Short Report: Camouflaging in autism spectrum disorder: Examining the roles of sex, gender identity and diagnostic timing

Goldie A. McQuaid[1], Nancy Raitano Lee[2], & Gregory L. Wallace[3]

[1]Department of Psychology, George Mason University, Fairfax, VA

[2]Department of Psychology, Drexel University, Philadelphia, PA

[3]Department of Speech, Language, and Hearing Sciences, The George Washington University, Washington, DC

Corresponding author: Goldie A. McQuaid, Department of Psychology, George Mason University, 4400 University Drive, 3F5 Fairfax, VA 22030, USA.

Email: gmcquaid@gmu.edu

ABSTRACT

Camouflaging in autism spectrum disorder (ASD) could be a factor in later diagnosis of individuals without co-occurring intellectual disability, particularly among those assigned female sex at birth. Little research to date has examined how gender identity impacts camouflaging, however. Further, no study has compared groups that differ in diagnostic-timing to directly investigate if later-diagnosed individuals demonstrate elevated camouflaging relative to those receiving an earlier diagnosis.

Using the Camouflaging Autistic Traits Questionnaire (CAT-Q) subscales (Assimilation, Compensation, and Masking), we investigated the roles of sex, gender identity (gender diverse vs. cisgender), and diagnostic timing (childhood/adolescent-diagnosed vs. adult-diagnosed), and the interactions of these factors, in ASD adults (*N*=502; ages 18-49 years).

Main effects of sex, gender identity, and diagnostic-timing were revealed. ASD females reported more camouflaging across CAT-Q subscales compared to males. Gender diverse adults reported elevated camouflaging on the Compensation subscale compared to cisgender adults. Adulthood-diagnosed individuals reported elevated Assimilation and Compensation compared to childhood/adolescence-diagnosed individuals. We discuss how the 'performative' aspects of camouflaging probed in the Assimilation and Compensation subscales may have particular implications for the intersection of neurodiversity and gender diversity, and for later diagnostic timing.

Camouflaging in autism spectrum disorder (ASD) refers to a repertoire of behaviors and/or strategies that mask the presentation of ASD features in social contexts in order to appear 'normal' (Attwood, 2007). Camouflaging modifies the behavioral presentation of core ASD features (e.g., social and communication differences), but the underlying ASD profile is unaffected, generating a mismatch between external observable features and the internal lived experience of ASD. Factors associated with camouflaging in ASD are beginning to emerge, with particularly strong evidence that those assigned female sex at birth demonstrate elevated camouflaging relative to ASD males (Hull et al., 2020).

Additionally, based on the limited evidence to date (Hull et al., 2020), ASD adults with non-binary gender expressions also demonstrated camouflaging, although these adults did not significantly differ in comparison to ASD cisgender females or males, respectively. However, this study included a sample of ASD adults with non-binary gender expressions (n=16) that likely did not provide sufficient statistical power to detect differences. Thus, it is unclear whether gender diverse individuals demonstrate elevated camouflaging relative to cisgender ASD adults. Given qualitative descriptions of the lived experiences of gender diverse ASD individuals, however, including feeling uncomfortable openly expressing their gender identity due to concerns of bias and harassment (Strang et al., 2018), research is needed to examine potential differences in utilization of camouflaging among gender diverse ASD adults. For instance, it is plausible that individuals who are both neurodiverse and gender diverse may be more susceptible to social pressures that contribute to camouflaging in ASD.

Missed, mis- and late diagnosis in ASD, particularly for ASD females without co-occurring intellectual disability (ID), has been attributed in part to camouflaging (Bargiela et al., 2016; Hull et al., 2017; Wood-Downie et al., 2020). Nevertheless, to our knowledge, no study has

directly investigated the question of whether individuals who are diagnosed later evidence more camouflaging than those who are diagnosed earlier. Delivery of timely (i.e., as early as possible) ASD diagnosis is associated with better outcomes (Mandell et al., 2005), and later diagnosed individuals report more mental health difficulties (Green et al., 2019). Elevated camouflaging is associated with greater internalizing symptomatology and suicidality (Cage et al., 2018; Cassidy et al., 2018); further, ASD women report elevated depression and—in a reversal of sex-based suicide rates in the general population—greater risk of completed suicide relative to ASD men (Hirvikoski et al., 2016). Thus, understanding the associations of camouflaging with later diagnosis as well as with the potentially different presentations of ASD features among females and gender diverse individuals is critical.

