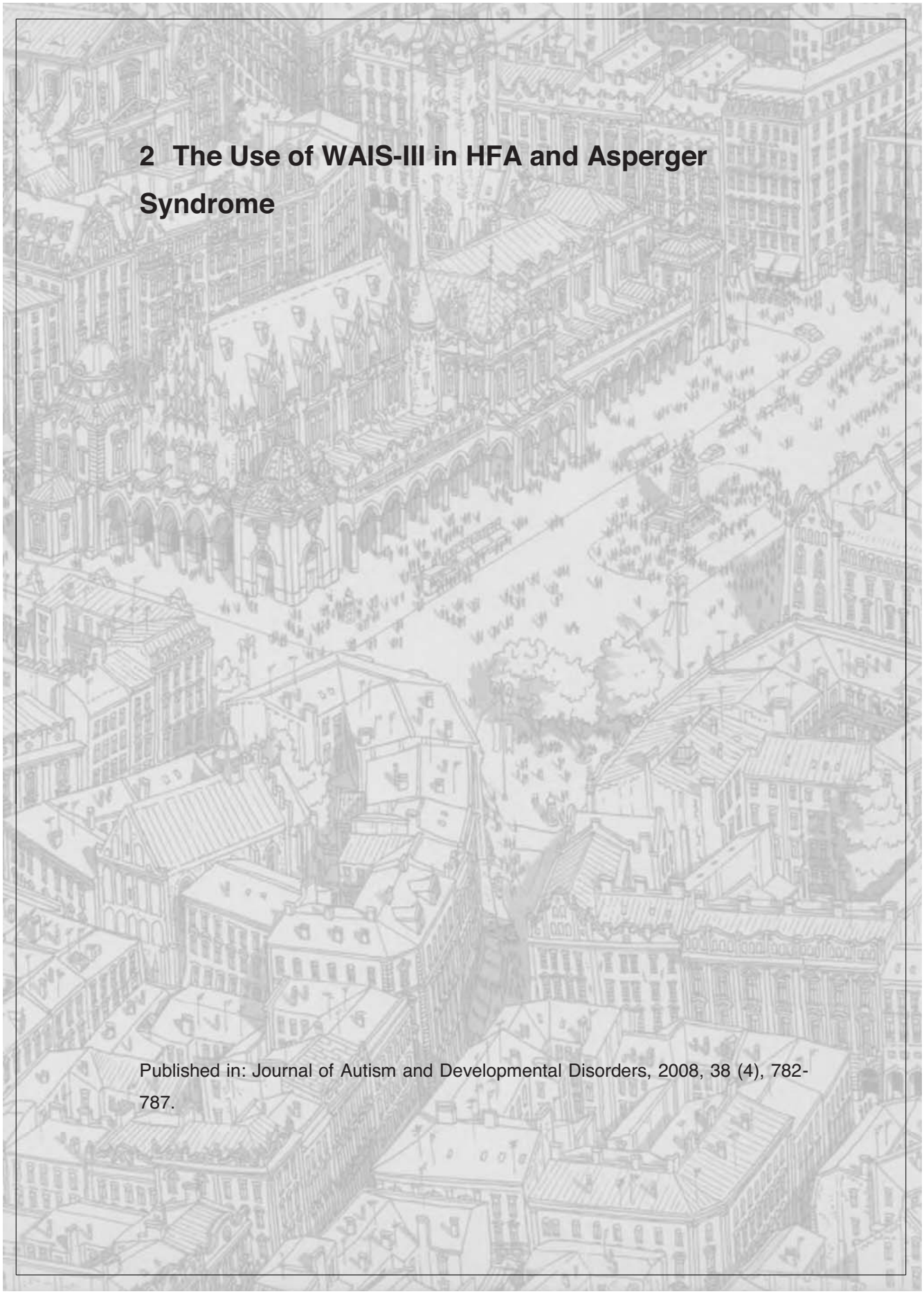
Cognitive profiles of adults with high functioning autism (HFA) and Asperger syndrome

Spek, A.A.



