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

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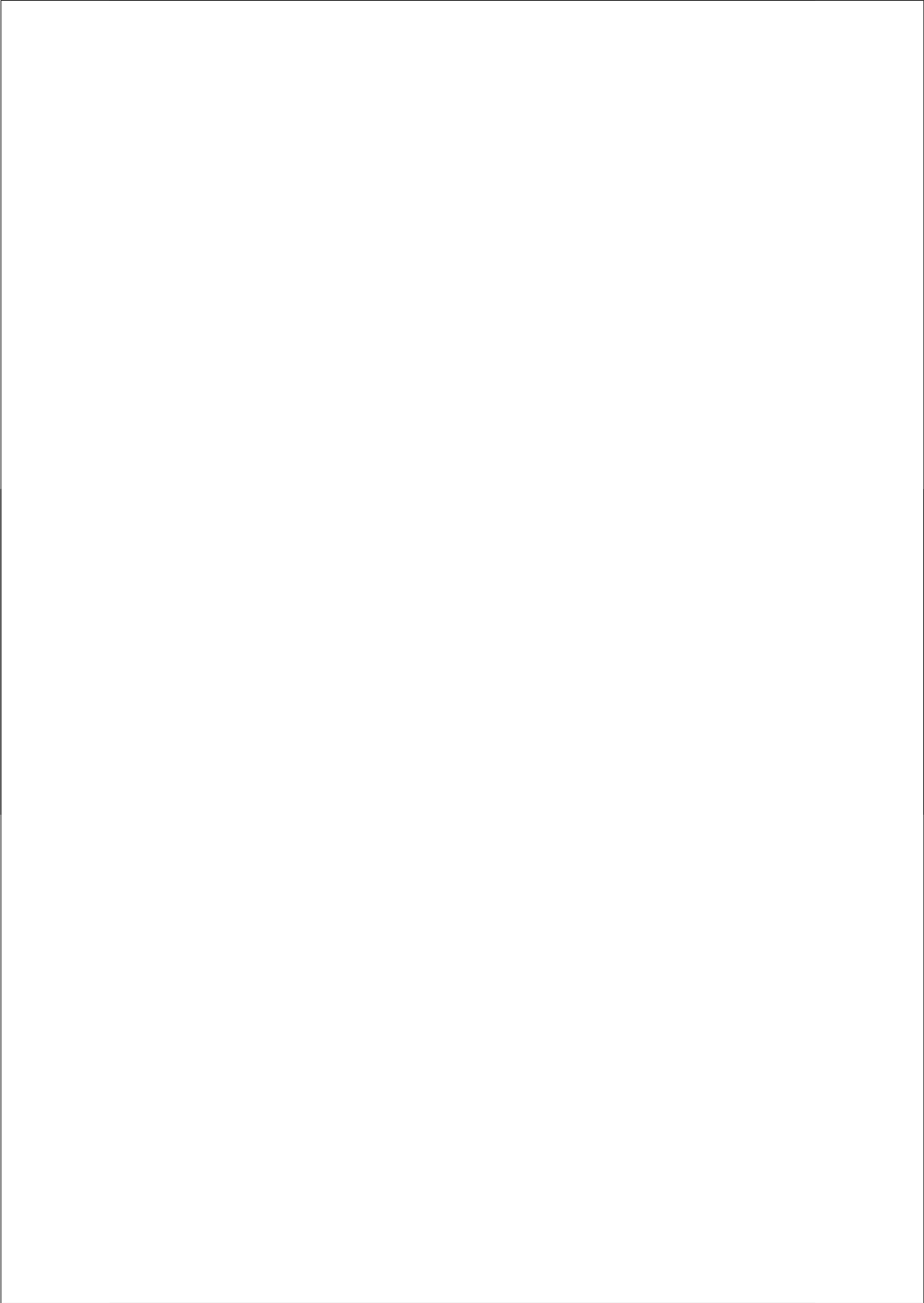
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6 General Discussion and Conclusions



6.1 Introduction

This research project focussed on the relevance of the three leading cognitive theories characterizing ASD in adults with the autistic disorder or Asperger syndrome. To this end, we investigated their general intelligence, their intelligence profiles and their characteristics with respect to theory of mind, central coherence and executive functioning.

6.2 Main findings

6.2.1 Intelligence Profiles

Our first aim was to assess the general cognitive ability of adults with the autistic disorder and Asperger syndrome and with an average to above-average intelligence. The WAIS-III was used to examine the intelligence profiles of these individuals. The results showed no differences in VIQ and PIQ between the two disorder groups. This discovery, combined with the recent finding that the VIQ-PIQ difference is not empirically valid (Arnou & Thompson, 2000; Ryan & Paolo, 2001) confirms the fact that these two scales cannot and should not be used in order to distinguish the autistic disorder from Asperger syndrome.

