A Systematic Review of Passing as Non-Autistic in Autism Spectrum Disorder

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Abstract

While long described in anecdotal accounts of the lived experiences of autistic individuals, the phenomenon of behaving in ways that appear inconsistent with the presence of autism (or passing as non-autistic; PAN) has recently seen a dramatic increase in scrutiny in the published scientific literature. Increased research attention has coincided with a proliferation of methods, definitions, measures, and population assumptions associated with PAN. To date, however, no review has sought to systematically identify and synthesize the literature on PAN. This systematic review reflects the state of the PAN literature as of May 2020. Ninety articles were screened, 66 were identified for evaluation, and 46 met inclusion criteria and were reliably coded for study characteristics and participant characteristics. Results reveal that the PAN literature includes a relatively even mix of qualitative, quantitative, and mixed-method studies, and that a variety of terms are used for PAN (with *masking* and *camouflage* being the most frequent). Sample sizes varied widely (from one to 832 participants), with 63.06% of participants being categorized as autistic. Nearly all studies reported methods for confirming autism diagnoses, with community and clinical diagnoses being most common. The majority of studies reported participant gender, with slightly more females included than males on average, but fewer than half of all studies compared PAN across genders. Nearly all studies reported participant age, demonstrating a wide range of 2 to 79 years, with a mean age of 23.85. Conversely, only 23.91% of studies provided participant race or ethnicity data. Nearly all studies formally or informally excluded participants with intellectual disability. Finally, measures of internalizing symptoms, which are often thought to be linked to PAN, were reported in only 17.4% of studies. Implications for gaps in understanding of PAN and future directions for the field are discussed.

Keywords

Autism spectrum disorder; camouflage; masking; passing; PAN; compensation

Autism Spectrum Disorder (ASD) is a complex, lifelong, neurodevelopmental disorder characterized by deficits in social communication and interaction, and the presence of restricted, repetitive patterns of behavior, activities, or interests (American Psychiatric Association (APA, 2013). ASD symptomology is characterized by significant heterogeneity between and within individuals on the autism spectrum across measures of social, adaptive, and cognitive functioning. Individual differences in developmental trajectories in ASD are similarly diverse, though understanding of this phenomenon is lacking (Livingston, Shah, & Happé, 2019b). Indeed, little is known about how some autistic individuals exhibit variation in their behavior by context (Lerner, De Los Reyes, Drabick, Gerber, & Gadow, 2017) to such a degree that they present in ways that defy formal diagnostic presentation altogether. Specifically, it is unclear why or how some autistic individuals are able to present behaviorally as non-autistic in select situations, despite persisting ASD-related cognitive and behavioral differences being apparent across other contexts (Livingston et al., 2019b). Understanding this phenomenon is crucial for unpacking the phenotypic heterogeneity that has become a hallmark of ASD.

For decades, clinicians and autistic individuals have described a subgroup of autistic people who behave in ways that appear non-autistic. These anecdotes suggest that despite experiencing differences in social cognition and other characteristics of ASD, some autistic individuals engage in overt behavior that is not distinguishable as autistic (Attwood & Grandin, 2006; Kopp & Gillberg, 1992, 2011; Willey, 1999; Wing, 1981). Various accounts have proposed that some autistic individuals may 'pass' as non-autistic or 'neurotypical' in social situations through concealing or 'camouflaging' their observable ASD symptoms. Furthermore, these accounts have generated common assumptions about who is likely to be engaging in social passing behavior, typically including females, adults, and those with average to above average intelligence (Allely, 2019; Bargiela, Steward, & Mandy, 2016; Hull & Mandy, 2017; Livingston et al., 2019b). Assumptions about the potential benefits of "passing" as non-autistic include improved outcomes for some autistic individuals who experience challenges in areas such as maintaining relationships, achieving higher education, and attaining employment (Jorgenson, Lewis, Rose, & Kanne, 2020; Livingston et al., 2019b), while assumed risks include mis- and missed diagnosis, exclusion from needed services, mental and emotional exhaustion, and increased rates of internalizing problems such as anxiety and depression (Livingston & Happé, 2017; Mandy, 2019; Raymaker et al., 2020). Recently, this phenomenon ("social camouflaging" or "passing") has been gaining formal research attention among ASD researchers. Some preliminary evidence supports earlier clinical accounts and personal narratives, suggesting that use of social passing strategies among autistic individuals is relatively common (Cage, Monaco, & Newell, 2018). However, because research examining camouflaging behavior in ASD is still in its infancy, investigators have yet to grapple with the critical tasks of determining *what* the phenomenon is, and *who* the population is, that are being studied. Before assumptions about social camouflaging in ASD can be empirically tested, the boundaries and features of the

phenomenon itself, as well as the specific population engaging in this behavior, must first be described and defined.

What is this Phenomenon, and What Do We Call it?

First, within the scientific literature on ASD, numerous terms have been employed to describe the phenomenon of autistic individuals behaving in ways that appear non-autistic, and the myriad behaviors and processes encompassed by its conceptual umbrella. These terms include, but are not limited to: camouflage, masking, passing, compensation, mimicry, imitation, and accommodation. Lack of consistent terminology across studies poses logistical issues for conceptualizing and communicating ideas within scientific and academic domains, as well as bridging the gap between research and clinical contexts. Furthermore, discrepant terminology threatens to obscure information necessary for replicating methodology and reconciling findings across studies. For example, use of variable terminology can be problematic if conceptual overlap exists between differentially labeled variables, and/or if one variable label is used across studies to indicate or define conceptually distinct phenomena. It remains unclear whether the language being used in academic research to label the phenomenon of autistic individuals behaving neurotypically is being applied consistently across studies.

Second, it is uncertain whether a consensus has been established amongst researchers regarding the conceptual definition (and the construct validity) of social camouflaging or passing (Lai et al., 2020). Some authors have hypothesized that some autistic individuals may consciously regulate (increase or decrease) specific behaviors to *camouflage* their social difficulties and lessen the surface appearance of their ASD symptoms during social interactions (Hull, Mandy, & Petrides, 2017; Hull, Petrides, et al., 2017). The term "masking" has been used to characterize specific aspects of camouflaging which involve concealing ASD symptoms (Allely, 2019). Behavioral masking includes intentional suppression of ASD-related behaviors considered socially unacceptable (e.g., self-stimulatory behavior, motor stereotypies, repetitive behaviors) and increased superficial performance of behaviors that the individual does not typically engage in, such as intentionally maintaining appropriate eye contact or asking questions about a conversation partner (Lai et al., 2017). Researchers have suggested that strategies such as taking on predefined social roles or personas, preparing topics and practicing conversations ahead of time, and following social scripts during social interactions may support individuals' ability to "mask" specific observable autistic behaviors (Allely, 2019; Lai & Baron-Cohen, 2015). Conversely, more recent formulations have described "masking" as an automatic response to stigmatization (Pearson & Rose, 2021; Perry, Mandy, Hull, & Cage, 2021), which may or may not be desired by autistic individuals or produce behavioral outcomes that conform to non-autistic norms. Behavioral "mimicry" or "imitation" has been described as the use of novel social behaviors which have been intentionally learned through observing and adopting the habits of socially competent peers (Attwood & Grandin, 2006; Hull, Petrides, et al., 2017). It has been suggested that by copying the mannerisms, vocal intonation patterns, interests, and fashion choices of typically-developing peers, some autistic individuals may develop the ability to maintain reciprocal conversations, make appropriate eye contact, and use gestures and other nonverbal social cues to

augment their speech such that their overt behavior appears non-autistic according to classic representations of ASD (Lai et al., 2011). Another hypothesis proposes that some autistic individuals may utilize alternative neurocognitive and behavioral strategies (i.e. "compensatory strategies") to "compensate" for cognitive differences and achieve external behavioral presentation that appears non-autistic (Livingston & Happé, 2017; Livingston et al., 2019b). Lastly, the terms "accommodation strategies," "adaptation strategies," and "coping strategies" have been used to describe behaviors and decision-making strategies which help support, without necessarily altering, differences in social behavior. For example, an individual may intentionally incorporate humor or wit into social interactions, or seek out environments which highlight personal strengths, such as occupations which value non-social skills more highly than social skills, or hobbies that involve one's restricted interest in an unusual topic (Livingston et al., 2019b). Such strategies may therefore be better understood as methods for harnessing and capitalizing on autistic strengths and may not necessarily be PAN-specific.

Each of these conceptual descriptions suggest that the within-person variability observed in ASD symptomology is at least in part context-dependent and reflective of the environmental, cognitive, and emotional demands of the situation, as well as the support and resources available to the individual. The diversity of terminology used thus far to describe this construct is indicative of the relative recency of this area of study, as well as the complexity of the construct. The linguistic variation exhibited thus far also demonstrates challenges inherent in describing a population and their experience from an outside perspective. For example, some of the terms utilized in the extant literature to label this phenomenon include ableist associations and assumptions that are perceived to carry negative connotations by members of the autistic community (Hull, Petrides, et al., 2017; Schneid & Raz, 2020). To avoid ableist language (Bottema-Beutel, Kapp, Lester, Sasson, & Hand, 2021), the authors prioritized autistic perspectives, seeking input and feedback from autistic self-advocates (including, but not limited to, members of our team) during conceptualization and throughout the preparation of this manuscript. This included discussions to identify a more inclusive descriptive term for the phenomenon of autistic individuals outwardly behaving in ways that are either intended to appear or perceived to be non-autistic in social situations, herein referred to as *passing as non-autistic* (*PAN*). The current study operationalizes PAN as an overarching umbrella term to encompass the array of conceptual and terminological variations used to describe autistic individuals who behaviorally present as non-autistic in social contexts despite experienced differences in dispositional traits and/or functioning across physiological, cognitive, and behavioral levels. The working definition of PAN is inclusive of any attempt (intentional or otherwise) to minimize, alter, or otherwise change the outward appearance of autistic behaviors, regardless of the perceived level of effectiveness or ineffectiveness attributed to such attempts. Any usage of other subsidiary terms in this manuscript is attributable to the specific usage in a given citation.