To advance our understanding of camouflaging, the current study seeks to: a) replicate prior findings of increased camouflaging in adult-diagnosed ASD females; b) examine whether elevated camouflaging is reported by gender diverse as compared to cisgender ASD adults; c) investigate if adult-diagnosed ASD individuals exhibit elevated camouflaging compared to those diagnosed in childhood/adolescence; and d) assess possible interacting effects between ASD diagnostic timing and either sex-assigned at birth or gender identity on camouflaging.

Methods

Participants

ASD adults (aged 18-49 years) without ID were recruited via Simons Powering Autism Research and Knowledge (SPARK) to complete a battery of online self-rated questionnaires. Participants provided informed consent in accordance with the Declaration of Helsinki. The

study was approved by The George Washington University institutional review board (NCR191497).

Of 665 adults who entered the study, 595 participants completed all measures used in analyses reported here. A community-based professional diagnosis of ASD was required for inclusion in the current analyses. One participant was excluded due to self-diagnosis. Consistent with the self-reported clinical diagnosis of ASD, 94% of the remaining sample (n=594) screened positive for ASD on the AQ-28 (>65).

Measures

Participants completed the 28-item Autism-Spectrum Quotient (AQ-28) (Hoekstra et al., 2011) and the Camouflaging Autistic Traits Questionnaire (CAT-Q) (Hull et al., 2019) as measures of ASD traits and camouflaging, respectively. The AQ-28 queries ASD features using a 4-point Likert scale (1=definitely agree, 4=definitely disagree). Total scores range from 28 to 112, with higher scores reflecting greater ASD features. The AQ-28 total score has shown acceptable to good internal consistency, and good validity and reliability within clinical samples (Hoekstra et al., 2011). To further characterize the sample, we also determined the number of participants scoring above the AQ-28 cut-off (>65) as described in the Participants section. The CAT-Q is a 25-item questionnaire that quantifies social camouflaging behaviors. Questions are answered on a 7-point Likert scale (1=Strongly disagree, 7=Strongly agree). The dependent variables in the current study were the three CAT-Q subscales: Assimilation, Compensation and Masking. These subscales probe strategies used to blend in during social situations (Assimilation; 8 questions); compensate for ASD-related communication and social differences (Compensation; 9 questions); and appear ‘non-autistic’ in social contexts (Masking; 8 questions).

Scores on the Masking and Assimilation subscales range from 8 to 56, and those for the Compensation subscale from 9 to 63, with higher scores reflecting greater levels of camouflaging. The CAT-Q has shown good internal consistency and convergent validity and acceptable test-retest reliability (Hull et al., 2019). The internal consistency reliability for these subscales in the current sample were also good (Assimilation: α=.84; Compensation: α=.88; Masking: α=.84).

Socio-demographics data were collected, including age of ASD diagnosis, gender identity (e.g., female, male, trans female, trans male, gender non-conforming, gender queer, another gender identity), and sex assigned at birth. Gender diverse participants included individuals who reported gender identity other than their sex assigned at birth (e.g., individuals who reported female gender identity and male sex assigned at birth; individuals who reported gender non-conforming and female sex assigned at birth). Cisgender individuals reported a gender identity identical to their sex assigned at birth.

To examine associations between ASD diagnostic timing and camouflaging, participants were grouped into those who received an ASD diagnosis during childhood/adolescence (diagnosis <18 years; *n*=251) versus those who received a diagnosis in adulthood (diagnosis ≥18 years; *n*=343). These diagnostic timing groups significantly differed for the ratio of sex assigned at birth, with a greater proportion of females in the adult-diagnosed group compared to the child/adolescent-diagnosed group ($\chi^2(1)=11.13$, $p<.001$). Perhaps the most consistent variable associated with camouflaging in the literature is female sex; thus, it is possible that the greater proportion of females in the adult-diagnosed group could drive any differences detected in diagnostic timing group comparisons. To control for this possibility, we used MatchIt in R to create a sample that was balanced for the female-to-male ratio between those diagnosed in childhood/adolescence

(*n*=251; female=136; male=115) and those who received a diagnosis in adulthood (*n*=251; female=140; male=111) (($\chi^2(1)=0.13$, $p=.72$) (Table 1)).

Data analysis

Multivariate analysis of covariance (MANCOVA) was used to evaluate potential differences in camouflaging subscales between: a) males versus females, b) gender diverse versus cisgender individuals, c) ASD child/adolescent- versus adult-diagnosed individuals. This MANCOVA was used to evaluate possible interactions among a-c described above, while controlling for ASD symptomatology (AQ-28 total score). Additionally, to be conservative, these analyses were re-run on a matched sample generated after first removing those participants (*n*=33) who did not meet the AQ-28 ASD cutoff.

