

## RESEARCH ARTICLE

# Is camouflaging unique for autism? A comparison of camouflaging between adults with autism and ADHD

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## Abstract

Camouflaging (using (un)conscious strategies to appear as non-autistic) is thought to be an important reason for late autism diagnoses and mental health difficulties. However, it is unclear whether only autistic people camouflage or whether people with other neurodevelopmental or mental health conditions also use similar camouflaging strategies. Therefore, in this preregistered study (AsPredicted: #41811) study, we investigated if adults with attention-deficit/hyperactivity-disorder (ADHD) also camouflage. Adults aged 30–90 years filled in the Dutch Camouflaging Autistic Traits Questionnaire (CAT-Q-NL), the ADHD Self-Report (ADHD-SR) and the Autism Spectrum Quotient (AQ). We investigated differences in camouflaging between adults with ADHD, autism, and a comparison group in an age and sex-matched subsample ( $N = 105$  per group). We explored if autism and ADHD traits explained camouflaging levels in adults with an autism and/or ADHD diagnosis ( $N = 477$ ). Adults with ADHD scored higher on total camouflaging and assimilation subscale compared to the comparison group. However, adults with ADHD scored lower on total camouflaging, and subscales compensation and assimilation than autistic adults. Autism traits, but not ADHD traits, were a significant predictor of camouflaging, independent of diagnosis. Thus, camouflaging does not seem to be unique to autistic adults, since adults with ADHD also show camouflaging behavior, even though not as much as autistic adults. However, as the CAT-Q-NL specifically measures camouflaging of autistic traits it is important to develop more general measures of camouflaging, to compare camouflaging more reliably in people with different mental health conditions. Furthermore, focusing on camouflaging in adults with ADHD, including potential consequences for late diagnoses and mental health seems a promising future research avenue.

## Lay Summary

In the present study, we investigated whether only autistic people use strategies to hide one's autistic traits (also referred to as camouflaging) or whether people with ADHD use similar strategies. We found that people with ADHD reported more camouflaging behavior compared to a neurotypical comparison group, but less than autistic people. Thus, these results indicate that camouflaging is not unique for autism and it is important to be aware of camouflaging strategies in people with ADHD.

## KEYWORDS

ADHD, autism, camouflaging, compensation, neurodiversity

## INTRODUCTION

In recent years, camouflaging behavior in autism has gained increasing interest in researchers, clinicians, and also in autistic people themselves (Libsack et al., 2021). Camouflaging is often defined as the use of (un)conscious strategies to minimize the visibility of one's autism traits to appear non-autistic (Hull et al., 2017; Libsack et al., 2021). This refers to the processes that result in a mismatch between showed behavior and underlying cognition in neurodevelopmental conditions and therefore, behaviors may not appear to be typical for autism even though the differences at cognitive and/or neurobiological levels are still present (Livingston & Happé, 2017). Autistic people report that camouflaging can help them navigate the demands of the neurotypical society (Perry et al., 2021), but they also report that camouflaging may have disadvantages, such as that it may result in more misdiagnoses and mental health difficulties (Bargiela et al., 2016; Livingston et al., 2019). However, it has been questioned whether camouflaging is unique to autism (Fombonne, 2020). Other people may also camouflage the traits that are not or less accepted by others, but the types of strategies and levels of camouflaging may differ across groups (Lai et al., 2021). When camouflaging is considered to be a type of impression management, it can also apply to other stigma-associated identities, for example related to race-ethnicity, sexuality, or disabilities (Ai et al., 2022). Until now, camouflaging has only been studied in autistic people and neurotypical comparison groups (see for review: Cook et al., 2021). Therefore, in the present study, we will investigate whether camouflaging is unique for autistic people by comparing camouflaging between people with autism, attention-deficit/hyperactivity-disorder (ADHD) and a neurotypical comparison group.

We chose to compare autistic people to people with ADHD because of the similarities between autism and ADHD. That is, autism and ADHD are both characterized in the DSM-5 as developmental conditions and there is a large biological and genetic overlap between autism and ADHD (American Psychiatric Association, 2013; Antshel & Russo, 2019). Also, people with ADHD and autism experience difficulties in executive functioning (Boonstra et al., 2005; Demetriou et al., 2018). Furthermore, within the neurodiversity movement ADHD and autism are both characterized as neurodivergent (Kapp, 2020; Sonuga-Barke & Thapar, 2021). While autism is characterized mostly by differences during social interactions, communication, and repetitive and stereotypical behaviors, and ADHD by inattention and/or hyperactivity and impulsivity (APA, 2013), people with ADHD also experience differences in social cognition and social interactions (Antshel & Russo, 2019). Because of the overlap in experienced difficulties in autism and ADHD, we hypothesize that people with ADHD may camouflage in a similar way compared

with autistic adults, and that camouflaging therefore can be investigated in a comparable manner.

Moreover, independent of this overlap, camouflaging is an important topic to investigate in people with ADHD, because people with ADHD experience—similar to autistic people—stigma, may receive late diagnoses, and report elevated levels of mental health difficulties. In autistic adults, camouflaging is hypothesized to be an automatic response to feeling stigmatized (Pearson & Rose, 2021; Perry et al., 2021). Social norms of autistic adults can differ from social norms of the more dominant non-autistic group and autistic adults are often told that their behavior is deviating. An automatic reaction can be to try to “pass as non-autistic” to avoid feeling stigmatized (Libsack et al., 2021). The main reasons reported by autistic adults for camouflaging are wanting to fit in and pretending to be “normal” (Bargiela et al., 2016; Hull et al., 2017). However, autistic adults are not the only stigmatized group, people with ADHD are also confronted with stigma (Mueller et al., 2012). That is, due to skepticism about ADHD diagnoses, the diagnostic process, and treatment, people with ADHD may not want to disclose their diagnosis or they may camouflage their ADHD traits (Han et al., 2022; Mueller et al., 2012). Therefore, people with ADHD may also use camouflaging strategies to hide their ADHD traits or to pretend to be “normal.”