How Do We Measure PAN?

Due to the subjective nature of behavior generally and the covert nature of PAN specifically, variations in the methodology used to quantify PAN threatens to obscure research outcomes, challenge interpretations of findings, and impede identification of autistic individuals who

engage in PAN behavior. Until very recently, little research attention has been dedicated to the methods of measuring PAN in ASD, including the question of whether this phenomenon can be measured and studied quantitatively. In a recent review examining the hypothesized relationship between camouflaging behavior and the 'female autism phenotype,' Allely (2019) identified four categories of study designs used to measure camouflaging (specifically in autistic girls and women): qualitative research using semi-structured interviews to explore first-hand experiences of autistic females; quantitative research using standardized measures of language and ASD symptoms; concurrent mixed methods; and a combination of behavioral, cognitive, and neuroimaging methods. Such evidence suggests there are multiple ways of measuring the PAN construct. It remains unclear whether the broader PAN literature is using similar methods, and whether PAN in ASD is currently and/or *can* be quantitatively measured.

Who is Engaging in PAN?

One of the assumptions stemming from clinician reports and personal narratives about PAN in ASD is related to reports of autistic individuals not being referred for diagnostic evaluation, or not receiving a formal ASD diagnosis until a much later age (if at all) due to a behavioral presentation that does not match the prototypical behavioral phenotype associated with ASD (Bargiela et al., 2016; Hull, Petrides, et al., 2017; Lai & Baron-Cohen, 2015; Lai et al., 2017; Livingston et al., 2019b; James C. McPartland, 2019). Because ASD is diagnosed based on behavior alone (APA, 2013), autistic individuals who engage in behavior to PAN are by definition more likely to appear non-autistic and therefore may fail to be referred for diagnostic services and/or fail to meet full diagnostic criteria for a formal ASD diagnosis. This poses a unique set of challenges for the study of PAN behavior in ASD, because the autistic individuals who are engaging in PAN behavior are the same individuals who are most likely to be "missed" by current gold-standard diagnostic instruments. Therefore, for research purposes, identification of autistic individuals who engage in PAN must go beyond behavioral observation and gold-standard diagnostic tools to measure ASD symptomology (Fombonne, 2020). However, it remains unclear if, and to what extent, various methods of diagnostic confirmation have been utilized across studies examining the PAN phenomenon in ASD.

In particular, it has been suggested that females[1] with ASD may present behavioral symptoms in ways that appear different from males with ASD, and that this 'female autism phenotype' may be one of the factors contributing to the underdiagnosis of females with ASD (Bargiela et al., 2016; Beck, Lundwall, Gabrielsen, Cox, & South, 2020; Fombonne, 2020). Furthermore, it has been theorized that a combination of factors, including differences in neurobiological, developmental, and cognitive factors, as well as gendered social expectations, may lead females with ASD to be more able and likely to engage in PAN behavior during clinical ASD assessments and therefore not receive ASD diagnoses as often as males (Hull et al., 2020). It has also been assumed that PAN may

[1]To date, the vast majority of studies reporting on participant gender in this literature do not explicitly differentiate between biological sex and gender, often using the two terms interchangeably, and many theoretical models which hypothesize higher rates of PAN among females presume 'female' to mean '*cisgender* female'. Any deviations from this implicit pattern in the literature or here will be specifically noted.

be especially common among older autistic females without intellectual disability (ID; Bargiela et al., 2016). Individuals who possess one or more of these characteristics (older age, female gender, average or above average cognitive ability) are less likely to be referred for diagnostic assessment (Fombonne, 2020; Hull & Mandy, 2017). These individuals may also experience greater external pressure to conform to neurotypical social expectations and may therefore PAN at a higher rate because they possess the requisite executive functioning skills, intellectual ability, and life experiences imperative for implementing strategies to PAN in social situations.

To test the assumption that PAN in ASD is more common among females, adults, and individuals with average to above average intelligence, it is imperative to first determine whether these demographic factors are being reliably reported across studies. Accounting for the demographic characteristics of the autistic individuals who have been included in PAN research to date will allow for identification of specific subgroups of the ASD population which have heretofore been neglected from this burgeoning field of study. Among studies which do report participant demographics, it remains unclear the extent to which researchers have compared groups to test for differences in levels of PAN behavior based on demographic variables such as participant gender, age, and/or intelligence.

Current evidence suggests that ASD occurs at similar rates across all racial and ethnic groups. The authors are not aware of any research that theorizes differences in PAN as a function of race or ethnicity. However, research indicates that despite the guidelines for reporting participant demographic information publicized by several prominent academic journals for ASD research (and the American Psychological Association; Appelbaum et al., 2018), only a small percentage of articles published in those same journals provide information about participants' race or ethnicity (Pierce et al., 2014). Furthermore, scientific articles which do report racial or ethnic information about research participants have included research samples of predominantly white participants (Harris, Barton, & Brunson Mcclain, 2020). Thus, investigating the percentage of studies reporting participants' racial and ethnic background, as well as describing the rate of inclusion of ASD research participants from traditionally underrepresented racial and ethnic groups, is critical for understanding the scope and generalizability of the findings of the current PAN literature.

Is PAN Helpful or Harmful to People Who Exhibit It?

When used in social situations, PAN may provide autistic individuals with an adaptive method for successfully navigating potentially overwhelming and threatening environments via avoiding social awkwardness and interpersonal conflict. PAN may therefore increase one's ability to reduce experiences of stigmatization and discrimination, and maintain relationships, employment, and independence (Hull, Lai, et al., 2020). However, it has been suggested that PAN may also be associated with a number of detrimental outcomes for autistic individuals, including poor mental health, difficulty accessing appropriate services, and significantly delayed, inaccurate, or lack of formal ASD diagnosis (Bargiela, Steward, & Mandy, 2016; Hull et al., 2017; Lai & Baron-Cohen, 2015; Lai et al., 2017; Livingston, Shah, & Happé, 2019a; McPartland, 2019). In the United States, this becomes especially problematic as documentation of formal diagnoses is often a prerequisite

for receiving necessary supports and services through school districts and government programs (Thomas, Ellis, McLaurin, Daniels, & Morrissey, 2007), as well as the ability to pay for those programs through private insurance companies. Furthermore, increasing knowledge and awareness about the impacts of PAN has important ethical implications for the implementation of social skills interventions, many (though not all; (Gates, Kang, & Lerner, 2017; Lerner, White, & McPartland, 2012)) of which implicitly or explicitly teach autistic individuals to PAN (Bottema-Beutel, Park, & Kim, 2018). Regardless of the potential impacts of PAN on mental health, since the goal of such interventions is often to produce behaviors that will be viewed as skilled by non-autistic peers, they effectively teach autistic individuals to modify their behavior to conform to these views and expectations, thus reinforcing a cultural hierarchy which values non-autistic behavior over autistic behavior. This devaluation of autistic traits may lead to decreases in self-esteem and authentic self-expression among autistic individuals (Bottema-Beutel et al.), thus presenting a potential mechanism of action for one of the most frequently cited rationales for studying PAN in ASD is the hypothesis that PAN is associated with increased rates of internalizing problems such as anxiety and depression (Beck et al., 2020; Cage & Troxell-Whitman, 2019; Cassidy et al., 2019; Lai et al., 2017). However, it remains unclear whether and how researchers are measuring the potential costs and benefits of PAN, and how the use of outcome measures compares across studies.

Rationale and Scope

Identification of autistic individuals who PAN is critical for providing needed accommodations and services to support the mental and physical well-being of this population. Identification of autistic individuals who PAN also has important implications for improving our understanding of variations in the behavioral presentation of the autism phenotype among individuals who do not fit within the prototypical idea of ASD, and therefore has implications for improving the sensitivity and specificity of diagnostic instruments. Research on PAN in ASD has increased dramatically over the past two decades and has seen especially rapid growth in the last couple of years (e.g., a PubMed search on September 9, 2020, reveals that in the 15 years between 2001 (when the term "camouflage" was first used in ASD research) and 2016, 9 publications used the terms "autism" and "camouflage," compared to the 11 publications so far in 2020 alone). Presently, there is a critical opportunity to clarify gaps in the literature to date and provide actionable guidance for future researchers seeking to explore some of the most pressing research questions posed for this area of study. To date, there has been only one prior systematic review of the PAN literature in ASD. However, this paper only examined studies which focused on camouflaging exclusively in females with ASD (Allely, 2019) and did not investigate research questions related to the characterization or measurement of PAN in ASD nor the people described as engaging in PAN.