Results

Using Pillai's Trace, the MANCOVA revealed significant main effects of sex ($F(3,491)=10.8$, $p<.0001$, $V=.062$), gender diversity ($F(3,491)=3.18$, $p=.024$, $V=.019$), and diagnostic timing ($F(3,491)=21.28$, $p<.0001$, $V=.115$). No significant interactions were found (ps>.05). Three follow-up ANCOVAs (Bonferroni-corrected $p<.0167$) revealed those reporting female sex assigned at birth endorsed significantly greater camouflaging across all three CAT-Q subscales compared to males (Assimilation: $F(1,493)=27.7$, $p<.0001$, $\eta^2_p=.054$; Compensation: $F(1,493)=16.6$, $p<.0001$, $\eta^2_p=.033$; Masking: $F(1,493)=13.6$, $p<.001$, $\eta^2_p=.027$). Gender diverse adults reported elevated camouflaging on the Compensation subscale compared to cisgender adults ($F(1,493)=6.45$, $p=.011$, $\eta^2_p=.013$). ASD individuals diagnosed in adulthood demonstrated

elevated camouflaging on the Assimilation ($F(1,493)=58.1$, $p<.0001$, $\eta^2_p=.11$) and Compensation ($F(1,493)=16.36$, $p<.0001$, $\eta^2_p= .07$) subscales compared to adults who received an ASD diagnosis in childhood/adolescence. Importantly, repeating these analysis after removing participants who did not meet the AQ-28 ASD cutoff did not change the results reported above.

Discussion

The results reported here address critical gaps in our understanding of camouflaging among ASD adults without ID by examining key moderating factors, including sex assigned at birth, gender identity, and diagnostic timing, while controlling for core ASD features. Consistent with existing research showing that ASD females, in general, demonstrate elevated camouflaging compared to ASD males (Hull et al., 2020), we found that ASD females reported higher levels of camouflaging across all three CAT-Q subscales compared to ASD males. Our results further enrich our understanding of camouflaging and gender identity by showing that gender diverse ASD adults endorsed more CAT-Q Compensation behaviors compared to cisgender ASD adults. Finally, we show for the first time in a direct between-groups comparison of ASD adults diagnosed in childhood/adolescence versus adulthood, that adult-diagnosed individuals reported significantly more camouflaging behaviors. Specifically, adult-diagnosed individuals reported more CAT-Q Compensation and Assimilation behaviors compared to childhood/adolescent-diagnosed individuals. Importantly, diagnostic timing groups were matched for the proportion of females and males. We further extend the literature by demonstrating that elevated camouflaging in females is attested not only in individuals diagnosed during adulthood, as has been shown in the literature thus far (Hull et al., 2020), but also among individuals diagnosed in childhood/adolescence.

The CAT-Q Compensation subscale queries modeling the social behavior of others, either in real-time, such as copying the gestures or phrasings of an interlocuter, or through rehearsal, such as 'trying on' facial expressions in a mirror. The Compensation subscale in particular may indirectly reflect awareness of social norms and motivation to conform to those norms in order to be socially successful. For instance, Compensation includes identification and close study of real-life or fictitious characters (e.g., from books, TV or other media) deemed to be socially adept. Through induction, ASD individuals may move from these exemplars to emulate patterns of social behavior and craft a persona that is gauged to have a high chance of social success. The CAT-Q Compensation scale may have unique implications for females and gender diverse individuals, as for both groups gendered stereotypes, including those presented in media, may exert a particular influence on gendered performance.

The CAT-Q Assimilation subscale prominently features questions that probe performative socializing (e.g., 'pretending to be normal'). This 'performance' aspect of the Assimilation subscale is notionally similar to the use of research, rehearsal and imitation of others described in the Compensation subscale, in that both Assimilation and Compensation subscales point to the effortful construction and enactment of a persona that gives one's social audience the impression of 'neurotypicality'. In contrast, the CAT-Q Masking subscale does not probe behaviors that *construct* a non-autistic persona but instead queries attendance to and adjustment of behaviors that may *'give away' one's autistic identity* (e.g., monitoring one's own language, gestures, facial expressions). We speculate that Assimilation and Compensation, which involve the active, generative processes of constructing a non-autistic persona may have particular implications for late diagnosis of ASD. Specifically, whereas Masking may conceal a presentation that might attract attention (including diagnostic assessment) as ASD; Assimilation and Compensation go

further, crafting a social presentation that *not only conceals* an ASD presentation but in fact *argues against* ASD. Thus, the active maintenance of a 'non-autistic' social self through Assimilation and Compensation may more strongly deter detection of this presentation as autistic and thus interfere with the referral of these individuals for diagnostic assessment of ASD and/or the results of such diagnostic evaluation.

