The Adult Developmental Coordination Disorders/Dyspraxia Checklist - German: Adapted factor structure for the differentiation of DCD and ADHD

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Author Note: Pilot data of this project was presented at the First Congress of the European Association of Clinical Psychology and Psychological Treatment in Dresden, Germany. The finalized German-ADC and revised English questionnaires will be uploaded to the repository MADOC upon acceptance of the manuscript for publication.

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Abstract

Background: The Adult Dyspraxia/DCD Checklist (ADC) is the only existing self-report questionnaire to screen adults for potential Developmental Coordination Disorder (DCD). It was developed in English and Hebrew, however, its factor structure has not yet been assessed.

Aims: The goals of the current study were to (1) develop and refine a German translation, (2) explore the emerging factors in a new and restructured ADC in German and apply this structure to an English ADC, and (3) explore its potential for distinguishing DCD versus ADHD.

Method: In a series of three studies, we assessed comprehensibility of the translation and revisions to the questionnaire. We further examined subscale structure in a sample of *N*=148 individuals with DCD or ADHD and retested it in an English-speaking sample (*N*=134).

Results: Overall, we found decent reliability and construct validity for the German ADC. Three components emerged with themes of fine motor coordination, gross motor coordination, and executive functions which had strong psychometric properties in German and English.

Conclusions: The studies collectively highlight the German translation is effective and has strong potential to differentiate DCD and ADHD. Most notably, there are unique symptom profiles in motor and executive functioning difficulties in adults with DCD or ADHD.

What this paper adds?

The translation and preliminary validation of the German ADC in this study has the potential to screen for probable DCD in German-speaking adults for the first time. In addition, the new subscale structure can be generalized to the English version as well and allows for the potential assessment of several key symptomatic patterns in the realms of gross motor, fine motor, and executive functioning skills that differ between adults with DCD and ADHD. These

differences were fairly consistent between English- and German-speaking samples, indicating potential for more widespread assessment and differentiation of DCD and ADHD.

Keywords: motor difficulties, executive functions, neurodevelopmental disorders, factor analysis, questionnaire translation

1.1 Introduction

Developmental Coordination Disorder (DCD) is a neurodevelopmental disorder which primarily affects fine and gross motor skills (American Psychiatric Association, 2013). It is now understood that DCD persists into adulthood in a majority of cases, often creating difficulties in university and work settings (Tal Saban & Kirby, 2018). One of the few available screening tools and self-report measures for DCD in adults is the *Adult Developmental Co-ordination Disorders/Dyspraxia Checklist* (ADC), created in English and Hebrew (Kirby et al., 2010). The ADC is an important tool for strengthening the diagnostic process, treatment, and research on adults with DCD. It is important to test the checklist further so that the ADC is available for more cultural groups and in other languages (Kirby et al., 2010). There are few tools for DCD available in German and, to our knowledge, no existing self-report measures for adults in German (Meachon et al., in press). Therefore, one purpose of this paper is the translation and assessment of a German ADC to make this available to German-speaking adults with DCD for the first time

In addition, individuals with other neurodevelopmental disorders, but not DCD, can score high on the ADC. This can be attributed to its assessment of several features which overlap with other neurodevelopmental disorders, especially ADHD (e.g., fidgeting behaviors, trouble concentrating). Given that DCD co-occurs with ADHD in up to 50% of cases (Blank et al., 2019), this must be explored in more detail. Therefore, another purpose of this paper is to explore the potential for the ADC to distinguish cases of DCD versus ADHD.

We begin with a global introduction by describing the functionality of the ADC, and the importance of maximizing its links to various symptomatic differences between DCD and

ADHD. We then present a series of three studies designed to expand the diagnostic classification capacities of the ADC.

1.1.1 The ADC: Purpose, Structure, and Implementation

A variety of primary and secondary symptoms of DCD are often reported to persist into adulthood (Purcell et al., 2015; Tal Saban & Kirby, 2018). In addition to executive functioning difficulties, adults with DCD are more likely to have symptoms of state and trait anxiety, depression, and generally lower well-being than non-affected peers (Hill & Brown, 2013; Kirby et al., 2013). The inclusion of several items beyond motor impairments makes the ADC a valuable tool to support the growing research of secondary symptoms in DCD.

The ADC contains 40 items which are organized in three subsections. Subsection A includes items about symptoms experienced in childhood, items in subsections B and C are about currently experienced symptoms (in adulthood). Subsection C, more specifically, includes social aspects of symptoms; as the authors describe it, symptoms "manifested by others" (Kirby et al., 2010). Each of the three subsections and the entire questionnaire had strong internal validity ($\alpha >$ .85) in the original study (Kirby et al., 2010). In addition, the subscale and total scores were significantly higher for all sections in a group of students with DCD and significant motor difficulties compared to unaffected controls (Kirby et al., 2010).

The ADC was designed to identify individuals at risk for DCD and those with probable DCD (Kirby et al., 2010). While it cannot be used exclusively to diagnose DCD, important information for clinicians in the diagnostic process can be derived from the ADC. For one, it provides a retrospective glimpse into symptoms experienced in childhood with Subscale A to support the DSM-5 criterion that symptoms must begin in childhood (American Psychiatric Association, 2013). Furthermore, the ADC is particularly useful to help clinicians determine if

individuals are experiencing difficulties in their everyday lives to address DSM-5 criterion B:that the motor difficulties must impair daily life (American Psychiatric Association, 2013). The ADC can also be used in an interview format, for which a clinician can ask follow-up questions about the items noted as frequent problems. Thus, an insightful first impression of pertinent symptoms and insights in the consideration of a DCD diagnosis can be gained with the ADC.

The ADC has been used to address DSM-5 criteria B (the motor deficits impact daily life in leisure, self-care, work, school, and play) and C (the difficulties begin in childhood; American Psychiatric Association, 2013) in various research contexts. This includes the allocation of individuals with potential DCD into groups (e.g., Hyde et al., 2018), the confirmation of a lack of movement difficulties in a control group (e.g., Du et al., 2015), and the assessment of executive functioning challenges in adults with DCD (e.g., Rosenblum, 2013). It can also be supplemented with various motor screening tools, however the current gold standard motor tests screen for likely DCD in youth (e.g., MABC-2; Henderson et al., 2007; BOT-2, Bruininks & Bruininks, 2005), and have not been validated in adults (ages 16+ and 21+, respectively). Further, ADC scores do not necessarily correlate positively with objective motor skill measures (e.g., Li et al., 2019) but this could be attributed to the questionnaire scoring scheme not distinguishing motor versus non-motor dimensions (Barnett, 2014).

Importantly, the evaluation by a professional clinician is crucial to the diagnosis of DCD; it cannot be based solely on ADC scores. This is, in part, due to substantial symptom overlaps between DCD and other neurodevelopmental disorders (e.g., ADHD, Autism Spectrum Disorders [ASD], Dyslexia), which can be challenging to distinguish (Cleaton & Kirby, 2018). Therefore, the ADC is not yet a tool for indication of any differential diagnosis.