To clarify the current status of academic research on PAN in ASD and to identify directions for future research in this area, the current systematic review aims to identify key study characteristics and participant characteristics present in the extant literature on PAN in ASD. Due to the relatively recent increase in formal research attention dedicated to PAN in ASD, the current study aims to elucidate the distribution and range of study designs utilized thus

far (e.g., qualitative, quantitative, and mixed methods designs) as well as the language used to describe and label PAN (e.g., *camouflaging*, *masking*, and *compensation*). The current study seeks to explore how consistently participant demographics are reported across the extant PAN literature, and when they are reported, to characterize the autistic participants included in PAN research to date, by providing a qualitative summary and quantifying the frequency distribution of each variables' constituent categories. Participant demographic variables of interest include: the specific method(s) of confirming ASD diagnosis, race and/or ethnicity, gender, and age. Additionally, the present study aims to document current reporting practices regarding standardized measures of intelligence and mean participant scores on such measures, inclusion of measures of broad internalizing symptoms, and in studies which include participants of more than one gender, the frequency of group comparisons of PAN rates by gender. Overall, these aims are meant to provide a benchmark for the current state of the field of PAN research.

Method

The current systematic review was conducted in accordance with the guidelines for Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA; Liberati et al., 2009; Moher, Liberati, Tetzlaff, & Altman, 2009).

Inclusion and Exclusion Criteria

Articles included in the current review were required to meet the following pre-established inclusion criteria: 1) full article text available in English; 2) article has been published in a peer reviewed journal or is a dissertation for the completion of a doctorate degree and approved by a University academic committee; 3) article empirically investigates behavior involved in PAN in human subjects with ASD.

Information Sources and Search Procedure

The PsycINFO and PubMed databases were searched to identify studies which empirically investigated PAN behavior in autistic individuals. Searches did not include a date restriction. Database searches were conducted on May 4, 2020. Search terms were applied to article titles and included the following search criteria: ("autis*" OR "asperger*" OR "ASD" OR "autis* spectrum disorder" OR "ASC" OR "autis* spectrum condition") AND ("camouflage*" OR "mask*" OR "pass*" OR "compensat*"). To ensure broad inclusion of papers on this ill-defined concept, we erred on the side of maintaining as wide a representation as possible of the PAN construct in the literature by including articles ranging from linguistic indicators of PAN to qualitative accounts by autistic individuals, to qualitative accounts by parents, to case studies, to empirical studies.

Study Selection

The selection process is summarized in the PRISMA flow diagram depicted in Figure 1. Search terms and Boolean phrases used in the initial database search were selected by the first author. Study identification and screening were carried out simultaneously by two trained research assistants. Following exclusion of duplicates from the initial database search results, 90 article titles were screened for relevance. Next, the abstracts of relevant titles

were screened to determine if articles met study inclusion criteria. Full-text articles were retrieved if abstracts indicated inclusion criteria were met or if an abstract lacked sufficient information to decide inclusion. The two research assistants agreed on inclusion/exclusion of articles based on title and abstract screening 87.6% of the time. Coder responses were automatically aggregated and reviewed by the first author to identify discrepancies between coders. To improve coding accuracy, coding discrepancies were discussed and resolved via consensus meetings with all coders. Seventeen additional articles were identified through systematic review of the reference lists of the 27 included articles (backward search), while the Google Scholar "Cited by" function was used to capture studies which had cited the 27 included articles identified from the database search (forward search), resulting in 22 additional articles.

The first author and a team of three trained coders assessed 65 full-text articles for eligibility, with 20 articles excluded for not meeting inclusion criteria (reasons for exclusion provided in Figure 1). The remaining 46 identified studies were determined to be empirical explorations of PAN behavior in autistic individuals and were included and coded by the team of three coders for variables of interest. Ten articles (21.7%) were triple-coded for reliability purposes and 8 articles (17.4%) were coded by the first author to ensure consistency with coding guidelines.

Data Collection and Items

All search procedures, coding instructions, variable definitions, and coding examples were operationalized by the first and last author in the study coding manual prior to initiation of coding included articles. Coders reviewed the coding manual prior to beginning coding and referenced the manual while actively coding each included article. Coders first coded several novel articles to pilot test the coding Google Form and coding manual and in order to identify and address points of confusion through reviewing results with the first author prior to coding articles included in the current review. Coders reviewed full-text articles for all included studies and recorded the following data items in the Google Forms. Coder responses were automatically aggregated and reviewed by the first author. Coding discrepancies identified for the articles which were triple coded for reliability were resolved by the first author through reviewing the original article to determine the correct code.

Coded items included continuous, binary, categorical, and narrative-form variables. Variables indicated as continuous were recorded by coders as discrete numerical values rounded to the nearest hundredth where necessary. Binary variables indicate items coded *yes* or *no*. Coding of categorical variables involved selecting one (single response) or more (multiple response) appropriate items from a pre-established set of multiple-choice answers. Multiple-choice items were pre-selected by the first author based on the most anticipated codes and detailed below for each categorical item. Multiple-choice items always included an "Other" response option which allowed coders to write-in responses not included among the multiple-choice response options. Narrative-form variables indicate items recorded via open text boxes in long-form text using either direct quotes from the study authors (indicated with quotation marks in Table 1) or paraphrased by the coder. Lastly, because the current systematic review specifically aims to characterize the autistic individuals thus far included

in PAN research, unless otherwise noted, all participant characteristics refer only to the autistic research participants included in the reviewed studies.

Study Characteristics

Study Design (Categorical, single response). Coders indicated whether the research design of the study was *Quantitative*, *Qualitative*, *Concurrent Mixed Methods*, or *Other*.

PAN Variable Label(s) (Categorical, multiple-response). The variable label(s) used to identify the phenomenon of PAN and behaviors included under its conceptual umbrella. If a study referred to PAN behavior by multiple names throughout the article, all terms used were coded. If the variable label used differed from the provided response options only in form or verb tense (e.g., "mask" instead of "masking" or "compensatory" instead of "compensation"), the pre-defined response option was selected. Response options included: *Camouflage*, *Masking*, *Passing*, *Compensation*, *Superficial Social Behavior*, *Imitation*, and *Other*.

PAN Operational Definition (Narrative). The operational definition provided by the study authors to conceptually define PAN.

Participant Characteristics

Sample Size (Continuous). The total number of all research participants included in a study, regardless of diagnostic status. Sample overlap between included studies was not able to be accounted for in the current review. Participant numbers may therefore include non-unique participants.

ASD Participants (Continuous). All included studies included research participants with ASD. Due to the theory that autistic individuals who are adept at camouflaging their ASD symptoms may be less likely to receive a formal ASD diagnosis, some PAN studies include autistic individuals with formal ASD diagnoses as well as individuals who self-identify as autistic without ever having received a formal ASD diagnosis. Studies do not consistently differentiate between individuals with and without formal ASD diagnoses included in the number of ASD research participants reported. Thus, the current review separately addresses the issue of diagnostic confirmation and includes all individuals identifying as autistic, regardless of the presence or absence of a formal ASD diagnosis, within the *ASD Participants* category. Multiple studies included individuals who identified as having significant difficulties in social situations and/or scored highly on measures of autistic traits, but who did not identify as an autistic person nor report a history of receiving an ASD diagnosis. According to the studies' authors, the inclusion of these participants reflects a concerted effort to better capture the wide heterogeneity which characterizes the full autism spectrum. This characteristic heterogeneity is artificially constrained in much of ASD research due to the selection biases which result from the use of standard ASD diagnostic tools and restrict research participation to those individuals who meet the formal diagnostic threshold. These non-diagnosed non-neurotypical participants were therefore counted and reported separately from ASD participants in the current review.

ASD Diagnosis Confirmation (Categorical, multiple response). This represents the method(s) by which investigators sought to confirm participants' ASD diagnosis. Coders selected one or more of the following response options: *No Confirmation*, no evidence of diagnostic confirmation is provided by the study; *Confirmation via Self-Identification*, confirmation of diagnosis is based on participant's self-reported identification as a person on the autism spectrum who has never received a formal diagnosis but who believes they meet diagnostic criteria for the disorder; *Confirmation via Community Diagnosis*, confirmation of diagnosis is based on participant's self-reported receipt of a formal diagnosis by a clinician or other health care provider in the community (e.g. pediatrician, psychiatrist, school psychologist, therapist, etc.), including participants who self-report receipt of a formal diagnosis without specifying the source of their diagnosis; *Confirmation via Clinical Diagnosis*, Confirmation of diagnosis is based on clinician observation and/or on the basis of DSM-5 or ICD-10 criteria; *Confirmation via Chart Review*, confirmation of diagnosis is based on review of medical records by research personnel to establish current or history of symptoms consistent with ASD diagnostic criteria and/or record of a formal diagnostic code indicating a diagnosis of ASD, autism, Asperger's, or PDD-NOS was provided; *Confirmation via Questionnaire*, confirmation of diagnosis based on answers to a questionnaire(s) reported by peers, parents, teachers, a significant other, or self-report (e.g., Social Communication Questionnaire (SCQ), Autism Quotient (AQ), Social Responsiveness Scale, Second Edition (SRS-2), etc.); *Confirmation via Standardized Assessment*, confirmation of diagnosis through clinical observation of participant's performance along a continuum of ability and/or achievement, excluding assessments with the ADOS-2 and ADI-R (e.g., CARS-2, the Behavior Observation Scale for Autism, the Behavior Rating Instrument for Autistic and Atypical Children, the Autism Observation Scale, the Autism Behavior Checklist, etc.); *Confirmation via the Autism Diagnostic Observation Schedule (ADOS) only*, diagnosis is confirmed through use of the ADOS assessment only; *Confirmation via the Autism Diagnostic Interview, Revised (ADI-R) only*, diagnosis is confirmed through the use of the ADI-R assessment only; *Confirmation via the ADOS and ADI-R*, confirmation of diagnosis is obtained through meeting diagnostic criteria on both the ADOS and ADI-R assessments; *Confirmation via ADOS, ADI-R, and Clinician (i.e. 'Gold-Standard' diagnosis)*, diagnosis is confirmed through meeting diagnostic criteria on both the ADOS and ADI-R assessments, as well as clinical judgment by a trained clinician with experience diagnosing autism.