The inclusion of both sex and gender impacts on camouflaging in ASD, and the relatively large number of gender diverse individuals, affording adequate statistical power to detect effects of gender diversity on camouflaging, are among the strengths of the current study. Unavoidably, given the distribution of age of diagnosis in the sample, the childhood-adolescent diagnostic timing group included individuals with a relatively timely diagnosis (during early childhood) and those with a late diagnosis (as late as 17 years). There is a need to examine camouflaging and its associations with diagnostic timing with greater granularity (e.g., toddlerhood, early childhood, middle childhood, adolescence, and adulthood). Nevertheless, the current study provides strong early evidence for factors that are linked to camouflaging in ASD. Further empirical scrutiny is needed to better understand underlying mechanisms and downstream consequences of camouflaging in ASD, particularly for these groups more likely to employ these approaches to navigate neurotypical society.

Declaration of conflicting interests

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Table 1. Demographics: Descriptive statistics and comparisons of childhood/adolescent- and adult-diagnosed groups

		Childhood/ Adolescent-Diagnosed (ASD diagnosis <18 years)	**Adult-diagnosed** (ASD diagnosis ≥18 years)	**Test-statistic, *p*-value, effect size**
	N=502	*n*=251	*n*=251	
Age, years				*W*=49054,
Mean(SD)	32.97(8.7)	28.86(7.87)	37.08(7.46)	*p*<.0001,
Median(Range)	*31.96(18.17-49.92)*	*27.42(18.17 49.92)*	*37.17(19.67-49.75)*	*r*=.48
Race (n,%)				$\chi^2(5)$= 6.68,
African American/Black	15(2.99%)	11(4.38%)	4(1.59%)	*p*=0.2451,
Asian	9(1.79%)	3(1.2%)	6(2.39%)	*V*=.12
Caucasian	412(82.07%)	207(82.47%)	205(81.67%)	
Native American/Alaska Native	4(0.80%)	3(1.2%)	1(0.40%)	
Native Hawaiian/Pacific Islander	0(0%)	0(0%)	0(0%)	
More than one race	48(9.56%)	23(9.16%)	25(9.96%)	
Other	12(2.39%)	4(1.59%)	8(3.19%)	
Not reported	2(0.40%)	--	2(0.8%)	
Ethnicity				$\chi^2(1)$= 1.46,
Latinx descent	50(9.96%)	29(11.55%)	21(8.37%)	*p*=.23,
Not of Latinx descent	441(87.854%)	216(86.06%)	225(89.64%)	*V*=.05
Unknown	9(1.79%)	5(1.99%)	4(1.59 %)	
Not reported	2(0.40%)	1(0.40%)	1(0.40%)	
Maternal educational attainment				$\chi^2(9)$=10.61,
No high school	12(2.39%)	6(2.39%)	6(2.39%)	*p*=.30,
Some high school	23(4.58%)	11(4.38%)	12(4.78%)	*V*=.15
GED diploma	21(4.18%)	12(4.78%)	9(3.58%)	
High school graduate	92(18.33%)	34(13.54%)	58(23.11%)	
Trade/vocational school	24(4.78%)	13(5.18%)	11(4.38%)	
Associate's degree	48(9.56%)	22(8.76%)	26(10.36%)	
Some college	66(13.15%)	36(14.34%)	30(11.95%)	
Baccalaureate degree	111(22.11%)	61(24.30%)	50(19.92%)	
Graduate/professional degree	81(16.14%)	42(16.73%)	39(15.54%)	
Unknown	22(4.38%)	14(5.58%)	8(3.19%)	
Not reported	2(.40%)	0(0%)	2(0.80%)	
Sex assigned at birth, n(%)				$\chi^2(1)$= 0.13,
Female	276(54.98%)	136(54.2%)	140(55.8%)	*p*=.72,

Male	226(45.02%)	115(45.8%)	111(44.2%)	V=.02
Gender Identity				$\chi^2(1)$=1.18,
Gender diverse	62(12.35%)	27(10.76%)	35 (13.9%)	p=.28,
Gender non-diverse	440(87.65%)	224(89.24%)	216 (86.1%)	V=.05
AQ-28 Total Score				t(489.11)=7.49,
Mean(SD)	83.42(11.68)	79.72(11.89)	87.13(10.23)	p<.0001,
Median(Range)	*83(47-112)*	*79(47-112)*	*87(59-110)*	d=.67
AQ-28 cut-off, n(%)				$\chi^2(1)$= 17.159,
>65	472(94.02%)	225(89.6%)	247(98.4%)	p<.0001,
≤65	30(5.98%)	26(10.4%)	4(1.6%)	V=.18
Age at diagnosis				
Mean(SD)	20.29(13.02)	9.08(4.96)	31.5(7.93)	W=63001,
Median(Range)	17.92(6 months-49.08 years)	*9(6 months - 17.83years)*	*31(18-49.08 years)*	p<.0001, r=.87
Autism diagnosis, n(%)				
ASD	211(42.03%)	81(32.27%)	130(51.8%)	$\chi^2(3)$= 270.6,
Asperger's Disorder	224(44.62%)	123(49.0%)	101(40.2%)	p<.0001,
Autism/Autistic Disorder	37(7.37%)	24(9.56%)	13(5.2%)	V=.42
PDD-NOS	30(5.98%)	23(9.16%)	7(2.8%)	