In addition, camouflaging may play a role in late or missed diagnoses. Even though autism and ADHD are both developmental conditions, for which the onset is already present during childhood, late diagnoses do occur in both conditions (Asherson & Agnew-Blais, 2019; Huang et al., 2020). Late-diagnosed autistic adults report that their late diagnosis may, among other reasons, be the result of them using strategies to hide their autism characteristics (Bargiela et al., 2016). For late-diagnosed people with ADHD it is hypothesized that their ADHD may have already been present in childhood as well but it was not yet apparent or recognized as such because ADHD traits were compensated for by a helpful family environment or a high intelligence of the child (Asherson & Agnew-Blais, 2019). Compensating for ADHD traits is conceptually highly similar to the camouflaging construct that has been investigated in autistic adults (Cook et al., 2021; Libsack et al., 2021). However, this hypothesis has not yet been directly tested in an empirical study for people with ADHD. Only one population-based study showed that a small percentage of late-diagnosed people with ADHD had an above average IQ and late-diagnosed people had similar childhood environments as people diagnosed in childhood (Asherson & Agnew-Blais, 2019). The results of this population-based study do not indicate that a high intelligence or a helpful family environment is a sufficient explanation for late ADHD diagnoses. Nonetheless, the compensation hypothesis resonates well with experiences of clinicians and adults with ADHD. Therefore, it seems important to

test this hypothesis in an empirical study using the available knowledge about camouflaging in autism. Since camouflaging has the potential to help further understanding of late diagnoses in ADHD, it could improve correct and timely diagnosis of ADHD.

Knowledge about camouflaging can not only improve the ability to better recognize ADHD in adulthood, but might help improve our understanding of why people with ADHD experience mental health difficulties. Even though camouflaging can have positive consequences—it may help to get or maintain a job, prevent bullying or make friends—autistic adults also report numerous negative consequences of camouflaging (Livingston et al., 2019). Acting in a non-authentic manner can be exhausting and have a negative impact on one's self-perception. In addition, reporting more camouflaging is associated with experiencing more mental health difficulties, such as anxiety, depression, or suicidal thoughts (Cook et al., 2021). Because adults with ADHD experience many co-occurring psychiatric conditions, such as anxiety, mood disorders, and substance abuse (Franke et al., 2018), camouflaging may also be an underlying explanatory mechanism in these mental health difficulties. Given the possible negative consequences of camouflaging, it is important to know whether adults with ADHD camouflage, so it can be considered in the diagnostic process and when providing mental health care.

Thus, because of the overlap in experienced difficulties, stigma, late diagnoses and mental health difficulties, camouflaging could also be an important concept to consider in people with ADHD. Therefore, the goal of this pre-registered study is to find out whether only autistic adults camouflage or whether adults with ADHD camouflage as well. In part 1 of the study, we investigate if the level of camouflaging differs between adults with only an ADHD diagnosis and adults with only an autism diagnosis, and between adults with only an ADHD diagnosis and a non-autistic/non-ADHD comparison group. Camouflaging is measured using the Dutch Camouflaging Autistic Traits Questionnaire (CAT-Q-NL; Hull et al., 2019; van der Putten et al., 2023). The CAT-Q has been developed based on the camouflaging strategies that were described by autistic adults. Three types of camouflaging are distinguished using the CAT-Q: (1) Compensation: finding ways around social and communication difficulties. (2) Masking: strategies that are used to hide autistic characteristics. (3) Assimilation: strategies with a goal to fit in with others in social situations. We expect that: (1) Autistic adults report more total camouflaging behavior and higher scores on all subscales of the CAT-Q-NL compared to adults with ADHD, because the questionnaire is designed to measure camouflaging of autistic traits. (2) Adults with ADHD report more camouflaging and higher scores on the masking and assimilation subscales of the CAT-Q-NL compared to a non-autistic/non-ADHD comparison group. We do not expect differences on the compensation

subscale because the strategies seem most specific for autistic individuals. In part 2 of the study, we explore whether self-reported autism and ADHD traits explain camouflaging in adults with either an ADHD or autism diagnosis or both. Through this study, we aim to find out whether camouflaging is unique for autism.

## METHODS

### Participants

All participants included in the present study, participated in a larger study investigating “Autism & Aging” (for protocol paper see: Geurts et al., 2021). Of all participants, 352 autistic adults, 123 adults with ADHD, and 312 adults without autism and ADHD filled in all questionnaires for this study. In Part 1, after applying all inclusion criteria, we included 105 adults in the ADHD group and a sex and age-matched autism and (non-autistic/non-ADHD) comparison group, each consisting of 105 adults. In Part 2, we included 477 adults with an ADHD and/or autism diagnosis. Characteristics of participants included in Parts 1 and 2 are shown in Tables 1 and 2, respectively. Adults with ADHD and autism were recruited through mental health institutions across the Netherlands, by means of advertisement via client organization websites and newsletters, and via social media (i.e., Twitter and LinkedIn). The comparison group was recruited through social media and personal networks of researchers and participants.

Inclusion criteria for all participants for Part 1 and Part 2 were: (1) no self-reported intellectual disability and (2) sufficient understanding of the Dutch language to fill in the questionnaires. An additional inclusion criterion for the autism group for both parts is: (1) a self-reported clinical autism diagnosis. For the autism group, the following criteria were applied only for Part 1: (2) AQ  $\geq 26$  and/or a score above the cut-off on the ADOS-2, module 4 (social affect  $>6$  or total score  $>8$ ), and (3) no self-reported clinical ADHD diagnosis and ADHD-SR  $<6$  for inattention and hyperactivity/impulsivity during childhood and/or adulthood. An additional inclusion criterion for the ADHD group for both parts was: (1) a self-reported clinical ADHD diagnosis. For the ADHD group, the following criteria were applied only for Part 1: (2) an ADHD diagnosis based on the MINI and/or ADHD-SR childhood  $\geq 3$  and adulthood  $\geq 4$  for inattention and/or hyperactivity/impulsivity, and (3) no self-reported clinical diagnosis of autism and AQ  $\leq 32$ .