1.1.2 The Co-occurrence of DCD and ADHD

Differentiation of DCD and ADHD is a particular limitation of many screening tools. In addition to the high co-occurrence between DCD and ADHD, there have also been reports of symptomatic overlaps between the two disorders (e.g., Goulardins et al., 2015; Pearsall-Jones et al., 2009). This has been noted even when participants have just one of the two disorders (Meachon et al., 2021; Querne et al., 2008). Despite the primary motor symptoms of DCD, there is evidence that individuals with DCD may exhibit executive functioning difficulties in childhood (e.g., Bernardi et al., 2018), and adulthood (Tal Saban et al., 2014). Similarly, while the primary symptoms of ADHD involving inattention, hyperactivity, and impulsivity, there is evidence that motor skills can also be impaired in those with ADHD compared to typically developing children (e.g., Kaiser et al., 2015). However, symptom profiles for motor deficits are not yet established for ADHD (Athanasiadou et al., 2020). With a high rate of co-occurrence, and increasing evidence of similarities between the two conditions, the ADC profiles among those with DCD and ADHD need to be examined.

1.1.3 Overview of Studies 1-3

A series of three studies was designed to create an effective German version of the ADC and to examine its potential to distinguish cases of DCD versus ADHD. A two-tiered recruitment effort was needed due to general challenges in recruiting German-speakers with a confirmed DCD diagnosis. First, in Study 1, we pilot-tested an initial translation of the ADC into German. We then implemented feedback from participants of Study 1 and tested a revised ADC in Study 2, conducted online to reach a larger sample. For studies 1 and 2, we expected our German translation of the checklist would contain (1) satisfactory reliability, (2) construct validity through significantly elevated scores on the ADC for participants with DCD versus controls, and (3) construct validity in the three subscales as well as overall for the translated questionnaire. In

Study 2, we also examined if the three subsections from the original measure could be optimized following a principal component analysis in order to differentiate between cases of DCD and ADHD. Finally, in Study 3 we tested the new factor structure with a separate set of English-speaking respondents compiled from previous independent studies using the original ADC. We expected that the new structure's functionality would hold across language groups. We present the method and results chronologically for each of the three studies and conclude with an overall discussion.

2.1 Method: Study 1, A Pilot Test of the German ADC

2.1.1 Questionnaire Translation

Items in the original ADC (Kirby, et al., 2010) were translated from English into German with a structured forward-backward translation. More specifically, the questionnaire was run through translation software (www.deepl.com) for English to German, then the translation was independently corrected for fluency and clarity by three native German-speakers bilingual in English and back-translated from German to English with the supervision of one native English-speaker and one native German-speaker. This initial translation was formulated to be as close as possible to the original questionnaire.

2.1.2 Participants

Study 1 consisted of n = 19, participants with n = 8 with a DCD diagnosis or self-reported severe coordination difficulties and n = 11 control participants matched by age, gender, and nationality for descriptive purposes. The participants were all native German-speakers, 37% students, 68% female, and an average age of 26.8 years old (SD = 6.1; Range = 18–35). Only one of the participants in the DCD group reported having other co-occurring conditions (mood disorder and auditory processing disorder).

2.1.3 Procedure

Participants were recruited at a German University, and in local psychotherapy, physiotherapy, or physical therapy clinics. To ensure our translation of the questionnaire into German was comprehensible and that the items are relevant to individuals with DCD, we used a cognitive interviewing approach. This qualitative method assesses cognitive processes involved in answering a questionnaire, such as how respondents interpret certain terms or entire questions (Willis, 2004). Participants filled out the questionnaire independently at their own pace and were then asked about their impressions of the questionnaire.

Participants were compensated for participation with €5 per half-hour. Study 1 and all following studies were reviewed by the local ethics committee and complied with ethical and data protection standards.

2.2 Calculations

Responses on the questionnaires corresponded to the following values: *Never* = 0, *Sometimes* = 1, *Frequently* = 2, *Always* = 3. Sum scores were derived for each subscale and total score, with possible range of total scores from 0 to 120. The original subscale scores have the following possible ranges: Subscale A: 0–30 (Items 1–10); Subscale B: 0-30 (Items 11–20); Subscale C: 0-60 (Items 21–40). Subscale A cutoffs were previously established for scores ≥ 17 indicating likely DCD in childhood (Kirby et al., 2010). In addition, a total score of ≥ 56 indicates being at risk for DCD and ≥ 65 indicates probable DCD (Kirby, 2011). We descriptively assess the specificity of these cutoff criteria in the present study.

To determine internal reliability, Cronbach's alpha (α) was calculated for sum scores of each subscale and the entire questionnaire. For indication of internal consistency, bivariate, two-

tailed correlations were calculated. Construct validity was determined with independent *t*-tests for sum scores of each subscale and the total scores.

To determine if group differences could be identified in ADC scores in the pilot and main study, the original subscales and total scores were compared descriptively and via independent samples *t*-tests for individuals with DCD versus those with no diagnosis. To test the assumption of equality of variances in these *t*-tests, Levene's test was computed. In the event the assumption was violated, a *t*-test with unequal variances is noted and reported instead. Reported effect sizes are with the Cohen's *d* statistic. All statistical analyses throughout the paper were conducted with IBM SPSS version 25.

3.1 Results: Study 1

3.1.1 Internal Reliability and Internal Consistency

Cronbach's Alpha values indicated strong reliability in each of the original subscales for the pilot test (A: Childhood symptoms, $\alpha = .904$; B: Current symptoms, $\alpha = .897$; C: Current symptoms manifested by others, $\alpha = .922$; and overall, $\alpha = .966$). All three subscales and total scores correlated strongly (see Table 1).

3.1.2 Construct Validity

Scores on the three subscales and the total score were higher in the DCD group ($M = 64.1$, $SD = 17.9$) compared to matched controls ($M = 23.2$, $SD = 11.6$) and this difference was highly significant $t(17) = 6.1$, $p < .001$ with a very large effect size ($d = 2.7$). Scores differed significantly in all subscales such that the DCD group scored higher than the control group (see Table 1). Differences in scores were less pronounced on subscales B and C, with subscale C showing the most overlap between groups (see Figure 1A for a visualization of all scores).

Finally, scoring cutoffs suggested by Kirby et al. (2010) were assessed. With these criteria, pilot participants in the control group were all correctly labelled as below threshold, but two participants with DCD scored < 17 in subscale A, and < 57 in their total scores.

3.1.3 Feedback-based Questionnaire Revisions

Through the feedback from participants in Study 1, several additions and changes were made to the questionnaire which deviate from direct English to German translations. First, we added examples to two items which were reported as ambiguous by participants in the pilot. Item 33: *Do you have difficulties preparing a meal from scratch?* was extended with the following: *e.g., measuring and chopping food*. In addition, Item 34: *Do you have difficulty packing a suitcase to go away*, was difficult for participants to answer in Study 1 because the item did not explicitly differentiate between the mental planning and physical placement aspects of packing a suitcase. To resolve this, we extended Item 34 to also include: *e.g., stowing items neatly in the suitcase, closing the suitcase*. Furthermore, we added another item to the questionnaire to cover the planning aspects, more specifically probing: *Do you find it difficult to think of the items you will need to pack for a trip?*

A number of participants expressed difficulty in answering several questions which did not apply to them for various reasons (e.g., Item 3: *As a child did you have difficulties riding a bike compared to your peers*, or Item 32: *If you are a driver, do you have difficulty parking a car*). More specifically, in Item 32, participants do not have the option to indicate if they are not a driver, and why. Therefore, we added a “does not apply” option to several items and requested paticipants expand on this with an explanation of why the item does not suit them.