At the factor scale level of the WAIS-III, adults with the autistic disorder showed impairment in their processing speed, in contrast to the Asperger syndrome group and the neurotypical individuals. The slowness in processing and acting upon information also influenced their performance in some of the tasks that aimed to assess the three cognitive theories of autism. For example, the verbal fluency impairment and the weakness in the Embedded Figures Test in adults with the autistic disorder could be attributed mainly to the impairments in processing speed. Subsequently, in several of the WAIS-III subtests, a time limit is used and bonus points can be earned when less time is spent on resolving the items. It is likely that the impaired processing speed in the autistic disorder group influenced performance on these subtests negatively. Overall, it is important to acknowledge that the processing speed impairment in adults with the autistic disorder can influence performance in a broad array of cognitive tests. We hypothesized that the impaired processing speed may be due to a bottom-up information processing style, which is characteristic for ASD (Frith, 1989; Happé, 2005). In this style of processing information, the basic elements of a concept are first specified in great detail before linking them together to form larger subsystems. This is more time-consuming than top-down information processing, in which irrelevant details are ignored and the

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focus is placed on relevant information (Frith, 1989, 2003, 2008; Happé, 2005; Shah & Frith, 1993).

6.2.2 *Theory of Mind*

The strengths of the disorder groups in the Comprehension subtest of the WAIS-III show that adults with ASD acquired relatively much knowledge about the rules and customs of society for how one should act in certain situations (For instance, one of the Comprehension subtest items is: what do you do if you find an envelope in the street that is sealed and addressed and has a new stamp?). Frith and Happé (1999) described this knowledge as an 'explicit' theory of mind. Apparently, adults with ASD train themselves to analyze social situations cognitively, which can lead to an above average knowledge of the rules in society in general. However, it remains difficult for individuals with ASD to react adequately in everyday social situations, as Frith et al. (1994) observed in a group of autistic children. Our third paper showed that this also applies to high-functioning adults with ASD. They exhibit a weakness in interpreting and acting upon subtle social situations as they occur on a daily basis, which has been described as advanced theory of mind (Happé, 1994). The emphasizing-systemizing account (Baron-Cohen, 2009) may be relevant in this respect. Systemizing strategies, in which underlying rules are identified in order to distinguish laws, may be helpful in distinguishing rules of society. However, these strategies may be less advantageous in social situations, since they are usually not (completely) lawful (Baron-Cohen, 2006). In real life social situations, empathizing strategies appear most effective. The tendency of individuals with ASD to use systemizing strategies has been hypothesized to influence performance in social situations negatively (Baron-Cohen, 2006, 2009).

In our study, impairment in advanced theory of mind was not only found for two of the three neuropsychological instruments that were used, it was also expressed in the self-reports. This suggests that the 'theory of mind' theory of autism is still relevant when individuals with ASD reach adulthood. Furthermore, the relationship between the self-reports and the neuropsychological instruments illustrated that high-functioning adults with ASD groups are, to a great extent, aware of their theory of mind impairment. Whereas previous research stressed the lack of insight in individuals with ASD (Frith & Happé, 1999, Hobson, 2005), a subgroup of the high-functioning adults with ASD is apparently conscious of their strengths and impairments.

6.2.3 *Detailed Information Processing*

We also examined detailed information processing in the two disorder groups and the neurotypical group. The self-reports strongly indicated a detailed information processing

style which characteristic for the ASD groups. However, no impairments were found for the neuropsychological instruments in this respect. To our surprise, the relationship between the neuropsychological instruments and the self-reports was only minimal or even nonexistent, not only for the disorder groups but also for the neurotypical group. Since it is not likely that neurotypical adults are entirely incapable of determining their information processing style, most evidence points to the validity of the self-reports in measuring detailed information processing. This would suggest that adults with ASD are more detail-prone. Our third paper also showed that our adult ASD groups are more inclined to use systemizing strategies compared to the neurotypical adults. Systemizing has been described as the drive to analyze variables in a system in order to identify underlying rules, which can be used to understand and predict the system. Therefore, the use of systemizing strategies may help individuals with ASD to maintain the overall picture in a world in which they tend to process more details than others do. Systemizing may be very helpful for individuals who use a bottom-up information processing style, because it presents a structured mode of interpreting the details in the environment. Our results thus suggest that the theory of a detailed information processing style in autism is still applicable in high-functioning adult ASD groups and that they develop strategies in order to handle this fragmented information processing style.