Adults without ADHD and autism (comparison group; COMP) only participated in Part 1 and additional inclusion criteria for these participants were: (1) no ADHD or autism diagnosis currently or in the past, (2) AQ  $\leq 32$  and ADHD-SR  $<6$  for inattention and hyperactivity/impulsivity during childhood and adulthood, and (3) no first-degree family members with an ADHD or autism diagnosis.

**TABLE 1** Characteristics of participants in Part 1.

|                                | Autism M (SD; range) | ADHD M (SD; range)  | Comparison M (SD; range) | Test statistics group comparison |
|--------------------------------|----------------------|---------------------|--------------------------|----------------------------------|
| Biological sex (M/F)           | 59/46                | 59/46               | 59/46                    | $\chi^2(2) = 0.03, p = 0.99$     |
| Age in years                   | 51.6 (10.8; 30–78)   | 51.4 (11.4; 30–80)  | 51.1 (11.5; 30–80)       | $F(1, 313) = 0.005, p = 0.95$    |
| Educational level <sup>a</sup> | 29/47/28             | 31/51/22            | 20/53/31                 | $\chi^2(3) = 4.50, p = 0.34$     |
| AQ total score                 | 36.7 (6.0; 16–48)    | 20.2 (6.3; 6–32)    | 14.4 (6.0; 3–31)         | $F(1, 313) = 175, p < 0.001$     |
| ADOS-2 total <sup>b</sup>      | 11.6 (3.4; 5–19)     | -                   | -                        | -                                |
| N ADHD MINI (%) <sup>c</sup>   | 0/53 (0%)            | 17/53 (33%)         | 0/47 (0%)                | -                                |
| ADHD-SR IA child               | 2.1 (2.4; 0–9)       | 6.7 (2.2; 0–9)      | 0.6 (1.3; 0–5)           | $F(1, 310) = 154.6, p < 0.001$   |
| H/I child                      | 2.3 (2.1; 0–9)       | 5.8 (2.6; 0–9)      | 0.5 (0.9; 0–4)           | $F(1, 311) = 98.48, p < 0.001$   |
| IA adult                       | 2.14 (2.1; 0–9)      | 5.9 (2.1; 0–9)      | 0.6 (1.2; 1–5)           | $F(1, 312) = 119.9, p < 0.001$   |
| H/I adult                      | 2.7 (2.0; 0–9)       | 5.6 (2.0; 0–9)      | 0.9 (1.2; 1–5)           | $F(1, 313) = 89.94, p < 0.001$   |
| CAT-Q-NL total                 | 102.0 (25.4; 54–162) | 75.5 (21.7; 35–156) | 67.4 (18.7; 31–114)      | -                                |
| Compensation                   | 32.7 (11.3; 9–63)    | 21.3 (9.2; 9–58)    | 18.87 (7.93; 9–44)       | -                                |
| Masking                        | 32.1 (11.0; 9–55)    | 29.4 (9.2; 11–49)   | 27.8 (7.7; 11–45)        | -                                |
| Assimilation                   | 37.3 (8.1; 12–54)    | 24.9 (9.2; 11–51)   | 20.7 (7.1; 8–37)         | -                                |

Abbreviations: ADHD-SR, ADHD self-report; ADOS-2, Autism Diagnostic Observation Scale 2; AQ, Autism Spectrum Quotient; CAT-Q-NL, Dutch Camouflaging Autistic Traits Questionnaire; H/I, hyperactivity/impulsivity; IA, inattention; MINI, Mini International Neuropsychiatric Interview.

<sup>a</sup>Education is classified using the Dutch Verhage scale ranging from 1 (less than 6 years of primary education) to 7 (university degree) (Verhage, 1964). The first five classes were merged to prevent empty cells and therefore include a range of education less than 6 years of primary education to practical higher education, the second cell refers to higher vocational education or pre-university education and the third to a university degree.

<sup>b</sup>ADOS-2 was administered in a subsample of only autistic adults ( $N = 29$ ) and therefore no scores can be calculated for the ADHD and comparison group. We report the mean, SD, and range of the total score on the ADOS-2.

<sup>c</sup>We report the number who met the criteria of an ADHD classification based on the MINI out of the number to whom the MINI was administered. Additionally, we report the percentage of people who met the criteria for an ADHD diagnosis based on the MINI.

**TABLE 2** Characteristics of participants in Part 2.

|                                      | Total group M (SD; range) |
|--------------------------------------|---------------------------|
| Biological sex (M/F)                 | 259/218                   |
| Age                                  | 52.0 (12.2; 30–84)        |
| Diagnosis ADHD/AUT/both <sup>a</sup> | 121/291/65                |
| AQ total                             | 137.6 (23.0; 74–187)      |
| ADHD-SR total Adulthood              | 28.0 (12.6; 2–60)         |
| CAT-Q-NL total                       | 92.4 (27.2; 29–169)       |
| Compensation                         | 28.6 (11.8; 9–63)         |
| Masking                              | 35.1 (11.7; 9–63)         |
| Assimilation                         | 32.5 (10.5; 8–54)         |

Abbreviations: ADHD-SR, ADHD self-report; AUT, autism; AQ, Autism Spectrum Quotient; CAT-Q-NL, Dutch Camouflaging Autistic Traits Questionnaire.