We also considered the possibility that individuals with DCD may sometimes choose not to attempt these activities (e.g., bike riding or driving) due to their coordination difficulties. For

this reason, we decided to include the option “does not apply” for items 3, 25, 30, and 32 with follow up explanations requested for participants who selected “does not apply.” This additional probing stands in the place of a researcher or clinician being able to ask follow-up questions for how these items should be answered in individual cases.

Finally, a panel of bilingual (German/English) researchers reviewed the revised questionnaire and a final version was produced (see Appendix A). This final version deviates slightly from the original ADC for the benefit of increased fluency and comprehension among German-speakers, and was tested in Study 2.

4.1 Method: Study 2, Retesting the ADC and Identifying Factors

4.1.1 Participants

A total of $N = 153$ participants with a previous diagnosis of DCD and/or ADHD completed the final version of the German ADC. We excluded $n = 4$ participants for leaving 10% or more of the checklist blank (4 or more items), and $n = 1$ participant who did not report a diagnosis of DCD, ADHD, or relevant difficulties. Thus, $N = 148$ participants with DCD and/or ADHD were included in the analysis. More specifically, $n = 17$ had a diagnosis of DCD, $n = 131$ had a diagnosis of ADHD, among those $n = 9$ participants had both conditions but remained in the DCD-mixed group for analysis purposes. The main study participants were 34.7 years old on average ($SD = 11.1$ years), including 63% women, 34% men, and 3% transgender or non-binary. A majority (88%) reported living in Germany, 6% in Switzerland, 2% in Austria, 2% elsewhere, and the remaining 2% did not specify a country of residence. All participants who completed the questionnaire indicated they had a level of high fluency or native speaking ability in German. Forty-three participants reported having at least one co-occurring condition such as a non-

specified Specific Learning Disability (*n* = 4), ASD (*n* = 6), Dyslexia (*n* = 5), Dyscalculia (*n* =1), and a depression and/or anxiety disorder (*n* = 27).

An additional *n* = 15 German-speaking participants with no history of any psychiatric or other medical conditions were recruited as a control group for construct validation of the questionnaire. These participants were descriptively matched to the demographic profiles of the participants with DCD by age (+/- 2 years), gender, and country of residence, *n* = 3 matches were used for two participants with DCD.

4.1.2 Procedure

Study 2 was conducted entirely online in order to reach a larger sample. We subsequently expanded recruitment to include posts on social media and websites for organizations supporting individuals with ADHD or DCD.

Participants completed the ADC without the structured feedback that took place in Study 1. In line with the original ADC, we also asked for history of specific conditions, including DCD/Dyspraxia, Dyslexia, ADHD or ADD, ASD or Asperger's Syndrome, Specific Learning Disabilities, and other conditions (Kirby et al., 2010). We further screened for history of brain injury or physical disabilities that could otherwise explain DCD (e.g., Cerebral Palsy). Further testing of the checklist was combined with other online studies. All participants had the option to enter for a chance to win a gift card at the end of the study as compensation for their participation.

4.2 Calculations

Initial scoring, reliability, internal consistency, and construct validity were determined with the same calculations as Study 1. To determine if group differences exist between those

diagnosed with DCD, ADHD, or neither, score comparisons were assessed with a One-Way ANOVA and to compare scores between groups, Tukey's HSD post hoc test was used.

In order to assess the existing subscale structure of the large questionnaire, a principal component analysis (PCA) was conducted and identified component loadings as Eigenvalues (λ). The PCA is appropriate due to its capacity for dimension reduction in this large, 40-item questionnaire, with minimal data loss (Lever et al., 2017). To determine the number of fixed components we followed indication from a scree plot. The *varimax* rotated component loadings are reported as the main indication for a new subscale structure.

In the event that a participant selected the "does not apply" option for one or more items, we assessed the explanation given by the participant to determine a prorated score. For example, if a participant indicated they never learned to drive due to fear they could not manage the motor load, we prorated their response to reflect substantial difficulty ("always"). In the event a participant did not respond, we coded this as a non-response and did not add or subtract points to the sum score for this item.

5.1 Results: Study 2

5.1.1 Reliability and Internal Consistency

Following the aforementioned changes, the final version of the German questionnaire was tested with a larger sample. There was strong reliability on each of the original subscales and overall scores for participants in the DCD-mixed and control groups (A: Childhood symptoms, α = .926; B: Current symptoms, α = .891; C: Current symptoms manifested by others, α = .927; Total Score, α = .971). All subscales and the total ADC scores correlated strongly and positively for the DCD and control groups as well (see Table 1).

In addition, there was moderate to strong reliability on all subscales and total scores for participants in the DCD-mixed and ADHD groups. High reliability was found for the entire checklist (α = .896) and subsection C (α = .807), and moderate (but still satisfactory) reliability was shown in subsections A (α = .744) and B (α = .742).

5.1.2 Construct Validity

The average total scores were 64.88 (*SD* = 18.52) for the DCD group; 59.47 (*SD* = 15.94) for the ADHD group; and 17.87 (*SD* = 9.93) for the control group. There was a significant effect of group (DCD, ADHD, and Control) on the original three subscales, A: childhood difficulties [$F(2, 160) = 35.02$, $p < .001$], B: current symptoms [$F(2, 160) = 26.03$, $p < .001$], C: current symptoms manifested by others [$F(2, 160) = 40.08$, $p < .001$], and sum scores [$F(2, 160) = 49.54$, $p < .001$]. Post hoc testing with Tukey's HSD revealed mean differences were not present in the comparison of the DCD and ADHD groups on Section B, C, and total scores.

In addition, scoring cutoffs noted by Kirby et al. (2010) were assessed. With these criteria, all participants in the control group were correctly allocated, however four participants with DCD scored below 17 in subscale A, and three participants with DCD scored below 57 in their total scores. Among participants with only ADHD, 89 out of 131 participants were correctly classified for subscale A, and for total scores, 71 out of 131 participants were correctly allocated with these criteria.

5.2.1 Principal Component Analysis

To determine the component structure for the ADC, a principal component analysis (PCA) was performed, and included those with DCD and/or ADHD (*N* = 148). A scree plot revealed three main component loadings. Therefore, we fixed the component number to three, and ran the analysis with a *varimax* rotation. The rotated component matrix revealed most items

have strong loadings ($\lambda > .300$) in three categories (see Supplemental Materials). Three unique themes emerged from the analysis, including (1) items about gross motor coordination, (2) items regarding fine motor coordination, and (3) items involving executive functions. Four items (8, 21, 28 and 31) had weak loadings, indicating no apparent match to any subscale. In one case, an item (1) originally from subscale A (Childhood symptoms), loaded nearly equally onto two factors (fine motor and gross motor). Due to this item specifically addressing fine motor tasks, it was allocated in this subscale for the consecutive analysis.

5.2.2. Reliability, Construct Validity, and Internal Consistency of New Components

We assessed the internal reliability for the sums of the new subsections and overall questionnaires with and without weakly loaded items removed, and all subscales were fair to strong with improved reliability when the weakly loaded items were removed from the analysis (see Supplemental Materials).

There was a significant effect of group (DCD, ADHD, and Control) on the three new subscales, including gross motor [$F(2, 159) = 24.88$, $p < .001$], fine motor [$F(2, 159) = 16.37$, $p < .001$], executive functions [$F(2, 159) = 46.87$, $p < .001$], and sum scores [$F(2, 157) = 40.62$, $p < .001$]. Post hoc testing with Tukey's HSD revealed the between-group differences held at the 5% significance level for all group comparisons aside from DCD versus ADHD in the fine motor subscale and total scores.

