Language and executive functioning in children with ADHD
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**Discussion and conclusion**

Following the order of the three research questions of this study, first language, then executive functioning, and lastly the relation between these two will be discussed in Sections 8.1, 8.2 and 8.3 respectively. The impact of these findings will be explored, also in relation to methodological issues. Suggestions for further research will be made in Section 8.4.

8.1 Language

The current study is the first to assess in detail language abilities in children with ADHD in the Netherlands. Within the group of psychiatrically impaired children studied by Blankenstijn and Scheper (2003) were ADHD children, but they were not specifically identified. Moreover, Geurts (e.g. 2004a) did study ADHD children, but only used a general language questionnaire.

We found significant differences between the group of ADHD children and the SLI and TD groups. Leonard (2000; also see Section 2.1.2) argued for a characterization of language problems in terms of profile differences, rather than in terms of delay or deviance. A pattern of profile differences reflects a different degree of delay across features. This study did find profile differences across language domains. As expected on the basis of previous research, ADHD children were mainly impaired in pragmatics, whereas SLI
children were clearly impaired in both grammar and pragmatics. SLI is primarily associated with grammatical problems, but pragmatic problems were not unexpected (see Table 2-3 for an overview). Interestingly, the new, fifth version of the diagnostic statistical manual of mental disorders, which is currently being debated, proposes the ‘social communication disorder’ as a new diagnosis. It encompasses persistent difficulties in pragmatics, across modalities, which affect social reciprocity. These should be present in early childhood and cause functional limitations. The pragmatic problems that were found in this study, both in the ADHD group and in the SLI group, would probably fit the criteria of this diagnosis, which is comparable to the diagnosis of ‘pragmatic language impairment’ that is used among speech language pathologists and clinical linguists (Bishop 2004, also see Section 2.1.2). The diagnosis in the DSM-5 would be welcome, because it would further enhance the awareness of the presence of language problems alone, or in addition to psychiatric impairments such as ADHD.

The grammar of children with ADHD was relatively spared in comparison with SLI children. SLI children, with their primary language problems, served as a benchmark for the secondary language problems of children with ADHD in this study. However, children in the ADHD group did have lower scores than children in the TD group on some grammatical outcome measures. Parigger (2010; using the same data of the same children as this study) examined four grammatical measures in more detail: the syntax scale score of the CCC-II-NL, the mean length of utterance in words in the frog story, the percentage of morpho-syntactic errors in the frog story, and the number of correct items on the sentence imitation

task. ADHD children had significantly lower scores than TD children on the first two, but not on the last two outcome measures. Moreover, 54% of the children with ADHD fell short on one or more of these measures, as opposed to 23% of the TD children. For 8% of the ADHD children, the problems were robust, that is, evident in all four measures. This was not the case for any of the TD children. In other words, individual ADHD children certainly can have grammatical problems, and these were sometimes masked by the group evaluations.

In order to explore the possibility that ADHD children fall into two groups, those with and those without language problems, we divided the ADHD group into two such subgroups. Previous studies have taken this approach at the outset of their research. We defined language problems in the ADHD group on the basis of two general language measures: the number of correctly repeated items of the sentence imitation test and the general communication composite of the language questionnaire. ADHD children who were performing below the cut-off on one or on both of these outcome measures were considered to have language problems. This resulted in a subgroup of 14 ADHD children with language problems (54%) and a subgroup of 12 ADHD children without language problems (46%). The ADHD subgroups were small, making it difficult to obtain significant results in a comparison of these two groups. In general, it must be concluded that there is no neat division between the two sub-groups on the outcome measures of the frog story and the non-word repetition task. Future research should thus make use of bigger sub-groups.

8.2 Executive functioning

Executive dysfunctions are seen in various disorders, not only in ADHD. Therefore, it is unclear how specific to a disorder executive
functioning deficits are. Pennington and Ozonoff (1996) already pointed to this ‘discriminant validity problem’, which was more elaborately discussed in Section 3.2. A possible solution to the problem would be to look for profile and level differences. That is, children with a specific disorder might be performing well on some executive functions, and poorly on others. Moreover, the severity of the impairment, thus per executive function, might differ across children with different disorders (cf. Leonard, 2000 – also discussed in the previous section).

This study examined the performance of children with ADHD and children with SLI on five executive functions measured non-verbally. This comparison had not been made before. A profile difference was found. ADHD children performed poorly on inhibition but well on working memory, planning, cognitive flexibility and fluency. SLI children did not show problems on any of the five aspects of executive functioning. On the basis of the literature, we expected to find problems with inhibition in the ADHD group (Section 3.2.1). We also expected to find problems in the SLI group, although this expectation was based on only a few available studies (Section 3.2.2). The result for the SLI children may be due to several factors. Of the studies discussed, most involved older children, possibly implying a more severe form of language impairment. Moreover, different tasks were used. Henry, et al. (2012) for example used the hand-fist Luria task, a task rather different from the SST task used here. Further research is thus necessary to investigate possible problems with inhibition in SLI children and to compare their performance to that of ADHD children.