<sup>a</sup>Both: participants who report to have a current ADHD and autism diagnosis. A subset of participants with an ADHD or Autism diagnosis is also included in Part 1, participants with both diagnoses were not included in Part 1.

## Materials

### Camouflaging behavior

The CAT-Q-NL (van der Putten et al., 2023) is a Dutch translation of the CAT-Q (Hull et al., 2019). The CAT-Q-NL is a self-report questionnaire that consists of 25 items describing different types of camouflaging strategies. Participants indicated on a seven-point Likert scale

whether they “strongly disagree” (1) to “strongly agree” (7) with each statement. The CAT-Q-NL measures three types of camouflaging behavior: compensation (strategies used to actively compensate for difficulties in social situations), masking (strategies used to hide autistic characteristics or portray a non-autistic persona), and assimilation (strategies that reflect trying fit in with others in social situations). The internal reliability of the CAT-Q-NL and its subscales ranges from sufficient to good (Cronbach’s  $\alpha$  autistic adults: 0.80–0.93; Cronbach’s  $\alpha$  comparison group: 0.75–0.87; van der Putten et al., 2023).

### ADHD traits

The ADHD Self-report (ADHD-SR; Kooij et al., 2005) is a self-report questionnaire that consists of 23 items measuring ADHD symptoms in childhood and 23 in adulthood. Participants indicated on a 4-point Likert scale whether they have shown this behavior 0 “rarely to never” to 3 “very often” in the last 6 months and during their childhood (0–12 years). For inclusion in Part 1, the 23 items were recalculated to 18 DSM-IV criteria (nine for inattention and nine for hyperactivity/impulsivity) in childhood and in adulthood. For including adults with ADHD, we used ADHD-SR adulthood  $\geq 4$  as the cut-off (see: Kooij et al., 2005) and ADHD-SR childhood  $\geq 3$ , in line with the DSM 5 criteria for ADHD (APA, 2013). For Part 2, total adulthood score is calculated by



summing the scores of 23 adulthood items, resulting in a score ranging from 0 to 69, where a higher score indicates more ADHD traits. The internal reliability of the subscales of the ADHD-SR are sufficient to good (Cronbach's  $\alpha$  between 0.72 and 0.83; Kooij et al., 2005).

## Autism traits

The Autism Spectrum Quotient (AQ; Baron-Cohen et al., 2001; Hoekstra et al., 2008) is a self-report questionnaire that measures level of autism traits and consists of 50 items scored on a 4-point Likert scale (1 “definitely agree” to 4 “definitely disagree”). For inclusion criteria of Part 1, items were rescored to a 0 or 1 following the algorithm of the AQ, with 1 indicating autistic-like behavior, resulting in a total score ranging from 0 to 50. For Part 2, we calculated a total score based on the 4-point scores to gain most detailed insight in someone's autism traits. Psychometric properties of the AQ are satisfactory (Baron-Cohen et al., 2001; Hoekstra et al., 2008; Ruzich et al., 2015).

## ADHD classification

The Mini International Neuropsychiatric Interview Plus (MINI-plus; Sheehan et al., 1997; van Vliet et al., 2000) is a structured diagnostic interview through which we measured if participants met (among others) the DSM-IV criteria of ADHD. The MINI-plus was administered to a subset of the participants, who participated in the face-to-face sessions and was used for the inclusion criteria of Part 1.

## Autism classification

Module 4 of the Autism Diagnostic Observation Scale, version 2 (ADOS-2; Bildt et al., 2013; Lord et al., 2012) is a semi-structured, standardized assessment measuring social interactions, communication, and stereotypical behaviors. The ADOS-2 was administered by trained researchers (authors CT and TAR) in all autistic adults who participated in the face-to-face sessions. For the inclusion criteria of Part 1, it was calculated whether autistic adults met the criteria of an autism classification through the cut-off scores of ADOS-2. The ADOS-2, Module 4 revised algorithm has a sensitivity and specificity of 80% (Hus & Lord, 2014).

## Procedure

As aforementioned, the present study was part of a larger longitudinal study investigating “Autism & Aging” (full

procedure is described in Geurts et al., 2021). Four autistic and/or older adults advised, among others, on recruitment of participants, study design, and information letters. This overarching study is approved by the ethical commission of the University of Amsterdam (2018-BC-9285). Data collection took place between 2018 and 2022. Participants gave written consent for participation in the study and filled in questionnaires including the CAT-Q-NL, the ADHD-SR, and the AQ. Hereafter, a subsample of participants was invited to a face-to-face or online session during which, among others, the MINI-plus was administered and for autistic adults the ADOS-2. Participants received compensation for travel expenses and a small monetary reward for participating. Please note that data used in this study, are and will also be used to answer other research questions.

## Statistical analyses

All analyses were preregistered (AsPredicted #41811; [https://aspredicted.org/8N4\\_21G](https://aspredicted.org/8N4_21G)) and executed using Rstudio version 3.6.2 (RStudio Team, 2020) and JASP 0.14.1 (JASP Team, 2022). We deviated from the preregistration by removing the comparison between the autism and comparison group in Part 1, because we cannot reliably compare these groups due to a lack of measurement invariance in the CAT-Q-NL for these groups (van der Putten et al., 2023). Therefore, instead of including group in the (M)ANOVAs as a variable with three levels, we executed separate analyses with group consisting of either the ADHD and autism group or the ADHD and comparison group. Through this, we do not make a direct comparison between the autism group and the comparison group.