6.1 Method: Study 3, A Confirmation of the New ADC Factors in an English Sample

6.1.1 Participants

To compare factors which emerged from the German version, responses from the original ADC for $N = 134$ English-speaking participants were compiled. Data was sourced from other studies at [blinded], and included adults with a diagnosis of DCD ($n = 52$), ADHD ($n = 32$), both

DCD and ADHD (n = 16), and a typically developed control group (n = 16). Some participants in the sample had co-occurring diagnoses other than DCD and ADHD, including Dyslexia (n = 19), ASD (n = 14), Dyscalculia (n = 2), Dysgraphia (n = 1), or anxiety and/or depression (n = 2), OCD (n =1), or an unspecified Learning Difficulty (n = 8).

6.2 Calculations

Scores in Study 3 were calculated based on the new questionnaire format (36 items and 3 new subscales). Other calculations to compare groups are in line with Study 2.

7.1 Results: Study 3

7.1.1 Analysis of an English-Speaking Sample

Finally, we examined the new subscales from a parallel study and preexisting ADC data from English-speakers. The average total scores were 63.44 (SD = 15.39) for the DCD group; 51.25 (SD = 16.81) for the ADHD group; 71.57 (SD = 11.80) for the DCD + ADHD group; and 19.31 (SD = 12.76) for the control group. Reliability was strong for each of the new subscales (Gross Motor, α = .892, Fine Motor, α = .876, Executive Functions, α = .845) and for total scores (α = .944). Internal consistency was also strong (see Table 2).

There was a significant effect of group on the three new subscales, including gross motor [$F(3, 128) = 41.70$, $p < .001$], fine motor [$F(3, 128) = 24.0$, $p < .001$], executive functions [$F(3, 130) = 22.45$, $p < .001$], and sum scores [$F(3, 126) = 42.78$, $p < .001$]. Post hoc testing with Tukey's HSD revealed several scores were not significantly different at the 5% level between clinical groups. This included the average scores on all subscales and total scores for the DCD versus DCD + ADHD group; and the executive functioning subscale scores were only significantly different for each clinical group compared to the control group, but comparisons between clinical groups were effectively equal for this subscale.

More specific comparisons between the DCD and control group were replicated and the DCD group scored significantly ($p < .001$) higher on all new subscales and in total ADC scores. See Supplementary Materials for DCD-control group comparisons.

8.1 General Discussion

DCD is a common neurodevelopmental disorder which persists into adulthood and there is a dire need for more appropriate instruments to indicate risk and symptom profiles for DCD in adults. The present series of studies indicate that the ADC can close this gap and identify symptom profiles that distinguish DCD and ADHD. Studies 1 and 2 showed that the German version of the ADC is well-received and comprehensible, while simultaneously revealing opportunities for improvement of the questionnaire. Strength of the original ADC was shown via decent reliability and construct validity between DCD and control groups with large effect sizes in Study 1. In this phase, a direct translation from German to English was tested with no revisions to the questionnaire. Thus, there was evidence the original ADC may be functional in distinguishing DCD symptoms from typically developed adults in German in its original form. However, in Study 2 it became clear a new subscale structure is needed in order to improve differentiation of DCD and ADHD. Differences between scores in these groups were only present in Section A, regarding childhood difficulties, and not in sections B and C about current symptoms in adulthood. This indicates that the difficulties in childhood may be reported to be more prevalent when one has DCD, and further, that childhood differences might differentiate those with a diagnosis of DCD, or DCD + ADHD, versus only ADHD. This is in line with the general notion that symptoms must be present in childhood for a DCD diagnosis (American Psychiatric Association, 2013), and that, by adulthood, individuals with DCD might learn to compensate for their symptoms (Wilmut, 2017). In sum, a direct translation of the original ADC

was sufficient, but a revised subscale structure showed evidence for even greater efficiency of the German ADC to identify individuals with DCD or DCD and ADHD versus participants with just ADHD.

Similarly, the testing of existing cutoff scores revealed areas for improvement. For one, there was a lack of overlap in total ADC scores for DCD and control groups visible in Study 1, but cutoff criteria for total scores were imperfect in distinguishing the groups (see Figure 1). There was some overlap in Study 2, a retest of the German ADC, and when cutoff criteria were applied to an ADHD group, even greater discrepancies were present. This reveals that the criteria are functional in some cases, but may differ based on sample size, or cultural differences in reporting of symptoms. Furthermore, cutoff criteria are especially poor in classifying participants with ADHD as not having DCD. This could reflect an issue far beyond the ADC, in that some individuals might be incorrectly diagnosed with ADHD or lack a DCD diagnosis. Most importantly, existing cutoff criteria should not be used as the sole determinant in a DCD diagnosis or DCD group classification. Future studies should examine the sensitivity and specificity of these cutoff criteria in more detail in the original ADC structure and newly presented structure in this paper.

Areas for improvement and optimization of the German ADC were also noted by participants in Study 1, a pilot test of the German translation, primarily for functional aspects of the questionnaire. The subsequent changes that were implemented allowed for increased interpretability and clarity of the German ADC. This is supported by our results in Study 2 showing strong potential for this revised ADC through strong reliability, internal consistency, and construct validity. Our changes to the ADC should be tested further in future studies,

especially in other languages to assess if they are also effective beyond our assessment in Study 2.

The most profound findings in Study 2 were the identification of new data-driven subscales, derived from a PCA. The three new data-driven subscales were identified and supported with further analysis, suggesting there are different themes to the ADC than the original structure in our sample of German-speakers with (primarily) ADHD, and DCD. We interpreted these new themes as: gross motor coordination, fine motor coordination, and executive functions, which are all symptom-based themes rather than temporal, as in the original ADC. Furthermore, fine and gross motor coordination are widely-known as core symptoms of DCD (Blank et al., 2019), and executive functions, while not official symptoms, are thought to be highly prevalent in cases of DCD (Bernardi et al., 2018; Leonard & Hill, 2015; Tamplain & Lage, 2019), including in self-reports of adults (Tal Saban et al., 2014). Using the symptom-based subscales scores, significant differences were indicated in post hoc tests between the DCD and ADHD groups for two subscales (gross motor and executive functions) as opposed to only one distinguishing subscale in the original structure. This indicates that items in the ADC can be organized to reveal differences in scores between participants with DCD and only ADHD, but only when examining symptom-based subscales rather than overall scores. More specifically, the DCD group reported struggling more with gross motor coordination while the ADHD group struggled more with executive functions. These unique symptom profiles align with the primary symptoms of motor deficits in DCD versus executive function deficits in single-occurring ADHD.