Notes: PDD-NOS=pervasive developmental disorder not otherwise specified; AQ-28=28-item Autism-Spectrum Quotient.

Table 2. Camouflaging Autistic Traits Questionnaire (CAT-Q) subscale scores: Descriptive statistics

		Childhood/Adolescent-Diagnosed (ASD diagnosis <18 years)	**Adult-diagnosed** (ASD diagnosis ≥18 years)
	N=502	*n*=251	*n*=251
CAT-Q subscale, Mean(SD) *Median(Range)*			
Assimilation	38.39(9.94) *39(8-56)*	35.71(10.56) *36(8-56)*	41.06(8.48) *43(17-56)*
Compensation	38.14(12.59) *39(9-63)*	36.01(12.43) *37(9-63)*	40.27(12.41) *41(11-63)*
Masking	33.17(10.39) *34(8-56)*	32.63(10.53) *34(9-56)*	33.72(10.23) *35(8-53)*

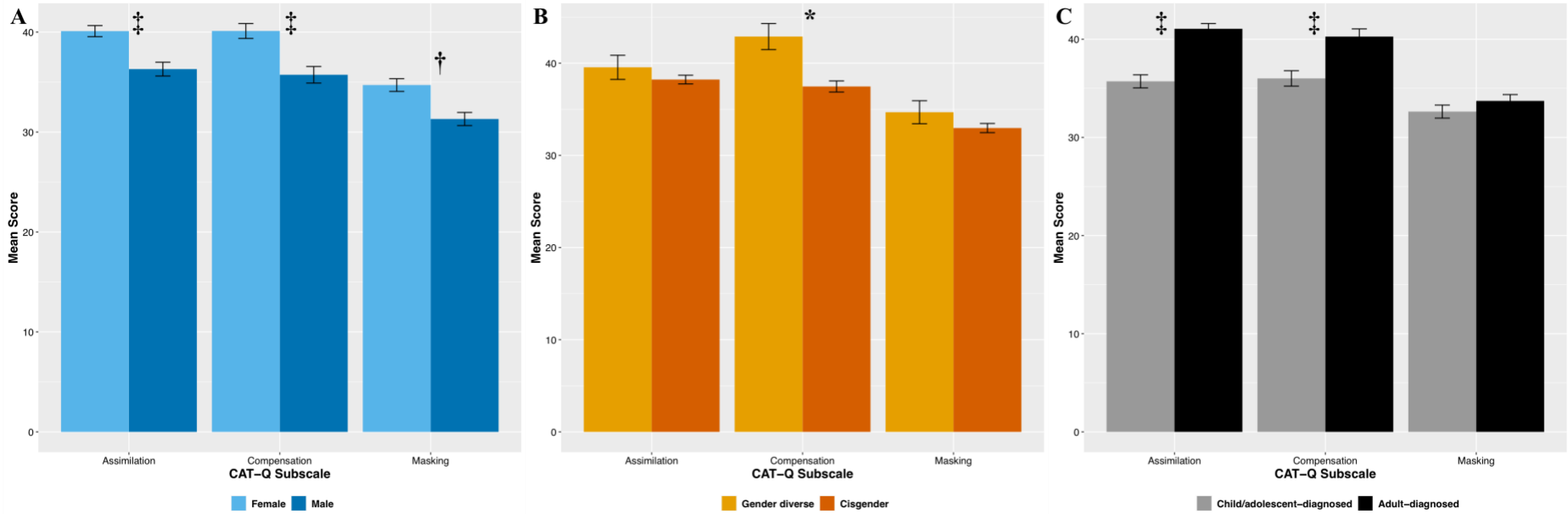

Figure 1. CAT-Q subscale scores by A) sex assigned at birth, B) gender identity and C) diagnostic timing (child/adolescent-, adult-diagnosed). Error bars represent standard error. **p*<.05; †*p*<.001; ‡*p*<.0001.