## Part 1: Group comparison

To investigate whether level of camouflaging differed between adults with ADHD and autistic adults or ADHD and the comparison group, we executed two ANOVAs with group (ADHD vs. AUT and ADHD vs. COMP) as independent variable and total camouflaging score as dependent variable. After this, we executed two MANOVAs with group (ADHD vs. AUT and ADHD vs. COMP) as independent variable and the CAT-Q-NL subscales as dependent variables. For the MANOVAs, post hoc univariate ANOVAs were executed to gain insight into the differences between the subscales, while applying a Bonferroni correction to control for multiple comparisons and therefore testing against a  $p$ -value of 0.0167. Next to frequentist analyses, we executed Bayesian analyses for the group comparisons. Bayesian analyses enabled us to investigate the likelihood of both the presence and absence of group differences.

We interpreted the Bayes factors (BF) according to the guidelines described in van Doorn et al. (2021), that is:  $BF < 3$  is inconclusive,  $BF > 3$  is moderate evidence,  $BF > 10$  is strong evidence.  $BF_{10}$  represents the likelihood of the data to occur given the alternative hypothesis ( $H_1$ : group difference) compared to the null hypothesis ( $H_0$ : no group difference). That is, a  $BF_{10}$  of five indicates the data is five times more likely under  $H_1$  than under  $H_0$ .  $BF_{01}$  represents the likelihood for the data to occur given  $H_0$  compared to  $H_a/H_1$ .  $BF_{10}$  is equal to  $1/BF_{01}$ .

## Part 2: Traits comparison

To explore the relation between camouflaging and autism and ADHD traits, we executed four multiple regression analyses with total camouflaging score, masking, compensation, and assimilation as dependent variables in adults with an autism and/or ADHD diagnosis ( $N = 477$ ). We included AQ score and ADHD-SR adulthood score as predictors, while controlling for age and sex. A Bonferroni correction was applied to control for multiple comparisons and, therefore, we tested against a  $p$ -value of 0.0125.

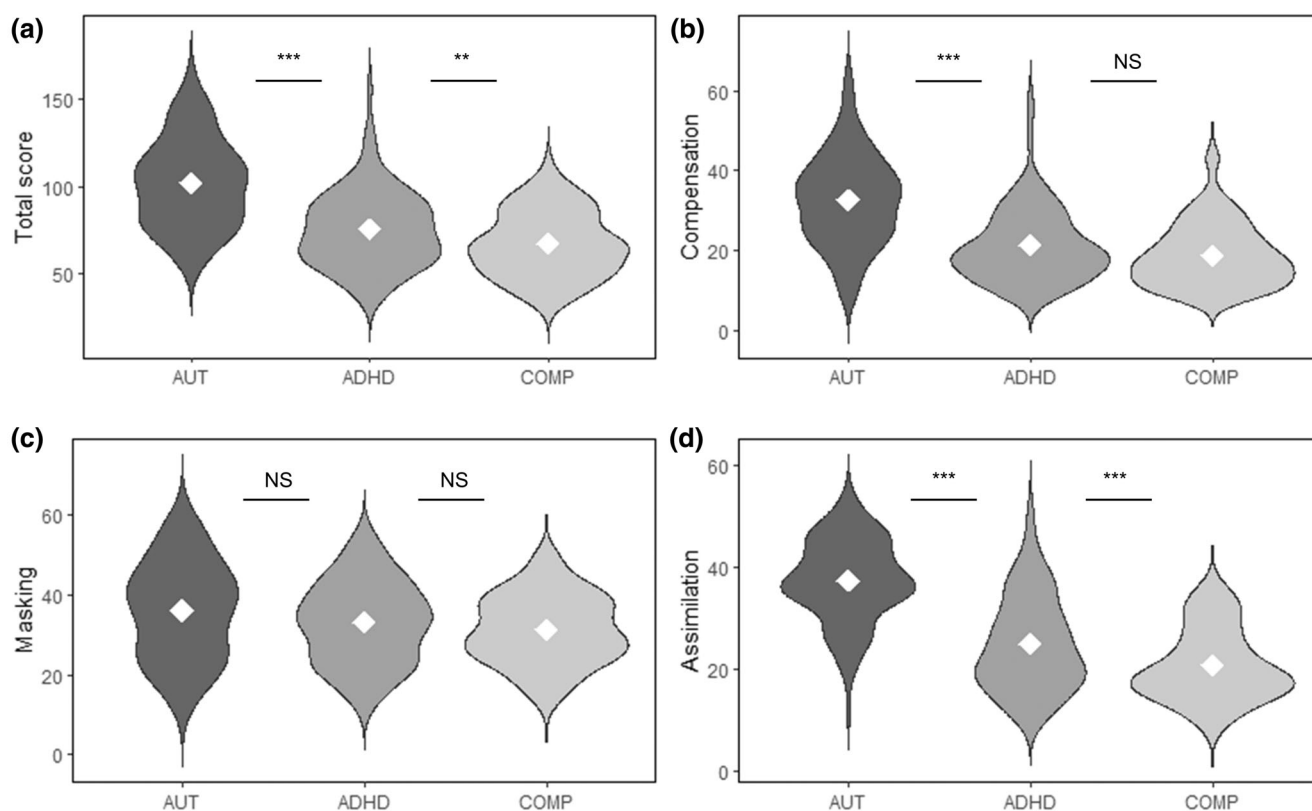
## RESULTS

### Part 1: Group comparisons

In Figure 1, the violin plots show the comparisons of the scores between people with autism, people with ADHD and the comparison group on total score of the CAT-Q-NL and its subscales.