While factor consistencies for most items were found within the new subscales, there were four items (8, 21, 28, 31) which did not load well in the PCA and had to be removed,

potentially due to symptomatic profile inconsistencies in this sample. Items 28 and 31, regarding the desire to spend time alone (item 28) or to go dancing at a club (item 31), are not necessarily applicable to the primary symptoms of DCD. More specifically, social interactions and support have been reported to be limited for those with DCD (Chen & Cohn, 2003), including adolescents (Tal Saban & Kirby, 2019), but social consequences are more likely secondary symptoms of DCD which do not apply to the gross motor, fine motor, or executive function subscales. Responses to items 28 and 31 could be more broadly based on general social preferences independent from DCD. Item 8, regarding learning to play a musical instrument, also did not fit to any of the new symptom-based subscales. While this skill has a motor link, the experience or opportunity to learn to play an instrument may involve other cultural factors beyond DCD (e.g., socioeconomic status). Finally, item 21, about sitting still and appearing fidgety, addresses hyperactivity and is more relevant to ADHD as a core symptom (American Psychiatric Association, 2013) than DCD. Notably, even with a particularly large ADHD group, item 21 did not load sufficiently into one of the three new subscales. This could be due to more adults with ADHD in this sample having predominantly inattentive profiles than hyperactive profiles, or simply that hyperactivity does not fall into the category of motor coordination or executive functions. It has been considered that motor impairments and inattention might be genetically linked (Martin et al., 2006) and that they have similar etiological networks, but not enough information exists to identify the finite symptomatic profiles of DCD versus ADHD (Goulardins et al., 2015). It is also plausible that the primary symptoms of DCD and ADHD each contribute to respective weakened executive functioning and motor skills (e.g., Kaiser et al., 2015). However, hyperactivity may still be relevant to children with DCD (Harrowell et al., 2018), and should be examined further in future DCD research among all age groups.

Finally, with an English-speaking sample, Study 3 serves as an important replication of the three new subscales. Study 3 included a larger number of participants with DCD only, as well as enough participants for a group with co-occurring DCD + ADHD, and a closer look into differences between these groups was achieved. The subscale scores showed similar patterns to the German-speaking sample, with the addition that the DCD and DCD + ADHD groups were effectively equal in post hoc comparisons for all subscales and total scores. This confirms there is high relevance in the ADC to those with DCD alone and with DCD + ADHD. The relevance to DCD is strong enough that there were still differences observed in fine and gross motor subscales between the ADHD and DCD + ADHD groups. However, the executive function subscale scores were not different between any clinical groups, providing further evidence that executive functioning difficulties are experiences among individuals with DCD, even without ADHD.

While many aspects of the symptomatic overlap between DCD and ADHD remain unclear (Meachon et al., in press), the present findings provide noteworthy evidence that, overall, adults with either DCD or ADHD are struggling more with symptoms listed in the ADC than adults without these conditions. Across all new symptom-based subscales and total scores, the control group consistently differed significantly in scores from all clinical groups. This emphasizes the notion that a majority of adults with DCD have continued symptom-related challenges and may benefit from intervention later in life (Blank et al., 2019; Niklasson et al., 2015; Tal Saban & Kirby, 2018). This is also supported for those with ADHD, given that symptoms persist into adulthood for an estimated 40-60% of individuals (Volkow & Swanson, 2013). Furthermore, the lack of differences in sum scores for DCD and ADHD groups does not mean there are no differences present in specific symptom profiles. This was shown in the

variety of differences present between DCD and ADHD groups in our analysis of the new subscale scores. Thus, when testing individuals with ADHD versus DCD, we suggest restructuring the questionnaire from its original three subscales and their temporal structuring (i.e., Subscale A covers childhood, B and C correspond to adulthood) to a new set of three based on symptomatic themes instead (see Appendix B). This potential use of the ADC to distinguish cases of DCD and ADHD with the new subscales should be replicated and examined further in future research. More consideration should also be given to the potential for testing new patient groups (e.g., adults with ASD) to compare and contrast symptoms profiles with DCD.

8.2 Limitations

There are several limitations of this study which must be noted. First and foremost, while we requested participants completed the study only if they have a diagnosis of DCD and/or ADHD given by a professional, for data protection purposes we could not request proof of a diagnosis, nor did we have any confirmatory diagnostic interviews in the studies. Therefore, we cannot control for potential differences which may arise in the path of diagnosis (e.g., forms of assessment differing between regions and professionals). Furthermore, individuals who did not indicate a preexisting diagnosis were not included in the main study. It must be recognized that this can bias the sample in that not all individuals of all backgrounds have equal access to the resources (e.g., costly in money and time) needed to get a diagnosis of DCD and/or ADHD.

Next, the sample of German participants with DCD was particularly small, and mixed with some who also had ADHD in Study 2. Furthermore, while we included a larger sample in the PCA, the majority were participants with ADHD, and, naturally, this larger group drove the PCA more than the small DCD group. Therefore, the group differences should be seen as preliminary, and promising evidence comes from the functionality of the subscales in Study 3.

Further, while PCA is an informative method of analysis to identify clusters in questionnaire data (Lever et al., 2017) with minimal data loss, there is still a chance for losses and ambiguities. In our analysis, indeed several items did not fit any subscale, and some fit into several subscales (e.g., item 19). Nonetheless, we produced a useful revised version of the ADC with 36 out of the original 40 questions, and one new question in the German version.

There are more properties of the ADC that we could not examine in this study which should be investigated in future research. For one, participants completed the survey once and remained anonymous, therefore we were unable to follow-up with specific individuals to examine test-retest reliability. In addition, we made several revisions to the questionnaire in the main study in order to increase fluency, but this comes with some costs. For one, our inclusion of "does not apply" as a response option for several items reduced the amount of cases which can be included in the analyses. Despite our prompts, some participants did not explain why they selected "does not apply," and other explanations were not clear enough to deduce an alternative response (e.g., "never learned" how to drive). With further explanation from participants in an interview format, this could be a potentially informative addition to the ADC. However, categorizing more detailed answers when questions do not apply should be implemented and tested in future research.

Due to the limited sample size, we did not have sufficient statistical power to run a confirmatory factor analysis (CFA). Therefore, future studies and replications should examine if the suggested subscale structure holds in a CFA, across different languages, and with consideration of a frequent co-occurring disorder: ADHD. The issue of small sample size is not a new problem in research on DCD, and there is a need for more research in many realms of the disorder, especially with adult populations and those with executive functioning difficulties

(Blank et al., 2019). Therefore, this study provides important groundwork by fostering diagnostic tools for future research involving the ADC, and for topics in need of more research, such as adults with DCD and relevant executive functioning difficulties.

Relatedly, the restructured ADC has only been tested to distinguish symptoms based on adults with DCD and/or ADHD. Future research should examine the possibility of the original ADC structure and the new subscales to differentiate other developmental motor difficulties (e.g., Cerebral Palsy) and acquired motor difficulties (e.g., Parkinson's, stroke, tumor, traumatic brain injury, etc.). In our samples, there are also some individuals with co-occurring diagnoses (e.g., studies 2 and 3). While this may be seen as a limitation, it is also a strength of our study that a more realistic set of participants was included, as DCD rarely occurs alone in clinical practice (Cleaton & Kirby, 2018).

Finally, it should be noted that while we offer a new data-driven structure of the ADC that can be useful in interpreting symptom-based differences, the structure of the original ADC is not without merit (see Appendix A for a translation of its original form). Its temporally based structure enables clinicians to address DSM 5criterion A for symptoms in childhood and criterion B regarding current symptoms interfering with daily life. Future research should consider the possibility to integrate the data-driven ADC structure with an option to address diagnostic criteria accordingly.