2 The Use of WAIS-III in HFA and Asperger Syndrome

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Chapter 2

Abstract

The WAIS III was administered to 16 adults with the autistic disorder and 27 adults with Asperger syndrome. Differences between Verbal Intelligence (VIQ) and Performance Intelligence (PIQ) were not found. Processing Speed impairment was observed in the participants with the autistic disorder. At the subtest level, the Asperger syndrome group performed weak on Digit Span. Strengths were found on the subtests Comprehension and Block Design. In the autistic disorder group, performance on Digit-Symbol Coding and Symbol Search was relatively poor. Strengths were found on Information and Matrix Reasoning. The results suggest that the VIQ-PIQ difference cannot distinguish between the autistic disorder and Asperger syndrome. WAIS III Factor Scale and Subtest patterning provides a more valid indicator.

2.1 Introduction

Over the past few years, interest in HFA and Asperger syndrome in adults with normal intelligence has increased markedly. However, not much is known about the cognitive profiles of these groups. Only a few studies exist about adults who function relatively well in society and have been diagnosed late in life (Howlin, 2004; Vermeulen, 2002). The present study aims to assess the cognitive profiles of this relatively high-functioning subgroup by means of the Wechsler Intelligence Scale III (WAIS III, Wechsler, 1997).
In WAIS III, the intelligence pattern is described at three levels: The first level contains Performance Intelligence and Verbal Intelligence. The second level consists of the four factor scales: Verbal Comprehension, Perceptual Organization, Freedom from Distractibility and Processing Speed. The third level contains the subtests. The following paragraphs summarizes previous research results of the intelligence profiles adults with the autistic disorder and Asperger syndrome on these three levels.

The Performance IQ (PIQ) - Verbal IQ (VIQ) dichotomy has been previously used incorrectly to underpin the diagnosis of autistic disorder and Asperger syndrome. It is questionable whether the two constructs should even be applied in general, because research did not support the construct validity of the VIQ-PIQ dichotomy (Taub, 2001).
Studies examining WAIS-R in adults with HFA have yielded contradictory results (Minshew et al. 1992; Siegel et al., 1996; Vermeulen, 2002), which may reflect the validity problems of the VIQ-PIQ dichotomy (Arnau & Thompson, 2000; Taub, 2001).
The factor scale level is of great importance in assessing cognitive abilities, sinceactor analytic studies indicate that they give the best estimates of the four factors underlying intelligence (Arnau & Thompson, 2000; Ryan & Paolo, 2001).
No studies have investigated the WAIS-III profiles for adults with HFA and Asperger syndrome, as far as we know. Therefore we have no information about the factor scale profiles in these groups. This leads to the conclusion that the most important factors of the intelligence patterns for adults with HFA and Asperger syndrome are still unknown.
At subtest level, some studies on WAIS or WAIS-R reported low Comprehension versus high Block Design scores (Goldstein et al., 2001; Rumsey & Hamburger, 1988). A relatively high variability between the subtests scores in adults with HFA has also been reported (Siegel et al., 1996).
In summary, research shows that among adults with HFA and Asperger syndrome, results of VIQ-PIQ differences vary and may be influenced by the validity problems of the VIQ-PIQ dichotomy. The factor scale scores and the subtest patterns provide a better

representation of the intelligence pattern but these are still unknown in adults with HFA and Asperger syndrome.

2.1.1 Aims of the Present Study

The present study aims to acquire insight into the WAIS III profiles of normal intelligent adults with HFA and Asperger syndrome. Profiles in the total group and differences between the two diagnostic groups will be examined.

2.2 Methods

2.2.1 Procedure

All participants were recruited from the GGZ (Mental Health Center) Eindhoven and Oost-Brabant. The participants met the criteria for Asperger syndrome or HFA. Participants with relevant neurodevelopmental conditions and genetic conditions were excluded, as were institutionalized patients and patients with a Full Scale IQ below 80.

2.2.2 Subjects

The mean Full Scale IQ of the participants was 110.16, individual scores varied between 83 and 145 (see table 1).