### ADHD versus AUT: Adults with ADHD camouflage less than autistic adults

The results of the ANOVA and MANOVA showed that autistic adults scored significantly higher than adults with ADHD on the total score ( $F(1, 208) = 66.21, p < 0.001, \eta^2 = 0.24$ ) and also across the subscales of the CAT-Q-NL ( $V = 0.43, F(1, 208) = 50.78, p < 0.001$ ). Autistic people scored higher than people with ADHD on the compensation and assimilation subscales (compensation:  $F(1, 208) = 64.33, p < 0.001, \eta^2 = 0.24$ ; assimilation:  $F(1, 208) = 107.50, p < 0.001, \eta^2 = 0.02$ ). The  $BF$ 's showed that there was strong evidence for group differences on these subscales (see Table 3). However, scores on the masking subscale did not differ significantly



**FIGURE 1** Scores for the post hoc comparisons between ADHD and AUT, and ADHD and COMP on the CAT-Q-NL total score and subscales depicted in violin plots with a diamond representing the group mean and asterisks indicating significance levels (NS, nonsignificant; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ ).

between autistic adults and adults with ADHD ( $F(1, 208) = 3.61, p = 0.059, \eta^2 = 0.34$ ). Also, the BF's were inconclusive so it is unclear whether there is an absence of a difference between people with autism and ADHD. We executed additional nonparametric post hoc Kruskal–Wallis tests to check whether group differences were not due to non-normality of the data. These tests resulted in similar results, that is, significant differences on total score ( $H(1) = 50.99, p < 0.001$ ), the compensation subscale ( $H(1) = 54.89, p < 0.001$ ) and the assimilation subscale ( $H(1) = 71.07, p < 0.001$ ), and no significant difference on the masking subscale ( $H(1) = 3.21, p = 0.07$ ).

### ADHD versus COMP: Adults with ADHD do camouflage

The results of the ANOVA and MANOVA showed that people with ADHD scored significantly higher than the comparison group on the total score ( $F(1,208) = 8.55, p < 0.01, \eta^2 = 0.02$ ) and also across the subscales of the CAT-Q-NL ( $V = 0.06, F(1, 208) = 4.55, p < 0.01$ ). Adults with ADHD scored significantly higher on the assimilation subscale ( $F(1, 208) = 13.46, p < 0.001, \eta^2 = 0.06$ ) than the comparison group, however not on the compensation and masking subscales (compensation:  $F(1, 208) = 4.08, p = 0.04, \eta^2 = 0.02$ , masking:  $F(1, 208) = 1.89, p = 0.17, \eta^2 = 0.01$ ). The BF's shown in Table 3 also showed strong evidence for group differences for the total CAT-Q-NL score and the assimilation subscale. However, for the compensation and masking subscales the BF's were inconclusive and, therefore, we cannot conclude whether there is evidence for the alternative or null hypothesis and therefore, whether a group difference is present or absent. Additional nonparametric post hoc Kruskal–Wallis tests resulted in similar results, that is, significant differences on total score ( $H(1) = 6.89, p < 0.01$ ) and the assimilation subscale ( $H(1) = 10.86, p < 0.001$ ), and no significant difference between those with ADHD and comparisons on the compensation subscale ( $H(1) = 4.03, p = 0.05$ ) and the masking subscale ( $H(1) = 1.48, p = 0.22$ ).

## Part 2: Traits comparisons

To investigate if autism and ADHD traits predict camouflaging, we executed four multiple regression analyses with CAT-Q-NL total score and all subscale scores as dependent variables. We included AQ score and ADHD-SR adulthood score as predictors and controlled for age and biological sex. The results (see: Table 4) showed that autism traits were a significant predictor for CAT-Q-NL total score, and subscales compensation, and assimilation. ADHD traits, on the other hand, were not a significant predictor for total camouflaging behavior or any of the subscales after controlling for multiple testing. For the masking subscale, autism and ADHD traits were both not significant predictors and  $R^2$  was low (0.06).

To disentangle these results between adults with ADHD and adults with autism, we further explored this association by executing similar analyses separately for adults with an autism diagnosis and adults with an ADHD diagnosis. Adults with both an autism and ADHD diagnosis were included in both analyses. We found similar results in these separate groups compared with the total group. For all subscales, except for masking, we found that autism traits were a significant predictor for level of camouflaging. Interestingly, only in the autism group, level of ADHD traits was a significant predictor for the assimilation subscale. Finally, in the ADHD group more variance in camouflaging seems to be explained by the autism traits since the  $R^2$  of all subscales except for masking, was higher in the ADHD group compared to the autism group.

## DISCUSSION

In the present study, we investigated whether camouflaging is unique for autistic people or whether people with ADHD also use camouflaging strategies. We argued that investigating camouflaging in people with ADHD is also important, because it could help understand why adults with ADHD experience elevated levels of mental health difficulties and why some people receive their ADHD diagnosis only later in life. To gain insight in whether adults with ADHD camouflage, we compared self-

**TABLE 3** Bayes factors for group comparisons of total camouflaging behavior and its subscales when comparing the ADHD group to the AUT and COMP group.

| ADHD vs      | AUT                    |                       |              | COMP |        |              |
|--------------|------------------------|-----------------------|--------------|------|--------|--------------|
|              | BF01                   | BF10                  | Evidence?    | BF01 | BF10   | Evidence?    |
| Total        | $1.47 \times 10^{-12}$ | $6.81 \times 10^{11}$ | Strong: Ha   | 0.06 | 15.76  | Strong: Ha   |
| Compensation | $8.65 \times 10^{-12}$ | $1.16 \times 10^{11}$ | Strong: Ha   | 2.74 | 0.36   | Inconclusive |
| Masking      | 0.48                   | 2.11                  | Inconclusive | 1.51 | 0.66   | Inconclusive |
| Assimilation | $3.44 \times 10^{-19}$ | $2.91 \times 10^{18}$ | Strong: Ha   | 0.01 | 145.53 | Strong: Ha   |

Note: BF10 implies evidence for the alternative hypothesis (Ha), BF01 implies evidence for the null hypothesis (H0).  $BF10 = 1/BF01$ . Criteria for evidence:  $BF < 3$  = inconclusive,  $BF > 3$  = moderate evidence,  $BF > 10$  = strong evidence.