9. Conclusions

The ADC is a usefultool which incorporates the essential features of motor coordination differences and other symptoms most prevalent in DCD, and can be equally useful for German speakers. Our translation of the ADC is a valuable tool for researchers and clinicians in need of a screening or self-report tool for German-speakers with potential DCD. In addition, the

restructuring of this questionnaire may be useful for future research and clinical work to provide an in-depth understanding of the gross motor, fine motor, and executive functioning abilities of adults with DCD compared to adults with ADHD, which was not assessed in the original questionnaire. We encourage researchers to use, test, and retest our translated German version of the ADC, and for international researchers to explore the use of a restructured version of the ADC.

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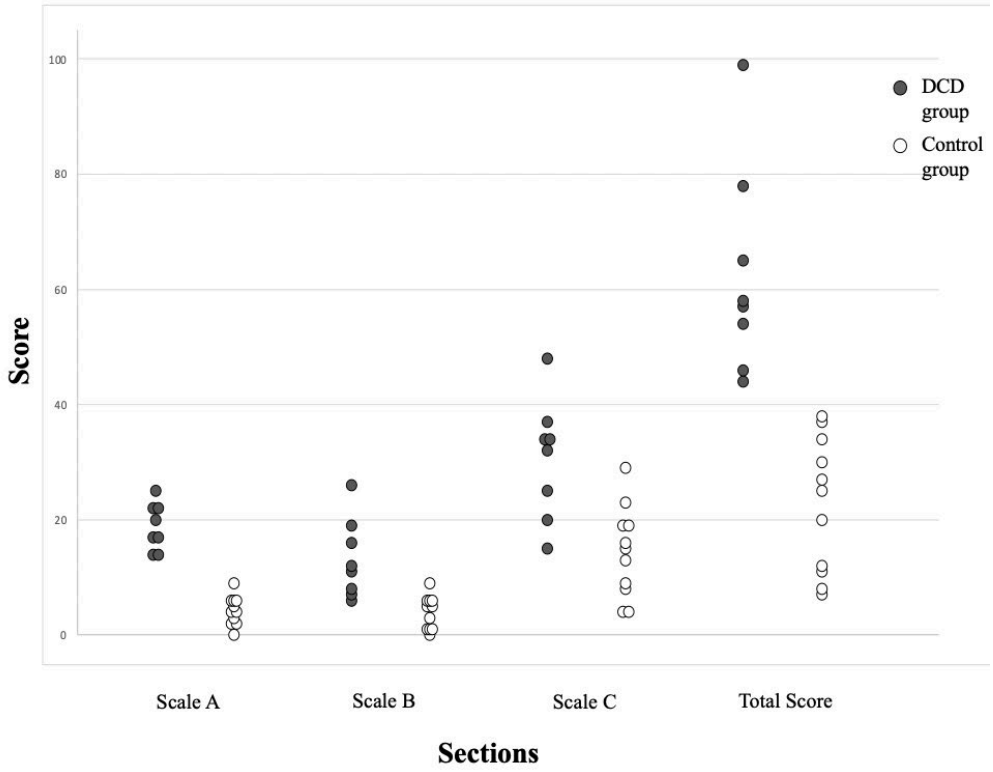
A).



B).

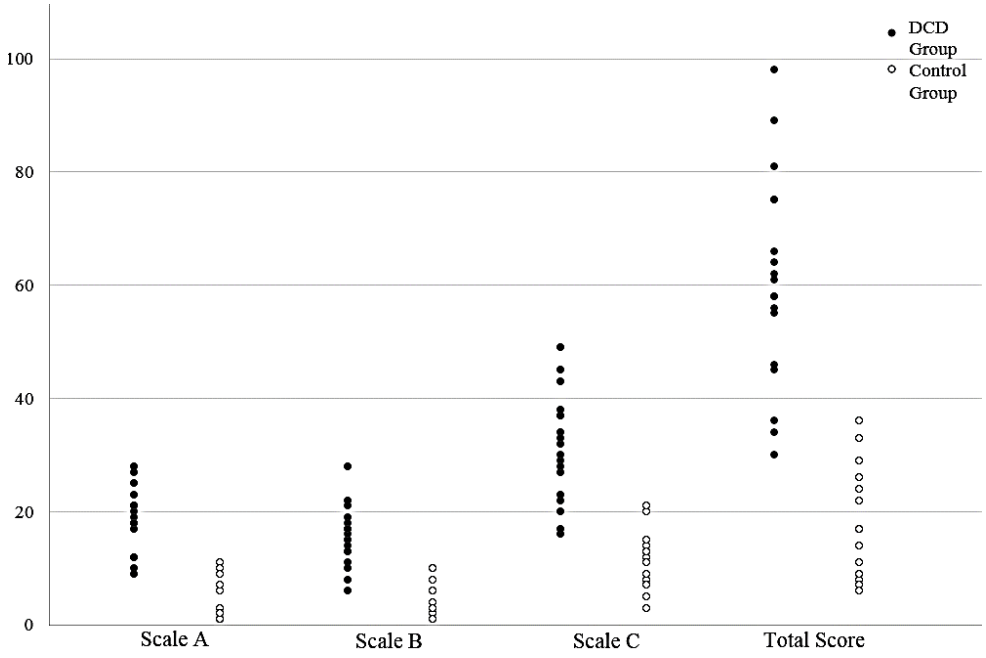


Figure 1. Scores on Translated ADC in Study 1 & 2

Note: Items were scored from 0 (*Never*) to 3 (*Always*). Therefore, the possible range of scores is 0 to 120. Comparison are between the DCD and control groups. A). Study 1; B). Study 2

Table 1. Intercorrelations of the subscales and total scores of studies 1 and 2

Measure	1	2	3
Study 1 (N = 19; df = 18)			
1. Subscale A	--		
2. Subscale B	.819**	--	
3. Subscale C	.760**	.800**	--
4. Total ADC	.912**	.921**	.945**
Study 2 (N = 33; df = 32)			
1. Subscale A	--		
2. Subscale B	.926**	--	
3. Subscale C	.880**	.902**	--
4. Total ADC	.960**	.966**	.971**

**$p < .01$ (two-tailed)

Table 2. Internal consistency of the new subscales in studies 2 and 3

Measure	1	2	3
Study 2, German-speakers (*N* = 148, *df* = 145)			
1. Gross Motor	--		
2. Fine Motor	.374***	--	
3. Executive Function	.418***	.389***	--
4. Total ADC	.826***	.720***	.764***
Study 3, English-speakers (*N* = 134, *df* = 131)			
1. Gross Motor	--		
2. Fine Motor	.659***	--	
3. Executive Function	.643***	.594***	--
4. Total ADC	.916***	.847***	.835***

Note: Participants include those with DCD and/or ADHD. Total ADC scores and executive function subscale contains one new item (41). Both samples exclude items 8, 21, 28, and 31.

Appendix A. The German Version of the ADC in Original Structure

Checkliste für Entwicklungsbedingte Koordinationsstörung / Dyspraxie bei Erwachsenen (CDE)

TEIL A: Schwierigkeiten im Kindesalter

Als Sie ein Kind waren...

1. Hatten Sie Schwierigkeiten damit, selbständig Ihre Schuhe zu binden, Knöpfe oder Reißverschlüsse zu schließen?

Nie Manchmal Oft Immer

2. Hatten Sie Schwierigkeiten damit, sich beim Essen nicht zu verkleckern?

Nie Manchmal Oft Immer

3. Hatten Sie im Vergleich mit Gleichaltrigen größere Schwierigkeiten damit, Rad fahren zu lernen?

Nie Manchmal Oft Immer

4. Hatten Sie bei Teamsportarten (z.B. Fußball, Volleyball) Schwierigkeiten damit, Bälle präzise zu werfen oder zu fangen?