Table 1
Characteristics of Participants

IQ and age	M	SD	Range
Full scale IQ	110.16	16.05	83 - 145
Mean age	41.93	10.67	20 - 60
Diagnosis	f	P	
Autistic disorder	16	37.2	
Asperger syndrome	27	62.8	
Gender			
Male	39	90.7	
Female	4	9.3	
Education			
Lower / middle education	18	41.9	
Higher education	25	58.1	
Employment status			
Employed or retired	30	69.8	
Studying	1	2.3	
Unemployed	12	27.9	
Current living circumstances			
Lives with partner	23	53.5	
Lives independently	12	27.8	
Sheltered living	2	4.7	
Lives with parents	6	14.0	

All individuals ranged in age from 18 to 60 years. The mean age was 41.93. Of all participants, 25 finished higher education and 30 individuals had work. 23 participants lived together with a partner. The relatively large number of participants who had a relationship, worked and were well educated emphasizes the relatively high level of functioning in this group.

2.2.3 Assessment of Disorder

Hetero-anamnestic information was gathered using the Dutch version of the Autistic Disorder Diagnostic Interview, revised version (ADI-R, Lord et al., 1994), administered by psychologists who were officially trained in the administration and scoring of the

instrument. To gather anamnestic information, a semi-structured interview was used to assess presence of the DSM-IV criteria of HFA and Asperger syndrome (APA, 1994). Because of the controversial nature of the DSM-IV criteria (Ghaziuddin et al., 1992; Mayes et al., 2001), additional questions were used to differentiate between HFA and Asperger syndrome, based on the diagnostic criteria of Gillberg & Gillberg (1989) and ICD-10 (WHO, 1993).

2.2.4 Assessment of Intelligence

The intelligence profile was assessed using the Dutch translation of the WAIS III (Wechsler, 1997). The WAIS-III has excellent psychometric properties (Sattler & Ryan, 1999) and has been validated for the Dutch population (Wechsler, 1997).

2.3 Results

Analyses were performed at the three WAIS-III levels: VIQ versus PIQ, the four factor scales and all subtests. Preliminary analysis included checks for normality, linearity, influential data points and assumptions of repeated measures. No serious deviations were found. T-tests showed that both diagnosis groups were comparable in education, work status and gender distribution.

2.3.1 Differences Between WAIS III VIQ and PIQ

Differences between VIQ and PIQ for the total group and for the two diagnostic groups were analyzed by means of paired *t*-tests. No statistically significant effects were found for any of the groups (see table 2).

Table 2
VIQ and PIQ Differences in the Total Group and in Diagnostic Groups

	VIQ		PIQ			
	M	SD	M	SD	mean diff.	n
Total group	110.30	13.83	108.42	18.21	1.88	43
Asperger	111.41	13.57	112.52	17.28	1.11	27
Autism	108.44	14.49	101.50	18.13	6.94	16

2.3.2 Differences Between Factor Scale Scores

Factor Scale profiles were studied within the total group and between the two diagnostic subgroups by means of repeated measures analysis of variance. Mauchly's test indicated that the assumption of sphericity was not met. Therefore the degrees of freedom were corrected using the Huynh-Feldt correction (ε=.89). Post-hoc comparisons using the Sidak adjustment for multiple comparisons showed that the main effect of the WAIS III Factor Scale was statistically significant (F(2.7,109.7)=7.0, p<0.001). An interaction effect of differences in Factor Scale mean by diagnostic group was also found (F(2.7, 109.7)=2.7, p=0.05). To find out which differences in WAIS III Factor Scale means added to the significant main effect, post hoc pairwise comparisons were done. This showed that the main effect in the total group can be attributed to Processing Speed being significantly lower than Verbal Comprehension (p < .01) and Perceptual Organization (p < .005).

Post hoc pairwise comparisons were done for the two diagnostic groups to analyse the 'within group' effect. In the Asperger group, no significant differences in Factor Scale mean scores were found. The HFA group however, showed a significant lower Processing Speed compared to Verbal Comprehension (p < .01), Perceptual Organization (p < .01) and Freedom from Distractibility (p < .05) (see table 3).