**TABLE 4** Regression coefficients for multiple regression analyses.

| CAT-Q-NL                                    | Constant | AQ                | ADHD-SR           | Age                | Sex   | R <sup>2</sup> |
|---------------------------------------------|----------|-------------------|-------------------|--------------------|-------|----------------|
| Total group (ADHD + Autism + both)          |          |                   |                   |                    |       |                |
| Total score                                 |          |                   |                   |                    |       | 0.26           |
| $\beta$                                     | 30.46    | 0.58              | 0.11              | −0.44              | 1.23  |                |
| <i>t</i>                                    | 3.30**   | 12.10***          | 1.31              | −4.83***           | 0.55  |                |
| Compensation                                |          |                   |                   |                    |       | 0.23           |
| $\beta$                                     | 5.67     | 0.24              | 0.02              | −0.19              | −0.35 |                |
| <i>t</i>                                    | 1.39     | 11.21***          | 0.41              | −4.62***           | −0.35 |                |
| Masking                                     |          |                   |                   |                    |       | 0.06           |
| $\beta$                                     | 34.84    | 0.05              | 0.04              | −0.20              | 1.78  |                |
| <i>t</i>                                    | 7.80***  | 2.21 <sup>a</sup> | 0.89              | −4.51***           | 1.63  |                |
| Assimilation                                |          |                   |                   |                    |       | 0.42           |
| $\beta$                                     | −6.22    | 0.30              | 0.06              | −0.08              | 0.00  |                |
| <i>t</i>                                    | −1.97    | 18.10             | 2.16 <sup>a</sup> | −2.50 <sup>a</sup> | 0.01  |                |
| Group with ADHD diagnosis (ADHD + both)     |          |                   |                   |                    |       |                |
| Total score                                 |          |                   |                   |                    |       | 0.30           |
| $\beta$                                     | 16.13    | 0.62              | 0.12              | −0.34              | 2.38  |                |
| <i>t</i>                                    | 1.22     | 8.60***           | 0.78              | −2.43*             | 0.71  |                |
| Compensation                                |          |                   |                   |                    |       | 0.25           |
| $\beta$                                     | 1.89     | 0.24              | 0.06              | −0.17              | −0.68 |                |
| <i>t</i>                                    | 0.33     | 7.61***           | 0.83              | −2.69**            | −0.46 |                |
| Masking                                     |          |                   |                   |                    |       | 0.02           |
| $\beta$                                     | 32.48    | 0.06              | −0.04             | −0.14              | 2.15  |                |
| <i>t</i>                                    | 4.96     | 1.61              | −0.52             | −1.96              | 1.30  |                |
| Assimilation                                |          |                   |                   |                    |       | 0.49           |
| $\beta$                                     | −14.66   | 0.33              | 0.10              | −0.05              | 1.15  |                |
| <i>t</i>                                    | −3.19**  | 12.97***          | 1.84              | −1.10              | 0.99  |                |
| Group with autism diagnosis (Autism + both) |          |                   |                   |                    |       |                |
| Total score                                 |          |                   |                   |                    |       | 0.16           |
| $\beta$                                     | 54.29    | 0.43              | 0.28              | −0.48              | 0.19  |                |
| <i>t</i>                                    | 4.42***  | 5.91***           | 2.36 <sup>a</sup> | −4.41***           | 0.07  |                |
| Compensation                                |          |                   |                   |                    |       | 0.13           |
| $\beta$                                     | 14.85    | 0.17              | 0.10              | −0.20              | −0.21 |                |
| <i>t</i>                                    | 2.73**   | 5.26***           | 1.93              | −4.05***           | −0.17 |                |
| Masking                                     |          |                   |                   |                    |       | 0.06           |
| $\beta$                                     | 41.26    | 0.01              | 0.09              | −0.21              | 1.27  |                |
| <i>t</i>                                    | 6.95***  | 0.35              | 1.53              | −4.06***           | 0.96  |                |
| Assimilation                                |          |                   |                   |                    |       | 0.28           |
| $\beta$                                     | 2.71     | 0.25              | 0.10              | −0.10              | −0.73 |                |
| <i>t</i>                                    | 0.67     | 10.38***          | 2.54*             | −2.65**            | −0.81 |                |

Abbreviations: ADHD-SR, ADHD self-report; both, people with both an autism and an ADHD diagnosis; AQ, Autism Spectrum Quotient; CAT-Q-NL, Dutch Camouflaging Autistic Traits Questionnaire.

<sup>a</sup>Not significant after correcting for multiple testing.

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

reported camouflaging as measured by the CAT-Q-NL between adults with ADHD (without autism), to autistic adults (without ADHD), and to a comparison group (without autism and ADHD). In line with our expectations, we found that adults with ADHD reported more

total camouflaging than the comparison group, but less than autistic adults. In addition, we found that especially level of autism traits and not ADHD traits, explained camouflaging in adults with an ADHD and/or autism diagnosis. Thus, camouflaging could be a potentially



interesting factor to further investigate in adults with ADHD.

Next to the expected general findings, there were interesting differences on the subscale level. First, as expected, adults with ADHD scored higher than the comparison group on the assimilation subscale. The items of this subscale may be most in line with a reaction to experiencing stigma (e.g., wanting to fit in and pretending to be normal). In autistic adults, it has been shown that experiencing more stigma is associated with more camouflaging (Perry et al., 2021). Since adults with ADHD also experience stigma (Mueller et al., 2012), this could also be an explanation for the elevated scores on the assimilation subscale. Second, as expected, no differences were found on the compensation subscale between adults with ADHD and the comparison group, and adults with ADHD reported less compensation strategies compared to autistic adults. Therefore, while it is known that adults with ADHD also experience social difficulties (Antshel & Russo, 2019), compensation behaviors as formulated in the CAT-Q-NL may tap into the difficulties that are most specific for autistic adults.