Nie Manchmal Oft Immer

5. Hatten Sie Schwierigkeiten damit, ordentlich zu schreiben (so, dass andere es lesen konnten)?

Nie Manchmal Oft Immer

6. Hatten Sie Schwierigkeiten damit, so schnell zu schreiben wie Gleichaltrige?

Nie Manchmal Oft Immer

7. Sind Sie häufiger als andere mit Gegenständen oder Menschen zusammengestoßen oder über Dinge gestolpert?

Nie Manchmal Oft Immer

8. Hatten Sie Schwierigkeiten beim Spielen eines Musikinstruments (z.B. Geige, Blockflöte)?

Nie Manchmal Oft Immer Nicht zutreffend

9. Hatten Sie Schwierigkeiten damit, Ihr Zimmer ordentlich zu halten oder Sachen in Ihrem Zimmer zu finden?

Nie Manchmal Oft Immer

10. Haben andere Ihre mangelnde Koordinationsfähigkeit angesprochen oder Sie als ungeschickt bezeichnet?

Nie Manchmal Oft Immer

TEIL B: Aktuelle Symptome

Bereiten Ihnen die folgenden Dinge aktuell Schwierigkeiten?

11. Aspekte der Körperpflege, etwa Rasieren oder Schminken?

Nie Manchmal Oft Immer

12. Das Essen mit Messer und Gabel / Löffel?

Nie Manchmal Oft Immer

13. Hobbys, die ein gutes Koordinationsvermögen erfordern?

Nie Manchmal Oft Immer

14. Ordentlich zu schreiben, wenn Sie schnell schreiben müssen?

Nie Manchmal Oft Immer

15. Genauso schnell zu schreiben wie Gleichaltrige?

Nie Manchmal Oft Immer

16. Das Lesen Ihrer eigenen Schrift?

Nie Manchmal Oft Immer

17. Fehlerfreies Abschreiben von Texten?

Nie Manchmal Oft Immer

18. Ihr Zimmer ordentlich zu halten / Sachen im Zimmer zu finden?

Nie Manchmal Oft Immer

19. Sich in ungewohnten Gebäuden oder Orten zurecht zu finden?

Nie Manchmal Oft Immer

20. Haben andere Sie schon als unorganisiert bezeichnet?

Nie Manchmal Oft Immer

TEIL C: Aktuelle Symptome (durch Andere offenbart)

21. Haben Sie Schwierigkeiten damit, still zu sitzen oder nicht zappelig zu wirken?

Nie Manchmal Oft Immer

22. Verlieren Sie persönliche Gegenstände oder lassen sie liegen?

Nie Manchmal Oft Immer

23. Stoßen Sie sich an Gegenständen an, verschütten oder machen Dinge kaputt?

Nie Manchmal Oft Immer

24. Sind Sie langsamer als andere darin, die morgendliche Routine zu erledigen und aus dem Haus zu kommen?

Nie Manchmal Oft Immer

25. Haben Sie länger als andere gebraucht, um Auto fahren zu lernen?

Nie Manchmal Oft Immer Nicht zutreffend

26. Finden andere es schwierig, Ihre Schrift zu lesen?

Nie Manchmal Oft Immer

27. Vermeiden Sie Hobbys, für die man ein gutes Koordinationsvermögen benötigt?

Nie Manchmal Oft Immer

28. Verbringen Sie Ihre Freizeit eher allein als mit anderen?

Nie Manchmal Oft Immer

29. Vermeiden Sie Mannschaftsspiele / Mannschaftssport?

Nie Manchmal Oft Immer

30. Treiben Sie Sport eher alleine (z.B. im Fitnessstudio) als mit anderen zusammen?

Nie Manchmal Oft Immer Nicht zutreffend

31. Haben Sie es als Teenager / junger Erwachsener vermieden, in Diskotheken zu gehen und zu tanzen bzw. vermeiden Sie es aktuell?

Nie Manchmal Oft Immer

32. Haben Sie Schwierigkeiten beim Einparken?

Nie Manchmal Oft Immer Nicht zutreffend

33. Haben Sie Schwierigkeiten damit, eine Mahlzeit (d.h. keine Fertigprodukte) zuzubereiten (z.B. Lebensmittel abmessen und zerkleinern)?

Nie Manchmal Oft Immer

34. Haben Sie Schwierigkeiten damit, beim Packen für eine Reise an alle notwendigen Dinge zu denken?

Nie Manchmal Oft Immer

35. Haben Sie Schwierigkeiten damit, Wäsche zusammenzulegen und diese ordentlich zu verstauen?

Nie Manchmal Oft Immer

36. Haben Sie Schwierigkeiten beim Verwalten von Geld?

Nie Manchmal Oft Immer

37. Haben Sie Schwierigkeiten damit, zwei Dinge gleichzeitig zu tun (z.B. Autofahren und einem Gespräch folgen oder ein Telefonat führen)?

Nie Manchmal Oft Immer

38. Haben Sie Schwierigkeiten damit, Entfernungen einzuschätzen (z.B. beim Einparken, beim Ausweichen von Hindernissen)?

Nie Manchmal Oft Immer

39. Haben Sie Schwierigkeiten damit, im Voraus zu planen?

Nie Manchmal Oft Immer

40. Haben Sie in bestimmten Situationen das Gefühl, schnell unaufmerksam zu werden?

Nie Manchmal Oft Immer

41. Haben Sie Schwierigkeiten damit, einen Koffer zu packen um zu verreisen (z.B. Dinge ordentlich im Koffer verstauen, den Koffer schließen)?

Nie Manchmal Oft Immer

Appendix B: Restructured ADC in English

Section 1: Gross Motor Skills

As a child, did you…
Have difficulty eating without getting dirty?
Never Sometimes Frequently Always

Have difficulty learning to ride a bike compared to your peers?
Never Sometimes Frequently Always

Have difficulties with playing team games, such as football, volleyball, catching or throwing
Never Sometimes Frequently Always

Bump into objects or people, trip over things more than others?
Never Sometimes Frequently Always

Have others comment about your lack of coordination or call you clumsy?
Never Sometimes Frequently Always

Do you currently have difficulties with the following items:
Hobbies that require good coordination?
Never Sometimes Frequently Always

Finding your way around new buildings or places?
Never Sometimes Frequently Always

Would you say that you bump into things, spill or break things?
Never Sometimes Frequently Always

Did it take you longer than others to learn to drive?
Never Sometimes Frequently Always Does not apply

Do you avoid hobbies that require good coordination?
Never Sometimes Frequently Always

Do you avoid team games/sports?
Never Sometimes Frequently Always

If you do a sport, is it more likely to be on your own, e.g., going to the gym, than with others?
Never Sometimes Frequently Always Does not apply

If you are a driver, do you have difficulty parking a car?
Never Sometimes Frequently Always Does not apply

Do you have difficulty preparing a meal from scratch?
Never Sometimes Frequently Always

Do you have difficulties with performing two things at the same time (e.g., driving and listening or taking a telephone message)?
Never Sometimes Frequently Always

Do you have difficulties with distance estimation (e.g., with regard to parking, passing through objects)?
Never Sometimes Frequently Always