Participant Sex/Gender (Continuous). The authors acknowledge the important distinction between biological sex and gender. As stated by the World Health Organization (WHO; 2010), 'sex' refers to genetically based biological characteristics determined at birth, whereas 'gender' is a socially defined construct used to describe behavioral attributes and which varies across cultures and time. Despite this, biological sex and gender are often used interchangeably in scientific research (WHO, 2010). Due to significant variability in the amount of information studies provided about how data describing participants' sex and/or gender was obtained, the current review is unable to differentiate between the biological sex and gender of research participants. Coders documented the number of ASD participants reported in four categories: *Female*, *Male*, *Neither Female Nor Male*, and *Not Reported*. The *Neither Female Nor Male* category includes individuals who identified their biological sex

and/or gender as something other than male or female, including but not limited to: "Other," "Non-binary," "Transgender," "Gender diverse," and "Gender fluid."

Participant Age (Continuous and Categorical). The mean age of ASD participants in years was extracted from each article. Mean ages provided in months were converted to years. Mean age was calculated for studies providing individual participants' ages. When mean ages were provided separately for subgroups of participants within the ASD group (e.g., ASD males and ASD females), subgroup means were averaged to calculate an overall mean. To code the age range of participants included in each study, coders recorded the age of youngest participant and the age of oldest participant, in years. When exact ages were not provided, coders recorded the minimum and maximum ages provided for participant eligibility. Participant age was also coded categorically to indicate whether the sample was comprised primarily of *Youths* (ages 2–17 years), *Adults* (18 years or older), or whether the sample included *Youths and Adults*. In cases where authors employed qualitative labels to indicate the age of participants (e.g., "participants were autistic adults") the sample was coded in accordance with the authors' qualitative label regardless of whether participant ages were reported.

Intelligence (Continuous). Studies reporting the results of cognitive testing were coded for the mean Full Scale IQ (FSIQ) score, the mean Verbal IQ (VIQ) score, the minimum IQ score used as a threshold to determine participant eligibility, and the name of the IQ assessment(s) used in each study. When mean FSIQ and/or VIQ scores were provided only separately for subgroups of autistic participants (e.g., ASD males and ASD females), subgroup means were averaged together to calculate an overall mean score. The qualitative descriptors *below average*, *average*, and *above average* were applied to IQ scores falling below 85, between 85 to 115, and greater than 115, respectively.

The following items were coded as binary (*yes*/*no*) variables: the study used a minimum IQ threshold and/or the presence of ID to determine participant eligibility; study grouped research participants by sex/gender for statistical comparisons; study results support group differences in PAN between sexes/genders; study included at least one measure of internalizing symptoms; study results support an association between broad internalizing symptoms and PAN; study reported participants' racial/ethnic background.

Inter-Rater Reliability of Coded Variables

Coder reliability was calculated for the subset of triple-coded articles and was assessed to be acceptable via Fleiss' Kappa (Fleiss, 1975) for categorical variables (all κ .59) and excellent via intraclass correlations (ICC 2,3) (Shrout & Fleiss, 1979) for all continuous variables (all ICC .79) (Cicchetti, 1994).

Data Synthesis

Due to the considerable heterogeneity in study and participant characteristics, as well as the variable format of target variables (e.g., operational definitions of PAN) used in studies meeting inclusion criteria, meta-analyses were not conducted. Bibliographic information, measurement tools, and study-specific operational definitions of PAN are summarized in Table 1.

Data Analytic Plan

Frequency analysis (sum, percentage of total) and descriptive statistics (mean, standard deviation, range) were examined for each of the variables of interest. Where possible, weighted means were calculated by gender for IQ variables. However, weighted mean IQ scores did not differ substantially from the unweighted mean IQ scores. Additionally, few studies reported the subgroup data necessary to calculate weighted means and gender-based subgroup means did not differ significantly within any study. Thus, only unweighted mean IQ scores are reported here.

Several manuscripts (see Table 2) contained partially overlapping samples. Thus, when reporting the sample and subsample (e.g., female, male) totals represented in the literature, we state that they indicate 'up to' a given number of unique individuals. Other variables that may reflect potentially overlapping samples (e.g., mean age, mean IQ, etc.) are similarly constrained.

Results

Out of the 65 full-text articles identified for evaluation (Figure 1), 46 articles met full inclusion criteria for the current systematic review.

Study Characteristics

Study Design.—Detailed study characteristics of the 46 included articles are summarized in Table 1. Included articles were well-distributed across three categories of study design: 1) Qualitative/Exploratory (32.6%; $k = 15$), 2) Quantitative/Experimental (37%; $k = 17$), and 3) Combination Qualitative/Quantitative (30.4%; $k = 14$).

PAN Variable Label(s).—Articles varied in terms of the language used to identify and label the concept of PAN, with many articles employing multiple labels to describe the phenomenon. Across all studies, the following 7 descriptors were used most frequently: *masking* ($k = 29$), *camouflage* ($k = 28$), *compensation* ($k = 19$), *passing* ($k = 4$), *assimilation* ($k = 4$), and *adaptation* ($k = 2$). A range of other unique variable labels (e.g., coping strategies, masquerade, adjustment, conform, cover-up) were identified among studies utilizing direct quotations from research participants to describe first-hand experiences of PAN ($k = 11$).

Participant Characteristics

Sample Size.—The 46 studies included in the current review included up to 5,980 total research participants, with an average overall sample size of 130 total participants ($SD = 185.08$, $Range = 1–832$) per study. Across all studies, autistic research participants accounted for up to 3,771 (63.06%) of total research participants. On average, studies included 81.98 ($SD = 95.79$, $Range = 1–353$) autistic individuals. Five studies (10.87%) included up to 176 ($M = 35.20$, $SD = 22.39$, $Range = 11–59$) undiagnosed individuals who identified as having significant difficulties in social situations and/or scored highly on measures of autistic traits.

ASD Diagnosis Confirmation.—Forty-three studies (93.47%) included detailed information regarding the methods used to confirm participants' ASD diagnoses. Nineteen studies (41.30%) utilized multiple methods, and thus percentages exceed 100%. ASD diagnosis was confirmed via the following methods: *Community Diagnosis* ($k = 27$; 58.70%), *Clinical Diagnosis* ($k = 13$; 28.26%), *Questionnaire* ($k = 8$; 17.39%), *ADOS only* ($k = 7$; 15.22%), *ADI-R only* ($k = 6$; 13.04%), *Self-Identification* ($k = 4$; 8.70%), *ADOS and ADI-R* ($k = 4$; 8.70%). No studies reported using *Chart Review* as a means of diagnostic confirmation. Of note, only 1 study reported utilizing the 'gold-standard' *Confirmation via ADOS, ADI-R, and Clinician* to confirm participants' ASD diagnosis.

Participant Race and Ethnicity.—Eleven studies (23.91%) provided information about research participants' ethnic and/or racial background. Of the 11 studies which reported participant race, on average, 84.13% (*Range* = 71–100%, *SD* = 9.32) of ASD participants were white.

Participant Sex/Gender.—Two (4.35%) studies did not report research participants' (combined $n = 323$) gender. The remaining 44 (95.65%) studies reported a total of up to 1,585 ASD males, 1,682 ASD females, 94 ASD individuals who identified as neither male nor female gender; gender information was not reported for 61 ASD research participants. Across these 44 studies, on average, ASD samples included 34.46 males (*SD* = 41.34; *Range* = 0–163), 36.57 females (*SD* = 48.47; *Range* = 0–182), 2.04 individuals identifying as neither male nor female (*SD* = 4.60; *Range* = 0–17), and 1.39 individuals for whom gender information was not reported (*SD* = 7.60; *Range* = 0–50). Across the 44 studies which reported participant gender information, 52.22% of ASD participants were female on average (*Range* = 0–100%, *SD* = 25.43). Eight studies included research participants representing a single gender category, 7 of which included only female participants. Across the 36 studies with two or more gender categories, on average there were 44 males (*SD* = 42.03, *Range* = 2–163), 44.36 females (*SD* = 52.15, *Range* = 1–182), 2.61 individuals identifying as neither male nor female (*SD* = 5.07, *Range* = 0–17), and 1.69 individuals for whom gender information was not reported (*SD* = 8.39, *Range* = 0–50). Across the 36 studies reporting two or more gender categories, on average, 44.38% of ASD participants were female (*Range* = 11–64%, *SD* = 14.03). Twenty-five studies included participants in 2 (female and male) gender categories and 11 studies included greater than 2 gender categories (e.g., transgender, gender-fluid, non-binary, other).

Participant Age.—Two studies did not report information about participants' age. Among the 44 studies which did report participant ages, ASD participants ranged in age from 2 to 79 years. Across studies, mean age of ASD participants was 23.85 years ($k = 41$; *SD* = 11.73, *Range* = 4.33–43.10). In terms of age range, the average minimum age of ASD participants was 13.65 years ($k = 40$; *SD* = 5.48, *Range* = 2–22) and the average maximum age was 36.62 years ($k = 39$; *SD* = 23.68, *Range* = 8–79). Of the 44 studies reporting participant age, 24 studies (54.55%) included only adults, 19 studies (43.18%) included only youths, and 1 study (2.27%) included both youths and adults.