Furthermore, unexpectedly, the masking subscale was the only subscale on which no significant differences were found between ADHD and autism as well as ADHD and the comparison group. Bayesian analyses indicated inconclusive results, which implies that either scores do not differ but are also not clearly similar or that there was not enough data to provide evidence for one of the directions. Furthermore, the masking subscale was the only subscale for which autism traits were not a significant predictor in the regression analyses. These findings are in line with a different study that found no differences on the masking subscale of the CAT-Q between autistic adults and non-autistic comparison group (Hull et al., 2019). These findings correspond to the suggestion that masking may be a more general type of impression management, while other components of camouflaging may be specific for autistic people (Ai et al., 2022).

Finally, we investigated if autism and ADHD traits explained levels of camouflaging in people with ADHD and/or autism. Our findings showed that mainly autism traits contributed to someone's level of camouflaging, while level of ADHD traits in general did not explain someone's level of camouflaging. Therefore, camouflaging, as measured with the CAT-Q-NL seems to be more prevalent in people (either with an autism or ADHD diagnosis) with more autistic traits, compared to people with lower autistic traits. For people with an ADHD diagnosis or both an ADHD and autism diagnosis, autistic traits explained more of the variation in camouflaging, compared to the people with an autism diagnosis or both an autism and ADHD diagnosis. In future studies, it would additionally be interesting to explore the levels of camouflaging reported by people with both an autism and ADHD diagnosis compared to autistic people or

people with ADHD. However, because the CAT-Q-NL measures camouflaging of autistic traits, it is difficult to disentangle whether only someone's autism traits are important for camouflaging or whether ADHD traits could also play a role when camouflaging would be measured more broadly.

While we showed that adults with ADHD do camouflage, the current study has some caveats which need to be considered when interpreting our findings. That is, while adults with ADHD reported higher scores than the comparison group, scores of autistic adults were substantially higher than those of adults with ADHD. This could be partly because the CAT-Q was developed based on experiences of camouflaging by autistic adults (Hull et al., 2019). The varying group differences between subscales, indicate that some factors of camouflaging are more important to adults with ADHD than others. However, additional camouflaging behaviors may be used by adults with ADHD that are not included in the CAT-Q. In addition, the psychometric properties for the CAT-Q (-NL) have not yet been investigated in adults with ADHD. That is, it needs to be studied whether CAT-Q-NL items are interpreted similarly by adults with ADHD as they are by autistic adults. Furthermore, developing measures that can be used to study camouflaging from a broader, more transdiagnostic viewpoint could help to find out whether camouflaging is relevant in people with different mental health conditions and how this compares to camouflaging of autistic people.

The current findings can serve as a starting point for a variety of future research avenues for people with ADHD. First, our work indicates that camouflaging strategies specifically used by adults with ADHD deserve attention. Research has shown that adults with ADHD used coping strategies to compensate for difficulties, such as using reminder apps and calendars to structure their day, physical activity to improve attention, and making sure to be punctual (Canela et al., 2017). These behaviors may be considered as a form of camouflaging, however, such items were not included in the CAT-Q-NL. In yet another study, adults with ADHD reported that using work-related compensatory strategies required less energy when they used medication (Palmini, 2008). Thus, medication use could influence whether people with ADHD are able to or need to camouflage or how much energy camouflaging requires. In addition, medication is generally used to decrease ADHD symptoms and therefore people who use medication may camouflage less. Including or developing instruments or questionnaires that can provide information about broader strategies used by adults with ADHD would be informative for future research.

Next to studying specific ADHD-related camouflaging strategies, consequences of camouflaging for adults with ADHD need to be studied. In autistic adults, camouflaging might be associated with mental health difficulties and is expected to be a cause of late diagnoses,

especially in autistic women (Bargiela et al., 2016; Cook et al., 2021). Also, people have voiced concerns about potential negative impact of interventions such as social skills training, in which camouflaging is learned or encouraged (Bottema-Beutel et al., 2018; Libsack et al., 2021). Because many treatment types for adults with ADHD are focused on reducing someone's ADHD traits (Hodgson et al., 2014; Rostain et al., 2015), people may learn to camouflage during treatment. Therefore, it is important to know whether camouflaging is associated to mental health difficulties in ADHD. In addition, future research should focus on whether camouflaging is related to age of diagnosis, especially in girls and women with ADHD. That is, ADHD is often not properly recognized in girls because the presentation of ADHD behavioral symptoms can differ (Quinn & Madhoo, 2014). Girls seem to have better coping skills and therefore be better at masking ADHD traits compared to boys. Focusing on whether and for whom camouflaging is associated with positive or negative consequences, would be an important step to assess whether camouflaging is important to consider in ADHD.

In summary, based on this study we can conclude that adults with ADHD show more camouflaging than a comparison group, but less than autistic adults. This study highlights the need for more general measures of camouflaging behavior, independent of diagnosis, to be able to compare camouflaging across different groups. Also, more in-depth studies are necessary to fully grasp how people with ADHD camouflage, whether this differs from camouflaging in autistic adults and to what extent camouflaging may be a source for mental health difficulties and late diagnoses in people with ADHD. It is important for clinicians and researchers to be aware of the potential impact of camouflaging in people with ADHD, so that appropriate mental health care can be provided earlier and better. Our study helps us one step in that direction.

## AUTHOR CONTRIBUTIONS

**W. J. van der Putten, T. A. Radhoe, C. Torenvliet:** Data collection. **W. J. van der Putten,** Analyses and writing of first draft of manuscript. **A. J. J. Mol, H. M. Geurts:** Feedback on subsequent versions of the manuscript. All authors contributed to the study design and pre-registration. All authors provided feedback on the final version and approved the manuscript.

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## CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

## ETHICS STATEMENT

The study was approved by the ethical review board of the Department of Psychology of the University of Amsterdam (2018-BC-9285).

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