Section 2. Fine Motor Skills

As a child, did you…
Have difficulties with self-care tasks, such as tying shoelaces, fastening buttons and zips?
Never Sometimes Frequently Always

Have difficulty writing neatly (so others could read it)?
Never Sometimes Frequently Always

Have difficulty writing as fast as your peers?
Never Sometimes Frequently Always

Do you currently have difficulties with the following items:
Self-care tasks such as shaving or make up?
Never Sometimes Frequently Always

Eating with a knife and fork/spoon?
Never Sometimes Frequently Always

Writing neatly when having to write fast?
Never Sometimes Frequently Always

Writing as fast as your peers?
Never Sometimes Frequently Always

Reading your own writing?
Never Sometimes Frequently Always

Copying things down without making mistakes?
Never Sometimes Frequently Always

Do others find it difficult to read your writing?
Never Sometimes Frequently Always

Section 3. Executive Functions

As a child, did you…
Have difficulties with organising/finding things in your room?
Never Sometimes Frequently Always

Do you currently have difficulties with the following items:
Organising/finding things in your room?
Never Sometimes Frequently Always

Have others called you disorganised?
Never Sometimes Frequently Always

Do you lose or leave behind possessions?
Never Sometimes Frequently Always

Are you slower than others getting up on the morning and getting to work or college?
Never Sometimes Frequently Always

Do you have difficulty packing a suitcase to go away? *e.g., stowing items neatly in the suitcase, closing the suitcase.*
Never Sometimes Frequently Always

Do you find it difficult to think of the items you will need to pack for a trip?
Never Sometimes Frequently Always

Do you have difficulty folding clothes to put them away neatly?
Never Sometimes Frequently Always

Do you have difficulty managing money?
Never Sometimes Frequently Always

Do you have difficulty planning ahead?
Never Sometimes Frequently Always

Do you feel you are losing attention in certain situations?
Never Sometimes Frequently Always

Supplementary Materials: Additional Tables

Table 3. Construct validity of studies 1 and 2 using independent samples t-tests

	DCD Group (n = 8)		Control Group (n = 11)			
	M	*SD*	*M*	*SD*	*t*-test	*df*
Study 1						
Subscale A	19.00	3.96	4.27	2.49	9.96**	17
Subscale B	13.13	6.85	3.91	2.88	4.03*	17
Subscale C	32.00	9.89	15.00	7.93	4.02*	17
Total ADC	64.13	17.87	23.18	11.60	6.07**	17
	DCD Group (n = 17)		Control Group (n = 15)			
	M	*SD*	*M*	*SD*	*t*-test	*df*
Study 2						
Subscale A	18.89	3.76	4.53	3.76	8.64**	31
Subscale B	15.56	5.23	4.13	3.16	7.39**	31
Subscale C	31.11	9.44	11.47	5.03	7.24**	31
Total ADC	65.56	18.07	20.13	10.96	8.51**	31

*$p < .01$; **$p < .001$

Note: Pilot study subscale B failed Levene's test for equal variances ($p < .05$), and therefore statistics for this section are reported for unequal variances.

Table 4. Rotated component matrix in final ADC factor analysis from study 2

Item	Gross Motor	Fine Motor	Executive Function
1. Have difficulties with self-care tasks, such as tying shoelaces, fastening buttons and zips?	.455*	.444*	-.024
2. Have difficulty eating without getting dirty?	.361*	.349	.238
3. Have difficulty learning to ride a bike compared to your peers?	.499*	.177	-.103
4. Have difficulties with playing team games, such as football, volleyball, catching or throwing balls accurately?	.727*	.011	-.032
5. Have difficulty writing neatly (so others could read it)?	.032	.732*	.077
6. Have difficulty writing as fast as your peers?	.103	.670*	.105
7. Bump into objects or people, trip over things more than others?	.589*	.067	.258
8. Have difficulty playing a musical instrument (e.g., violin, recorder)?	.161	.197	-.077
9. Have difficulties with organising/finding things in your room?	-.087	.144	.692*
10. Have others comment about your lack of coordination	.549*	.153	.274
11. Self-care tasks such as shaving or make up?	.041	.568*	.174
12. Eating with a knife and fork/spoon?	.255	.405*	.125
13. Hobbies that require good coordination?	.599*	.191	-.068
14. Writing neatly when having to write fast?	.057	.730*	.240
15. Writing as fast as your peers?	.095	.752*	.136
16. Reading your own writing?	.061	.709	.118
17. Copying things down without making mistakes?	-.040	.498*	.257
18. Organising/finding things in your room?	.073	.171	.781*
19. Finding your way around new buildings or places?	.526*	.017	.352
20. Have others called you disorganised?	.086	.111	.686*
21. Do you have difficulties sitting still or appearing fidgety?	-.072	.082	.148
22. Do you lose or leave behind possessions?	.214	.115	.631*
23. Would you say that you bump into things, spill or break things?	.526*	.195	.213
24. Are you slower than others getting up on the morning and getting to work or college?	.118	.246	.414*
25. Did it take you longer than others to learn to drive?	.600*	.095	.154
26. Do others find it difficult to read your writing?	.023	.714*	.109

27. Do you avoid hobbies that require good coordination?	.665*	.189	.080
28. Do you choose to spend your leisure time more on your own than with others?	.292	-.032	-.027
29. Do you avoid team games/sports?	.661*	-.023	.001
30. If you do a sport, is it more likely to be on your own, e.g., going to the gym, than with others?	.375*	-.169	-.085
31. Do you/did you in your teens/twenties avoid going to clubs/dancing?	.139	-.046	.271
32. If you are a driver, do you have difficulty parking a car?	.616*	.041	.211
33. Do you have difficulty preparing a meal from scratch?	.410*	.206	.228
34. Do you have difficulty packing a suitcase to go away? *e.g., stowing items neatly in the suitcase, closing the suitcase*.	.307	.176	.622*
35. Do you find it difficult to think of the items you will need to pack for a trip?	.040	.287	.510*
36. Do you have difficulty folding clothes to put them away neatly?	.005	-.028	.570*
37. Do you have difficulty managing money?	.411*	.214	.339
38. Do you have difficulties with performing two things at the same time (e.g., driving and listening or taking a telephone message)?	.607*	-.033	.308
39. Do you have difficulties with distance estimation (e.g., with regard to parking, passing through objects)?	.105	.088	.608*
40. Do you have difficulty planning ahead?	-.010	.090	.483*
41. Do you feel you are losing attention in certain situations?	.270	.168	.597*

*Indicates component loading over .300.

Note: The rotated component matrix was derived with the *Varimax* rotation and Kaiser-Normalization with a PCA.

Table 5. Reliability of new subscales in studies 2 and 3 before and after weak components were removed

	Study 2, German-speakers (N = 148)		Study 3, English-speakers (N = 134)	
Subscale	All items α	Weak items removed α	All items α	Weak items removed α
Gross motor	.863	.866	.892	.894
Fine motor	.825	.842	.874	.876
Executive function	.816	.849	.831	.845
Entire Checklist	.900	.906	.944	.944

Note: "All items" signifies the computation of α based on the highest component loading for each item, including those which were weak (< .300). "Weak items removed" is the α computed with only items loading strongly (> .300) and therefore items 8, 21, 28, & 31 were removed. Entire checklist consists of 37 items in the German sample due to the creation of a new item, and thus, only 36 items in the English sample.