6.2.4 *Executive Functioning*

In chapter five, executive functioning has been assessed by means of verbal fluency tasks. Impairment was found, mainly for individuals with the autistic disorder. However, based on the hypothesis of executive dysfunction in autism, we expected that problems with switching and using strategies would underlie the fluency impairment. To our surprise, this was not what we found. The verbal fluency impairment in the autistic disorder group could be attributed predominantly to the impaired processing speed that characterizes this specific group. Therefore, our results in verbal fluency do not point to impairment in executive functioning in high-functioning adults with ASD. This is in line with the lack of impairment in the WAIS-III factor scale 'Freedom from distractibility' for the two ASD groups. Performance in this factor scale has been thought to reflect working memory skills. Based on the hypothesis of executive deficits in ASD, impairment would be expected in the 'Freedom from distractibility' scale (Pennington & Ozonoff, 1996). Our findings demonstrate that impairment in executive functioning is less severe or at least more subtle in adults with ASD than we expected. This gives rise to the hypothesis that the theory of executive impairment is less central to autism than previously thought.

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6.2.5 *Autistic Disorder versus Asperger Syndrome*

The results of our studies demonstrated differences between the autistic disorder and Asperger syndrome in processing speed, while similarities appeared in the three cognitive areas that characterize ASD. More research is needed to examine whether the slowness in processing information in the autistic disorder group is related to the three cognitive theories that describe ASD. In general, our results are in line with the recent observation that the autistic disorder and Asperger syndrome have too many features in common to justify a distinction between the two disorders (Volkmar & Klin, 2005).

6.3 Clinical Implications

The results of the present studies can provide useful information about the strengths and weaknesses of adults with ASD in the following areas:

Our data showed that adults with the autistic disorder are impaired in their speed of processing information. This can strongly influence performance of daily-life tasks: Whereas it may often seem as if adults with the autistic disorder do not understand the information they receive from their environment, this may actually be due to their slowness in processing information. Adults with the autistic disorder will be able to use their qualities more adequately when they are given more time and when emphasis is put on perfection instead of working speed.

The results of our studies illustrated that self-reports can be a great help, not only in research but also in clinical practice. Self-reports can be valuable for examining strengths and needs, especially since the validity of neuropsychological instruments for assessing daily life skills is questionable (Chaytor et al., 2006). Moreover, self-reports are generally more specific in what they aim to measure, compared to neuropsychological instruments. Apparently, adults with ASD and a relatively high level of functioning and average to above average intelligence can have relatively good insight. For these individuals, their introspective ability can have a positive impact on opportunities in work and education. When people with ASD are able to recognize and express their strengths and needs, it will be easier for employers and teachers to match these needs and find employment and education programs that suit their cognitive abilities. This can enhance the employment prospects and the job satisfaction for individuals with ASD.

Another clinically relevant finding is that individuals with ASD report strengths in the area of detailed information processing and the tendency to use systemizing strategies. These strengths and preferences can lead educational and vocational opportunities. For instance in job placement it is important to be aware of the environmental and instructional conditions under which individuals with ASD can function

optimally. Considering the results of these studies, high-functioning adults with ASD may function best in a vocational or educational area in which there is little time pressure and social constraints are limited. Emphasis is put on perfection in a setting in which a systematic and detail-focussed approach is beneficial. In this respect, it is not surprising that previous studies list administrative, computer and technical professions as suitable for high-functioning adults with ASD (Howlin et al., 2005).

6.4 Limitations and Implications for Future Research

The present research project was undertaken with adults with average to high verbal abilities. Therefore, our results cannot be generalized to ASD populations with below average verbal abilities. This emphasizes the importance of examining similar cognitive features in adults with ASD and a below average intellectual ability.

Secondly, although the research groups were carefully selected and all participants had at least average verbal ability, deficiencies in semantic processing which are characteristic for individuals with ASD may have influenced performance, mainly in the self-reports. Furthermore, the lack of insight that has been associated with ASD (Frith & Happé, 1999, Hobson, 2005) also warrants caution with the clinical use of self-reports. Therefore, the self-reports should, when possible, be used together with anamnestic and hetero-anamnestic information when investigating the strengths and impairments that characterize ASD.

Third, although our results did not point to impairment in executive functioning in the two disorder groups, we only examined verbal fluency and working memory. There is evidence that high-functioning adults with ASD show impairment in the Wisconsin Card Sorting Task (Rumsey & Hamburger, 1988) and the 'shift' task of the CANTAB (Ozonoff et al., 2004), which has been attributed to impairments in cognitive flexibility. It is possible that impairment in executive functioning is present in adults with ASD, but only subtle and restricted to certain areas. Further research is necessary to examine more thoroughly whether the theory of executive dysfunction is still relevant for high-functioning adults with ASD.

Finally, a proportion of our ASD individuals was diagnosed in adulthood. A late diagnosis has been hypothesized to be related to milder symptoms (Vermeulen, 2002). Although all individuals matched the diagnostic criteria for the autistic disorder or Asperger syndrome, the characteristics of our group may be somewhat different compared to an adult group in which all individuals were diagnosed at a young age. Therefore, we need to be careful about generalizing our results to all adults with ASD. Further research on adult groups,

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specifically those in which all individuals have been diagnosed early in life, may shed more light on this.