Table 3
Factor Scale Scores for the Total Group and the Diagnostic Groups

Factor Scale	M	SD	n
Verbal Comprehension			
Autistic disorder	107.5*	12.1	16
Asperger syndrome	110.8	11.9	27
Total	109.6*	12.0	43
Perceptual Organization			
Autistic disorder	105.0*	18.7	16
Asperger syndrome	111.8	13.0	27
Total	109.3*	15.5	43
Freedom from Distractibility			
Autistic disorder	105.1*	18.2	16
Asperger syndrome	107.2	15.4	27
Total	106.4	16.3	43
Processing Speed			
Autistic disorder	91.8*	17.4	16
Asperger syndrome	106.5	19.4	27
Total	101.0*	19.8	43

* $p < .05$.

2.3.3 Differences Between WAIS III Subtest Scores

The Subtest profiles were explored within the total group and between the two diagnostic subgroups by means of a repeated measures analysis of variance. The assumption of sphericity was not met. Therefore the degrees of freedom were corrected using the Huynh-Feldt correction (ε=.82). Post-hoc comparisons were performed using the Sidak adjustment for multiple comparisons. The results (see table 4) showed a significant main effect of the type of Subtest ($F(10.7,438.7)=4.8$, $p<0.001$).

Table 4
Mean Standardized Subtest Scores for the Total Group

Subtest Scores	M	SD	n
Vocabulary	11.63*	2.564	43
Similarities	11.42	2.490	43
Arithmetic	11.77*	3.046	43
Digit Span	10.72	3.268	43
Information	12.42*	2.779	43
Comprehension	12.53*	2.772	43
Letter-Number Sequencing	10.98	2.956	43
Picture Completion	10.88	3.253	43
Digit-Symbol Coding	9.81*	3.438	43
Block Design	12.02*	3.562	43
Matrix Reasoning	11.98*	2.454	43
Picture Arrangement	11.53	3.731	43
Symbol Search	10.37*	3.970	43
Object Assembly	11.16	3.086	43

* $p < .05$.

An interaction effect of Subtest by diagnosis was also found ($F(10.7, 438.7)=2.1$, $p<0.05$), indicating that the patterning of the WAIS III subtest mean scores for the two diagnostic groups differs. Table 5 and 6 show the mean Subtest scores and standard deviations for the HFA group and the Asperger syndrome group.

Table 5

Mean Standardized Subtest Scores for the Autistic Disorder Group

Subtest Scores	M	SD	n
Vocabulary	11.31	2.496	16
Similarities	10.94	1.769	16
Arithmetic	11.44	3.705	16
Digit Span	11.31	3.400	16
Information	12.13*	3.284	16
Comprehension	11.75	2.176	16
Letter-Number Sequencing	10.25	3.152	16
Picture Completion	10.81	4.070	16
Digit-Symbol Coding	8.38*	3.030	16
Block Design	10.56	3.444	16
Matrix Reasoning	11.44*	2.828	16
Picture Arrangement	10.19	3.674	16
Symbol Search	8.44*	3.483	16
Object Assembly	9.88	3.324	16

* $p < .05$.

Table 6

Mean Standardized Subtest Scores for the Asperger Syndrome Group

Subtest Scores	M	SD	n
Vocabulary	11.81	2.632	27
Similarities	11.70	2.826	27
Arithmetic	11.96	2.638	27
Digit Span	10.37*	3.200	27
Information	12.59	2.485	27
Comprehension	13.00*	3.013	27
Letter-Number Sequencing	11.41	2.805	27
Picture Completion	10.93	2.745	27
Digit-Symbol Coding	10.67	3.431	27
Block Design	12.89*	3.401	27
Matrix Reasoning	12.30	2.198	27
Picture Arrangement	12.33	3.595	27
Symbol Search	11.52	3.847	27
Object Assembly	11.93	2.716	27

* $p < .05$.

Post hoc pair wise comparisons showed that the main effect in the total group can be attributed to the fact that Digit-Symbol Coding was significantly lower than Vocabulary ($p < .05$), Arithmetic ($p < .05$), Information ($p < .005$), Comprehension ($p < .005$), Block Design ($p < .05$) and Matrix Reasoning ($p < .005$). Furthermore, Symbol Search was lower than Information ($p < .05$) and Comprehension ($p < .05$).