Intellectual Ability.—Eligibility criteria for 4 studies (8.70%) prohibited inclusion of participants with current or past history of ID, and 14 studies (30.43%) required eligible participants to meet a minimum IQ score ranging from 70–85 (*M* = 73.14, *SD* = 5.32). Fourteen studies (30.43%) provided mean Verbal IQ (VIQ) scores for ASD participants, while 19 studies (41.30%) provided mean Composite or Full-Scale IQ (FSIQ) scores for ASD participants. ASD participants had a mean VIQ score of 103.96 (*SD* = 16.81, *Range* = 51.63 – 119.20) and a mean FSIQ of 106.30 (*SD* = 10.68, *Range* = 73.79 – 119.00).

Grouping by Gender.—Nineteen studies (41.3%) grouped research participants by gender for the purposes of comparing PAN across genders. Of these 19 studies, 17 studies (89.47%) reported findings supporting group differences between genders in behaviors thought to be associated with PAN. Overall patterns of effect size and direction of the association were not broadly interpretable due to inconsistencies arising from the wide variation in participant characteristics, sample size, study design, and construct measurement (Table 1; e.g., observer-coded linguistic strategies, self-rated ASD traits, parent-reported adaptive skills). Among the 3 studies that directly examined rates of PAN across genders and measured PAN using the same self-report methodology (the Camouflaging Autistic Traits Questionnaire [CAT-Q; Hull et al., 2018]), one found higher rates of PAN among adult females compared to adult males (Hull, Lai, et al., 2020), one reported no gender differences in rates of PAN among autistic adolescents (Jorgenson et al., 2020), and one reported that participants' reasons for engaging in PAN differed by gender but that rates of PAN across genders were not directly examined (Cage & Troxell-Whitman, 2019). Of the 7 studies that directly examined rates of PAN across genders and utilized discrepancy metrics (i.e., discrepancy between individuals' 'external' behavioral presentation and their 'internal' dispositional and/or cognitive status) to measure PAN, 5 studies (4 of which included only adult participants) reported greater rates of PAN among autistic females compared to autistic males (Lai et al., 2019, 2011, 2017; Lehnhardt et al., 2015; Ratto et al., 2018). However, this apparent consistency should be interpreted with caution, as use of specific measurement tools was not consistent across the 5 studies, and 3 studies included partially overlapping samples (Lai et al., 2019, 2011, 2017).

Internalizing.—Measures of broad internalizing symptoms were included in 17.4% (*k* = 8) of included studies. Of the 8 studies including measures of broad internalizing symptoms, 7 studies (87.50%) reported findings supporting a positive association between broad internalizing symptoms and PAN.

Discussion

This is the first systematic review of the PAN literature in ASD mapping the contours of the field as of May 2020. The current review delineates what is being studied (and how is it being assessed) when PAN is being studied, and in whom PAN is being examined. Results show there is considerable variability in the types of research designs utilized, as well as in the specific language and operational definitions employed to label and define the concept of PAN in ASD. Findings indicate that the ASD participants included thus far in PAN research studies *are* subject to some diagnostic classification, but the classification method varies widely between studies. Compared to ASD prevalence rates in the general population

(Maenner et al., 2020), research participants included in PAN studies are disproportionately white females over the age of 18 with average to above average intellectual ability. While some studies have begun investigating gender differences in behavior associated with PAN in ASD, few studies have directly explored the often-cited hypothesized relationship between PAN and internalizing problems in ASD. Current findings therefore provide evidence of the inconsistency in assessment method and identified construct, as well as exclusion of specific groups of autistic people from the existing research on PAN in ASD. This raises important questions about the generalizability of current empirical knowledge about PAN in ASD (Fombonne, 2020).

Study Characteristics

The current findings suggest the current PAN literature is characterized by a range of study designs and methods, including qualitative, quantitative, and concurrent mixed methods designs. Results reveal variability across studies in the terminology used to label the phenomenon of PAN, with the labels applied most frequently being *camouflaging*, *masking*, and *compensation*. As is common when new areas of research emerge in any field, many studies included in the current systematic review utilized qualitative research designs, some with the express purpose of exploring and defining the conceptual boundaries of the PAN phenomenon. Perhaps in part due to the emergence of the PAN construct from the first-hand accounts of autistic people in clinical and research contexts, some investigators have continued to utilize qualitative methods to help capture and amplify autistic voices, perspectives, and lived experiences related to PAN in an effort to deepen knowledge about PAN in ASD, develop accurate conceptual definitions, and design measurement tools to try to quantify those concepts (Dachez & Ndobo, 2018; Raymaker et al., 2020; Schneid & Raz, 2020). Additionally, these results reveal a variety of quantitative methods used to study PAN, such as measurement of discrepancies between "perceived" and "actual" abilities (e.g., Livingston, Colvert, Bolton, & Happé, 2018; Livingston & Happé, 2017a). The diversity of constructs and methods in this growing field suggests a readiness to coalesce around and explore correlates of common definitions and measurement approaches to advance key questions of PAN construct validity (Lai et al., 2020).

While the diversity of language used to describe this construct is instructive, it is also fraught with the challenges of trying to describe a population or experience from the outside. One example of this challenge are the ways in which current labels for PAN have been perceived by members of the autistic community as carrying negative associations and connotations (Hull, Petrides, et al., 2017; Schneid & Raz, 2020). To this effect, we emphasize the importance of employing an inclusive over-arching term that is grounded in experience, such as PAN.

Participant Characteristics

The vast majority of studies (93.47%) reported the method(s) used to confirm ASD diagnosis. *Community Diagnosis* was the most common method of diagnostic confirmation reported, while diagnostic confirmation via *Questionnaire* and *Self-Identification* were only indicated by 17.39% and 8.70% of studies, respectively. Considering the hypothesis that many individuals who engage in PAN may experience increased difficulty receiving a formal

ASD diagnosis as a result of their ability to PAN (Hull & Mandy, 2017), the relative lack of studies using methods of self-identification to confirm ASD diagnosis is particularly surprising. This suggests that either some individuals who PAN are still being missed by the current literature, or PAN may be more common among more conventionally identified autistic individuals, or both.

Only 41.30% of studies reported information regarding participants' race/ethnicity. Nonetheless, the studies that did so reported the vast majority of participants in their samples to be white. This indicates notable under-representation of racial and ethnic minority groups, as current evidence suggests ASD occurs at similar rates across all racial and ethnic groups (Maenner et al., 2020). This is consistent with recent work highlighting a lack of inclusion of racially and ethnically diverse research participants in ASD research (Harris et al., 2020; West et al., 2016), and supports the importance of broader inclusion.

Almost all studies reported participants' sex/gender. Participants were disproportionately female, which is unusual for ASD research (Halladay et al., 2015), as the reported diagnostic ratio for ASD favors males (Loomes et al., 2017). Among studies investigating PAN in ASD, samples on average included ~2 more autistic females than autistic males, with a gender ratio approaching 1:1. Multiple studies in the current review also included female-only samples. Some authors indicate the disproportionate inclusion of male research participants in the development of gold-standard diagnostic tools has biased our understanding of what ASD looks like toward what ASD looks like in males (McPartland, Law, & Dawson, 2016). Likewise, the inclusion of female-only participant samples in PAN research may introduce a potential bias in understanding this social phenomenon toward experiences that may be unique to females with ASD. Examining PAN exclusively in female research participants may in part reflect the unique social pressures experienced by females in male-dominated societies to conform to gendered social expectations, in addition to the pressure to "act neurotypical," experiences which may not generalize to the experiences of non-female autistic individuals. Equally important is the lack of attention being given to differentiating individuals' biological sex and gender identity, thus complicating interpretations of currently available data when such conclusions are based on assumptions about participants' gender.

Most studies (95.65%) reported participant age, with participants drawn from a wide range of ages including young children, adolescents, young adults, and older adults. Of those reporting participant age, a greater number of studies included only adult research participants (54.55%) compared to those including only youths (43.18%). This finding contrasts with data showing ASD is a lifetime disorder affecting individuals of all ages and the historical dominance of child and adolescent research samples across ASD research as a whole. This may reflect the era in which PAN has emerged as a research topic, in which inclusion and understanding of autism across the lifespan has become a more prominent focus of ASD research worldwide.

Less than half of included studies reported information regarding participants' intellectual ability. Despite most articles making references to cognitive testing batteries being included in study protocols and/or screening procedures, only a small subset of those studies provided information about research participants' intellectual capabilities. Of the studies that reported

participants' IQ metrics, all mean FSIQ and VIQ scores were within the average to above average range of intelligence. A minority of studies included in the current review included autistic participants with higher support needs, and/or lower verbal or intellectual ability (Damico & Nelson, 2005; Frith, Happe, Siddons, Happé, & Siddons, 1994; Livingston et al., 2018; Sutherland, Hodge, Bruck, Costley, & Klieve, 2017; Waizbard-Bartov et al., 2020). These findings are consistent with recent evidence showing a selection bias skewed toward inclusion of more cognitively able research participants across ASD research, a trend which has been increasing in specific domains of ASD research in recent years (Stedman, Taylor, Erard, Peura, & Siegel, 2018). For example, out of the many thousands of ASD research participants included in the National Database for Autism Research (NDAR), only 11% had an IQ score of less than 85 as recently as 2016 (Jack & Pelphrey, 2017). In addition to the overall lack of reporting on intellectual functioning in the PAN literature, when this information was provided, the data reported was not consistent across studies. For example, some studies report excluding participants with a history of ID without providing how ID was operationally defined. Other studies varied in their reporting of specific IQ scores. Inconsistencies in reporting participants' intellectual ability make comparisons across studies challenging, limit the ability to conduct meta-analyses, and prohibit the generalization of findings to groups in the general population.