There is considerable discussion in the literature on the use of different measures for executive functioning. Differences are found between clinical and typically developing groups, but it is still a question of further research as to whether these differences can be interpreted as a problem with an executive function or as a problem
with a certain task. In a critical review of cognitive flexibility tasks for example, Geurts, Corbett and Solomon (2009) highlight the discrepancy between the observation of inflexible everyday behaviors in autistic children on the one hand and the lack of consistent evidence for cognitive flexibility deficits from experimental tasks on the other.

8.3 Language and executive functioning

An association between pragmatic language problems and problems with executive functioning, as predicted by Tannock and Schachar’s model (1996), was not found. The model could therefore not be supported.

The question of overlap between symptoms of inattention/hyperactivity-impulsivity, language problems and/or reading problems was discussed in Section 5.7.2. The large amount of overlap as found in this study was expected on the basis of the literature (also see Section 2.3 and, in particular, Figure 2-1). Although we did not report on this overlap in relation to executive functioning, we will briefly explore the issue here. A look at the SSRT scores of the inhibition subtest shows that out of the eight children with a score equal to or more than one SD below the mean, only one belonged to the ADHD-only group. Two were in the ADHD group with language problems, and one more was in the group with language and reading problems. However, four were in the ADHD group with both language problems and reading problems. Clearly, clustering of various symptoms is fairly common and we know that children with clustered problems are generally more impaired (e.g. Leonard, 2000). The question thus arises what the status of each label is, and this will have to be addressed in future research. Qualitative analyses will also be important, because then, as we have seen, quantitative analyses can easily mask individual differences.
In contrast to children with a cluster of problems, there were also children in this study who were performing relatively well, and only showed symptoms of one or two of the four domains presented above (symptoms of inattention/hyperactivity-impulsivity, language problems, reading problems, executive dysfunctioning). For example, half of the ADHD children had no problems with executive functioning at all. Sonuga-Barke (e.g. 2002; 2003; 2005, also see Section 6.2.2) already concluded that executive dysfunctioning alone cannot explain ADHD and proposed multiple developmental pathways to ADHD. Instead of executive functioning, other underlying processes, such as reward processing, may also play a role in the development of ADHD. Environmental factors are probably important as well. For example, Pelsser (2011) reported a rather large effect of a restricted elimination diet on symptoms of ADHD. If it is indeed the case that other factors than executive functioning can cause ADHD, it is not surprising that we found ADHD children without signs of executive functioning problems and also without pragmatic language problems. This could also be predicted by Tannock and Schachar (1996). However, the presence of ADHD children with executive dysfunctioning problems but without pragmatic problems, or, even more problematic, without executive dysfunctioning problems but with pragmatic language problems, cannot be explained. These cases constitute further evidence against their model.

8.4 IMPLICATIONS AND FURTHER RESEARCH

The results of this study clearly show that a clustering of problems can occur in ADHD children. More attention must be paid to the co-occurrence of ADHD and language/reading problems in clinical practice. In the Netherlands, this is generally not the case. A child with inattention/hyperactivity-impulsivity symptoms will go to a
psychiatrist and/or psychologist. On the other hand, a child with language and/or reading problems will visit a clinical linguist and/or speech-language therapist. These are two separate diagnostic and treatment channels. The most salient problems initially get the most attention and the focus tends to remain on the one type of problem since the child usually stays within one channel. There are only a few places, for the most complicated cases, where the two disciplines work together. An interdisciplinary approach should be more common, also for less severe cases. In the case of a child with ADHD underperforming in class, the teacher is likely to attribute this to the symptoms of inattention and/or hyperactivity-impulsivity. The child could be helped more adequately if the poor school performance could be also related to co-morbid language and/or reading problems.

In the discussion of the above issues, suggestions have been made for future research. In addition, Karmiloff-Smith (1998) already pointed out that different disorders might be considered to lie on a continuum rather than to be truly specific. This is applicable to both the ADHD and SLI children in this study. Karmiloff-Smith therefore proposed that:

‘Rather than concentrate on the study of disorders solely at their end state in school-aged children and adults, which is most commonly the case, it becomes essential to study disorders in early infancy, and longitudinally, to understand how alternative developmental pathways might lead to different phenotypical outcomes.’ (Karmiloff-Smith, 1998: 397)

This proposal needs to be taken more seriously in future work.