Post hoc pair-wise comparisons were also performed for the two diagnostic groups to analyze the 'within group' effect. The two groups showed significant differences in Subtest scores. In the Asperger syndrome group, Digit Span was lower than Comprehension ($p = .005$) and Block Design ($p < .05$).

In the HFA group performance was significantly higher in Information compared to Digit-symbol Coding ($p < .05$) and Symbol Search ($p < .05$). Furthermore, Digit-Symbol Coding was lower than Matrix Reasoning ($p < .05$).

2.4 Discussion

2.4.1 WAIS VIQ Versus PIQ

No significant differences were found between VIQ and PIQ in the total group nor in the two diagnostic subgroups. The results are in line with factor analytic studies which showed that the VIQ-PIQ dichotomy is not valid for general populations (Arnau & Thompson, 2000; Taub, 2001).

2.4.2 WAIS III Factor Scale Level

The Asperger syndrome group was characterized by a flat Factor Scale profile in the Asperger syndrome group, while the HFA group performed significant low in Processing Speed. A low Processing Speed indicates problems in speed of processing visual information (Wechsler, 1997). Adults with HFA apparently need more time than other people to process and integrate visual information and to act on this information.

The Processing Speed performance of the HFA group might be influenced by problems with top-down processing and ignoring irrelevant details, which are characteristic of people with HFA (Happé, 2005; Shah & Frith, 1993). In order to maintain an overview of what they are doing, they work slowly.

2.4.3 WAIS III Subtest Level

Analyses showed different Subtest patterns in the HFA and the Asperger syndrome groups.

The HFA group performed significantly poor in Digit-Symbol Coding and Symbol Search. These two subtests together form the Processing Speed Factor. The low scores for these subtests represent the problems in speed of processing visual information as described in the preceding paragraph.

The HFA group showed significantly high performance in Information and Matrix Reasoning. High scores for Information are in line with the fact that people with autism usually acquire much factual knowledge (Happé, 1999).

Matrix Reasoning taps nonverbal perceptual reasoning. Matrix Reasoning is the only Perceptual Organization subtest without a time limit and is possibly not influenced by low Processing Speed performance scores. The strengths of the HFA group in this subtest can probably be attributed to their visual-spatial strengths (Lincoln et al., 1995; Tsatsanis, 2005) and to the absence of a time limit for this subtest.

In the Asperger group, scores for Digit Span were relatively low. Digit Span taps working memory capabilities (Wechsler, 1997), which can been defined as 'the ability to hold in mind past states of the environment and past actions while currently performing an action' (Russell, 1997). People with autism and Asperger syndrome tend to store information in details instead of using strategies, which often leads to problems in retaining information (Happé, 2005; Minshew et al., 1992; Tsatsanis, 2005). Low Digit Span scores in the Asperger group may reflect problems in applying strategies to retain information.

The Asperger syndrome group performed significantly well on the subtest Comprehension. High scores on Comprehension in this group seem to contradict former research results (Klin et al., 2005b; Mayes & Calhoun, 2003; Siegel et al., 1996). However, people with Asperger syndrome often try to function in society by analyzing social situations at a cognitive level, which has been described as using an 'explicit theory of mind'(Frith & Happé, 1999). An extremely well developed explicit theory of mind may have caused the strengths of the Asperger syndrome group on Comprehension.

The Asperger Syndrome group also performed significantly well on Block Design. Qualities in Block Design have often been reported in studies of people with HFA and Asperger syndrome (Happé, 2005; Shah & Frith, 1993). This has been attributed to strengths in processing unconnected stimuli outside a meaningful context, which go together with the central coherence problems that are characteristic for people with autistic impairment (Shah & Frith, 1993).

2.4.4 Conclusions

The present study found participants with Asperger syndrome to differ significantly from individuals with HFA in WAIS III Factor Scale profiles and WAIS III Subtest patterning. In the individuals with HFA Processing Speed problems were found. Further, the HFA and Asperger syndrome group showed different subtest patterns. The present study supports the idea that HFA and Asperger syndrome can be differentiated empirically at the level of intellectual functioning. This lends support to the hypothesis that HFA and the Asperger syndrome are two separate disorders.