Roughly half of the studies examined gender differences in behavior thought to be associated with PAN, and a majority of those studies report gender-based group differences in behaviors associated with PAN. However, this association may be premature due to wide variations in sample characteristics and construct measurement across studies. Among the 10 studies that both examined a directional relationship between gender and PAN and measured PAN constructs in the same way (3 via the CAT-Q and 7 via discrepancy metrics), there is some preliminary evidence (Hull, Lai, et al., 2020; Lai et al., 2019, 2011, 2017; Lehnhardt et al., 2015; Ratto et al., 2018) suggesting rates of PAN may be higher among some autistic females compared to autistic males. However, inconsistency of measurement approaches and prevalence of overlapping samples (Lai et al., 2019, 2011, 2017) limit firm conclusions at this time. These findings highlight the need for additional empirical studies directly examining PAN across genders and demonstrate that *a priori* assumptions about PAN (i.e., that PAN is more common among females) are being made without the support of extensive empirical scrutiny in the current literature.

Finally, a minority of studies measured broad internalizing symptoms, almost all of which provide evidence supporting an association between PAN and broad internalizing symptoms. Of the 8 studies that included measures of broad internalizing problems 3 studies (Bargiela, Steward, & Mandy, 2016b; Hull et al., 2018; Lai et al., 2011) used clinical cutoff scores to characterize participants' scores in terms of the presence or absence of clinically significant internalizing problems. None of the 8 studies reported on participants' current or past mental health diagnoses in addition to ASD. However, some studies that did *not* include measures of broad internalizing problems *did* report on participants' self-reported mental health diagnoses beyond ASD. Importantly, all 8 studies included at least one broad internalizing measure that, at the time of the study's publication, had either previously or has subsequently been directly validated in autistic populations. Indeed, only two of the broad internalizing measures used in the studies included in this review (the Beck Anxiety

Inventory [BAI] and the Generalized Anxiety Disorder 7-item scale [GAD-7]) have not yet been validated in autistic populations, and even these measures have been used in multiple studies with autistic participants (e.g., Connor, Sung, Strain, Zeng, & Fabrizi, 2020; Lin & Huang, 2019; Murray, Kovshoff, Brown, Abbott, & Hadwin, 2019; Syu, Huang, Wang, Chang, & Lin, 2020). This highlights the rapid advancement of the psychometric study of internalizing problems in autism. These findings are particularly notable given the frequent claim that PAN may be related to higher levels of internalizing problems such as anxiety and depression (Beck et al., 2020; Cage & Troxell-Whitman, 2019), one of the leading rationales for increasing research attention around PAN in ASD.

Future Directions

Study Characteristics.—Currently there is not a consensus among researchers as to what the most valid method of measuring PAN may be, and there has been a lack of research comparing the unique merits and the potential overlap between the various quantitative methods proposed for measuring PAN in ASD. These results emphasize the importance of developing more standardized instructions to assess the presence of PAN. To date, only two questionnaires, the 25-item Camouflaging Autistic Traits Questionnaire (CAT-Q; Hull et al., 2018) and the 31-item Compensation Checklist (Livingston, Shah, Milner, & Happé, 2020), have been developed in an attempt to quantify camouflaging and compensation behavior, respectively, in ASD. Development of both measures has centered on the lived experiences of autistic adults, thus marking an important shift away from historically popular methods of measuring and defining autistic experience based on comparisons to non-autistic standards. However, due to the recency of these tools' development, it remains to be determined whether these measures provide a reliable and valid method of assessing PAN behaviors in autistic individuals, as well as other groups (Fombonne, 2020). Future research in this area will therefore benefit from empirical investigations which compare various methods of measurement and establish standardized metrics.

Lack of consistency in the field reflects both constructs indicated by multiple terms and individual terms used to describe diverse constructs. One way to begin to resolve this issue is to rely more heavily on the ecological validity of a construct that has largely emerged from descriptions of lived experiences. As explicitly noted by multiple authors in the current review (Raymaker et al., 2020; Schneid & Raz, 2020), future research concerning PAN in ASD should prioritize including autistic researchers, academics, and community members beyond the data collection phase of research. As demonstrated in some included manuscripts (Cage et al., 2018; Cage & Troxell-Whitman, 2019), actively seeking input from autistic people (e.g., via scholarly collaboration at the primary investigator level, consulting roles, focus groups) during preliminary study development, data interpretation (e.g., Hull, Petrides, et al., 2017), and the peer review process is vital for preemptively addressing the biases inevitably introduced by non-autistic people seeking to understand a phenomenon believed to be unique to the lived experiences of autistic people. Inclusion of autistic perspectives is also critically important to ensure that the priorities reflected in ASD research are consistent with the research priorities that have been identified by the autistic community as pivotal for the health and wellbeing of autistic people (McConachie et al., 2020).

Participant Characteristics.—The present manuscript aimed to represent the status of the published literature on PAN, rather than to indicate the total number and characteristics of all sampled people in the literature who may PAN. Thus, we do not claim to provide a precise summary of the features of all study participants in the PAN literature to date. Future studies following from the recommendations contained herein should utilize meta-analytic techniques to provide more precise point estimates when this is possible.

The current review revealed two major issues regarding participant characterization: lack of adherence to basic standards regarding how demographic information about research participants is measured and reported across studies, and debates over who should be included as research participants in PAN research and how those individuals should be identified for inclusion. Despite calls for more rigorous reporting of participant demographics in published ASD research dating back over three decades (Charman, 1994; Kistner & Robbins, 1986), and reporting standards and recommendations instituted by various funding agencies and academic publishing outlets (including the American Psychological Association's standards for reporting in quantitative studies with human subjects; Appelbaum et al., 2018), numerous articles included in the current systematic review failed to report basic participant demographics such as age, gender, IQ, race and ethnicity, and SES. Additional key variables relevant to PAN should also be included in future studies to test hypotheses about those who PAN including factors such as education level, employment status, income, receipt of services, and age of ASD diagnosis.

Confirmation of ASD status using standard diagnostic tools restricts inclusion of heterogenous participant samples and may therefore bias results in ways that are not representative of the full autism spectrum. This concern is especially acute when attempting to capture PAN precisely because individuals who have become skilled at camouflaging their ASD traits may be among the most likely individuals to skirt diagnostic detection and PAN. It is therefore important to balance the literature by increasing selection for autistic individuals who self-identify as having ASD but who lack a formal ASD diagnosis (potentially due to their engagement in social camouflaging behavior) in some studies to increase understanding of this behavioral phenomenon. Currently, assumptions about who is most likely to PAN often drive participant selection in PAN studies (Fombonne, 2020). It would be valuable to compare traits of people who PAN in both kinds of study designs (high vs. low sensitivity for PAN and ASD, respectively) and to do so would ultimately provide more information about PAN across the ASD population. Additionally, measures developed to assess behaviors thought to be associated with PAN from qualitative studies utilizing participant selection strategies informed by *a priori* preconceptions must undergo wider testing to establish reliability and validity indices for the broader ASD population.

<u>**Race/Ethnicity.:**</u> Race and ethnicity are rarely reported in the field. This issue makes generalizing findings across groups from different racial and ethnic backgrounds difficult. Perhaps more pressingly, this precludes the ability to consider the intersectional experiences of societal oppression experienced by autistic individuals from traditionally underrepresented groups, a serious ethical concern that must be meaningfully addressed in future ASD research (Cascio, Weiss, & Racine, 2020). Recent work has applied the Minority Stress Model specifically to understanding the unique stressors faced by autistic individuals

as members of a minority identity (Botha & Frost, 2020). However, future work must further consider the impact of cumulative traumas experienced by autistic individuals of color, for example, via applying intersectionality frameworks to investigate potential differences in PAN and associated outcomes in the context of multiple stigmatized identities. For example, autistic people of color are dually pressured to conform to both white and non-autistic expectations of social behavior. Dual stigmatization on the basis of race and disability may increase the societal pressure to PAN among autistic people of color. Furthermore, autistic people of color are more likely to receive an ASD diagnosis at a later age (Mandell et al., 2009) and are more likely to be misdiagnosed as oppositional or having externalizing problems compared to their white autistic peers (Mandell, Ittenbach, Levy, & Pinto-Martin, 2007). Such findings emphasize the notion that when performed by people of color, autistic behaviors may be construed through the lens of non-conformity to racial majoritarian norms and highlights the aforementioned pressure to navigate both. Conversely, the imperative to PAN is likely even more urgent among Black autistic youth to keep oneself safe; that is, the consequences of failing to PAN can lead to real risk of bodily harm (Prahlad, 2017). This may then mean that the act of PAN itself is especially stress-inducing in this population due to the raised stakes of doing so (Prahlad, 2017). Such work should also explore interpretations of autistic intersectionality as a strength that may serve as a protective factor against potential costs of PAN, for example via the provision of virtual and physical communities and safe environments that are accepting of a range of authentic ways of being.

Sex/Gender.: The unusual gender balance of research on PAN towards greater inclusion of female research participants highlights the importance of exploring PAN across genders in future research. As previously noted, failure to differentiate individuals' biological sex and gender identity hinders interpretation of currently available data when such conclusions are based on assumptions about participants' gender. In order to better explore and understand the potential relationships between biological sex, gender, and PAN, future studies must explicitly define the terms used to characterize participant demographics more carefully. While research on PAN to date has emanated largely from conceptual models identifying PAN with the experience of being autistic and female, results of this study highlight that non-female individuals clearly experience some version of PAN as well. Given the high rates of non-cisgender and non-binary gender identity in autistic populations (and vice versa; Warrier et al., 2020), future research must focus on exploring the PAN phenomenon across multiple gender identities. Future studies should therefore aim to recruit participants representative of the broader gender spectrum, including males, trans, and non-binary folks who PAN. Indeed, given the parallels between PAN and "passing," "code switching," and "code shifting" in the trans and queer communities (Anderson, Irwin, Brown, & Grala, 2020; Davidson & Henderson, 2010; Miller, Wynn, & Webb, 2019) as well as in racially and ethnically diverse communities, it would be valuable to better understand the behavioral and strategic overlap (and non-overlap) between these constructs. Relatedly, future work should investigate whether, when, and the extent to which conscious thought, planning, and/or intentionality are involved in PAN in ASD. Meta-analytic methods will be critical for future examinations of gender-based differences in PAN to account for the potential contribution of publication bias to the current findings showing that the majority of published studies

comparing PAN across gender groups support gender differences in behaviors associated with PAN.

Age.: Despite multiple studies (Jorgenson et al., 2020; Livingston et al., 2019b) providing preliminary evidence for a developmental effect of PAN in ASD, the inclusion of children and adolescents in PAN research remains limited in comparison to ASD research overall. Adolescence is a critical period of identity development during which gender-based differences in social behavior, peer relationships, and internalizing symptoms emerge in neurotypical populations. Thus, in addition to elucidating how PAN develops and changes over the course of development, inclusion of younger samples that may be followed longitudinally over time is particularly important for understanding the short- and long-term effects of PAN. For example, longitudinal studies can help clarify the direction of the hypothesized relationship between PAN and internalizing problems in ASD, as well as help identify social compensatory behaviors unique to ASD, versus those which may be better understood as resulting from gendered socialization patterns and present across the general population. Elucidating developmental trajectories of PAN is especially important for highlighting and better understanding the lived experiences of non-cisgender autistic individuals.

Intellectual Ability.: The current review suggests that the extant PAN literature is dominated by research samples comprised of autistic individuals with average to above average intelligence. Future studies on PAN in ASD must include participants with a wider range of intellectual ability, including those with ID, if findings about PAN in ASD are to be generalizable to individuals across the autism spectrum. Inclusion of autistic individuals with variable levels of intellectual ability will also provide researchers with vital opportunities to further explore the hypothesized relationship between PAN and intelligence and/or verbal ability. Extending PAN research to be inclusive of autistic individuals with different intellectual abilities may require moving beyond measurement methodologies reliant on self-reported experiences and provide the opportunity to develop and incorporate observational and caregiver-report methods.

Internalizing.: As noted, it is often claimed that internalizing problems are common among autistic people who PAN (Allely, 2019; Beck et al., 2020; Livingston & Happé, 2017) However, as a point of scientific inquiry, the field's examination of this possibility is problematic in two ways. First, the association between PAN and internalizing problems is often described in the literature as if it is *prima facie* self-evidently true, and so is often provided with no citation or rationale for the hypothesized association. This hampers the field's ability to be cumulative and to begin to unpack potential mechanistic explanations for these claims. Second, empirical studies to date have rarely examined this potential association directly. In turn, this slows efforts to understand whether this basic correlation is supported by data. This is particularly perplexing because the small amount of qualitative and quantitative evidence that has been gathered on this topic to date does provide evidence supporting this association (Beck et al., 2020; Cassidy et al., 2019; Lai et al., 2017; Livingston et al., 2018), further emphasizing the need for more direct investigation, replication, and extension. Future examination of the association between internalizing

problems and PAN must also include meta-analytic methodology to determine whether the results of the current review revealing that almost all of the extant published studies on PAN including measures of broad internalizing symptoms support a relationship between PAN and internalizing problems may be an artifact of publishing bias.

Clinical Implications

Examining the hypothesized relationship between PAN and internalizing problems has important clinical implications in terms of identifying individuals at higher risk of developing internalizing problems and providing appropriate services and preventative care. Identification of costs associated with PAN is imperative for providing psychoeducation to autistic individuals about the risks and benefits of PAN and increasing knowledge-based decision making about whether to engage in PAN behaviors. Furthermore, these data may provide the impetus for psychoeducation for non-autistic individuals about the importance of supporting neurodiversity and embracing environmental accommodations which promote inclusion of neurodiverse individuals (Schneid & Raz, 2020). Finally, future investigations of potentially detrimental outcomes of PAN for autistic individuals must include a critical examination of the ethicality of the set of social skills interventions for ASD that emphasize the importance of conforming to neurotypical social standards (Bottema-Beutel et al., 2018). It is therefore imperative for future studies to continue identifying, examining, and further developing the smaller subset of social competence interventions that do *not* contain this same emphasis, and instead focus on promoting the strengths and interests of, and relationships among, autistic individuals on their own terms (e.g., Legoff, 2004; Lerner, Mikami, & Levine, 2011; Suskind, 2014).

Future research should include 'neurotypical' comparison groups as well as samples of non-autistic individuals *with* other psychiatric and neurodevelopmental conditions (e.g., anxiety, ADHD) to better understand the relationship between PAN and its parallels in other marginalized groups (Dell'Osso, Lorenzi, & Carpita, 2020) and to explore its potential overlap with similar phenomena such as so-called "optimal outcomes" (Fein et al., 2013). While many studies included in the current review include non-autistic participants, only recently have a small number of research groups begun to directly examine how PAN rates, strategies, motivations, and subjective experiences may vary across autistic and non-autistic groups (Hull et al., 2018; Hull, Petrides, & Mandy, 2020; Jorgenson et al., 2020; Livingston et al., 2018; Robinson, Hull, & Petrides, 2020). Such comparisons are vital for understanding whether the developmental trajectory of PAN in ASD is different from that observed in other populations (Jorgenson et al., 2020) and whether the consequences of PAN are similar across groups. Furthermore, it is critical that future work looking into the consequences of PAN extend beyond the often cited social, psychological, and emotional outcomes, to investigate how PAN may influence autistic individuals' experiences with school disciplinary action, hospitalization, law enforcement contact, and involvement in the criminal justice system (Railey, Love, & Campbell, 2021; Turcotte, Shea, & Mandell, 2018).

Notably, almost all studies in this literature to date have been conducted in Western, Educated, Industrialized, Rich and Democratic (WEIRD) societies, from which limitations of generalization to the broader human population are well-documented (Henrich, Heine,

& Norenzayan, 2010). Thus, it will be important to examine the PAN construct more globally to assess the representativeness of and differences in this phenomenon among autistic populations in non-WEIRD societies.

Future studies examining the risks of PAN should also seek to identify variables which may act as protective factors. Autism acceptance, or "feeling accepted or appreciated as an autistic person, with autism positively recognized and accepted by others and the self as an integral part of that individual" (Cage et al., 2018), may provide one launching point for this line of work. Personal acceptance of ASD as part of one's identity has been shown to increase self-esteem, which may protect against anxiety and depression (Cooper, Smith, & Russell, 2017). A similar protective effect may be tied to the concept of neurodiversity, which considers differences in cognitive styles and neural function as positive, integral elements of the human condition, which deserve to be valued and celebrated, rather than framed as disability or disorder (Jaarsma & Welin, 2012). Many autistic individuals take pride in identifying as neurodivergent and want to be accepted by others based on their authentic identity; i.e., for being "who they really are" (Cage, Bird, & Pellicano, 2016; Cage et al., 2018; Humphrey & Lewis, 2008; Hurlbutt & Chalmers, 2002; Jaarsma & Welin, 2012; Robertson, 2009). Consistent with work in other populations showing unconditional self-acceptance is negatively correlated with anxiety and depression, studies show that autistic individuals who self-identify more strongly with neurodiversity have more positive views of ASD (Cage et al., 2018; Kapp, Gillespie-Lynch, Sherman, & Hutman, 2012).

Conclusion

This study explored the current literature on PAN in autistic individuals. Results revealed considerable terminological and methodological variability across the field, as well as gaps in representation of the populations that may engage in PAN, and a number of implicit hypotheses about this population that remain largely untested. These gaps provide clear direction for a rapidly evolving area of ASD research as researchers seek to understand this construct. Overall, it is clear that PAN is a complex phenomenon that affects a notable portion of the autistic population and has the potential to significantly impact how ASD is understood in the context of sociocultural processes. Increasing understanding of PAN in ASD has important implications for advancing the science of social communication and for significantly improving quality of life for many individuals who identify as being on the autism spectrum.

Acknowledgement:

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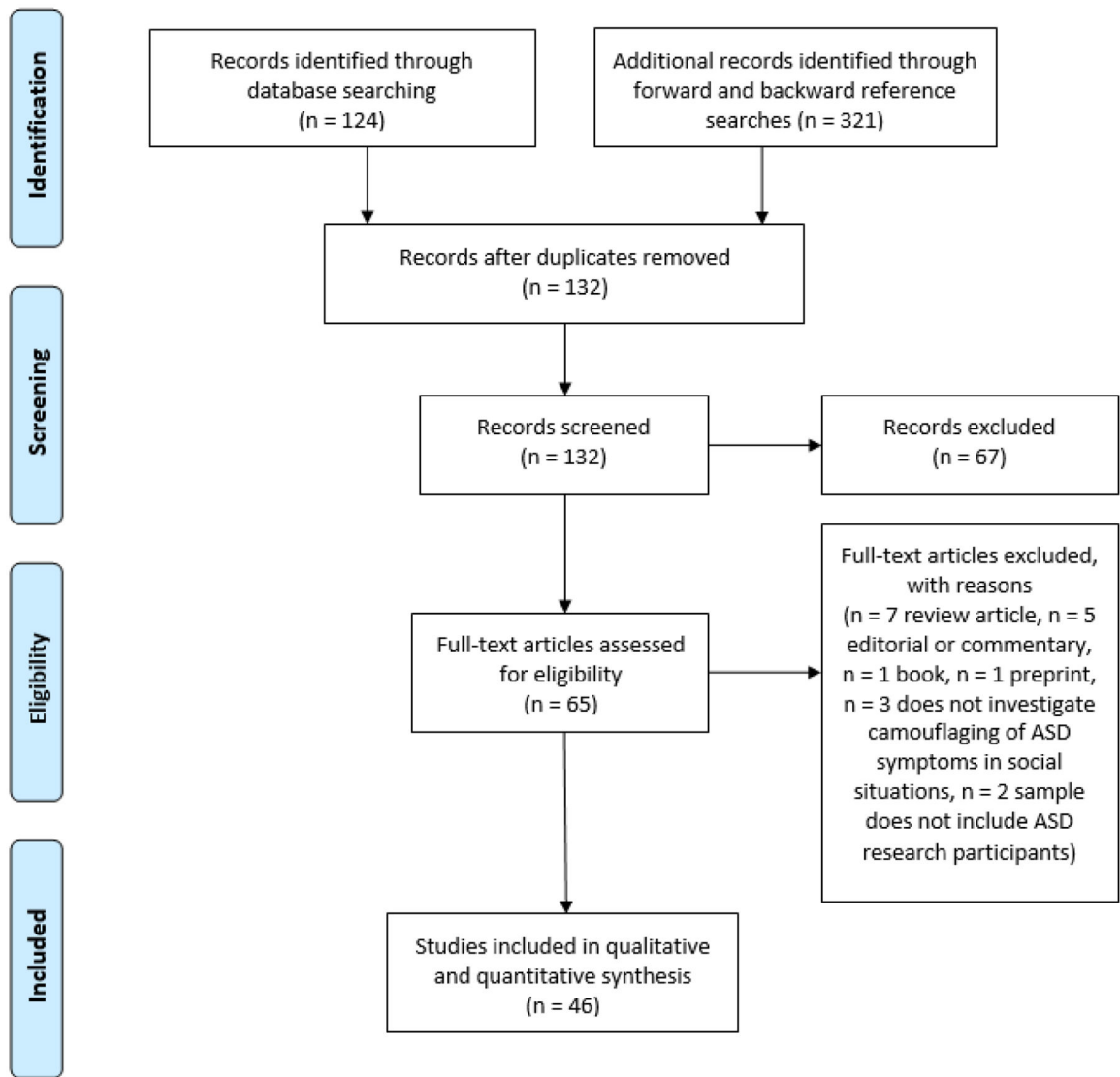
Figure 1.
PRISMA flow diagram of article selection process.

Table 1.

Study Characteristics

Author(s)	Year	Study Design	PAN Variable Term	Operational Definition of PAN
Anderson, Stephenson, & Carter	2020	Qualitative	Camouflage, Masking	Qualitative descriptions of autistic individuals' lived experiences.
Anderson, Marley, et al.	2020	Qualitative	Masking	Qualitative descriptions of autistic individuals' lived experiences.
Bargiela, Steward, & Mandy	2016	Qualitative	Camouflage, Masking	Qualitative descriptions of autistic individuals' lived experiences.
Beck et al.	2020	Quantitative	Compensation, Camouflage, Masking	CAT-Q
Boorse et al.	2019	Quantitative	Compensation, Camouflage, Masking	'Linguistic compensation' measured via comparing coded cognitive process word use during the ADOS with parent-reported social impairment (SRS-2) and ASD symptoms (SCQ).
Cage & Troxell-Whitman	2019	Mixed-Methods	Camouflage, Masking, Passing, Other	CAT-Q
Cage, Di Monaco, & Newell	2018	Mixed-Methods	Camouflage, Masking	Qualitative descriptions of autistic individuals' lived experiences related to autism acceptance.
Cook, Ogden, & Winstone	2018	Qualitative	Camouflage, Masking	Qualitative descriptions of autistic individuals' lived experiences.
Dachez & Ndobo	2018	Qualitative	Compensation, Masking	Qualitative descriptions of autistic individuals' lived experiences.
Damico & Nelson	2005	Qualitative	Compensation	During a clinical interview, coded 'compensatory adaptations,' or non-conventional behaviors that are often perceived as problematic and used by individuals with pragmatic impairments to create meaning in social contexts.
Davidson & Henderson	2010	Qualitative	Camouflage, Passing, Other	Qualitative descriptions of autistic individuals' lived experiences.
De Bruycker	2017	Mixed-Methods	Compensation, Camouflage, Masking	Compared individuals with and without a clinical ASD diagnosis on ADOS severity score, diagnostic algorithm score, and item-level scores, verbal and performance IQ, receptive and expressive language, and qualitative descriptions of autistic individuals' lived experiences.
Dean, Harwood, & Kasari	2017	Mixed-Methods	Camouflage	Qualitative and quantitative coding of playground behavior using the Playground Observation of Peer Engagement (POPE).
Frith, Happé, & Siddons	1994	Mixed-Methods	Compensation, Adaptation	Discrepancy between performance on lab-based false belief tasks ("Smarties" test and "Three Boxes" test), and evidence of use of theory of mind skills in real life using three parent-reported domains: adaptive behavior (VABS), active and interactive sociability, and antisocial and bizarre behavior.
Head, McGillivray, & Stokes	2014	Mixed-Methods	Camouflage, Masking, Passing	Qualitative descriptions of autistic individuals' lived experiences.
Hull et al.	2020	Quantitative	Compensation, Camouflage, Masking, Assimilation	CAT-Q
Hull et al.	2018	Quantitative	Compensation, Camouflage, Masking, Assimilation	CAT-Q
Hull et al.	2017	Qualitative	Compensation, Camouflage, Masking, Assimilation	Qualitative descriptions of autistic individuals' lived experiences.

Author(s)	Year	Study Design	PAN Variable Term	Operational Definition of PAN
Jorgenson et al.	2020	Quantitative	Compensation, Camouflage, Masking, Assimilation	CAT-Q
Kanner, Rodriguez, & Ashenden	1972	Qualitative	Adaptation, Adjustment, Other	Qualitative descriptions of autistic individuals' lived experiences.
Kofke	2019	Qualitative	Masking	Qualitative descriptions of autistic individuals' lived experiences.
Lai et al.	2019	Quantitative	Compensation, Camouflage	Discrepancy between an individual's 'external' behavioral presentation in social-interpersonal contexts (ADOS) and the individual's 'internal' status (i.e., dispositional traits (AQ) and social cognitive capability (RMET)).
Lai et al.	2017	Quantitative	Camouflage	Discrepancy between an individual's 'external' behavioral presentation in social-interpersonal contexts (ADOS) and the individual's 'internal' status (i.e., dispositional traits (AQ) and social cognitive capability (RMET)).
Lai et al.	2011	Quantitative	Compensation, Camouflage, Masking, Other	Compared clinician coded childhood ASD symptoms (ADI-R), clinician coded current ASD symptoms (ADOS), and self-reported cognitive characteristics: ASD traits (AQ), empathy (EQ), systemizing (SQ), and mentalizing (RMET).
Lehnhardt et al.	2015	Quantitative	Camouflage	Compared self-reported ASD traits (AQ), empathy (EQ), systemizing (SQ), and mentalizing (RMET) with executive functioning performance, and a retrospective chart review surveying lifetime rates of mental health care consultation and frequency of intimate partnerships, living status, educational level, and employment status.
Livingston et al.	2018	Quantitative	Compensation	Discrepancy between theory of mind performance (computerized Frith-Happè Animations) and clinician-rated social behavior (ADOS).
Livingston et al.	2019	Mixed-Methods	Compensation, Masking	Qualitative descriptions of autistic individuals' lived experiences.
Livingston et al.	2020	Quantitative	Compensation, Masking, Other	Compensation Checklist
Lorenz et al.	2016	Mixed-Methods	Compensation, Other	Qualitative coding of responses to a survey about barriers to maintaining employment. Framed as individuals' coping/ problem-solving strategies for solving problems at work.
Milner et al.	2019	Qualitative	Camouflage, Masking	Qualitative descriptions of autistic individuals' lived experiences.
Moseley, Hitchiner, & Kirkby	2018	Mixed-Methods	Camouflage, Masking, Other	Examined between group differences on 4 symptom domains of the Ritvo Autism Asperger Diagnostic Scale Revised (RAADS-R): social relatedness, circumscribed interests, language, and sensorimotor abnormalities.
Parish-Morris et al.	2017	Mixed-Methods	Camouflage, Masking	Examined 'linguistic camouflage' by comparing coded filled pauses during the ADOS, lifetime ASD symptoms (SCQ), and parent-reported social communication ability (VABS).
Ratto et al.	2018	Quantitative	Compensation, Masking, Passing	Discrepancy between parent-reported adaptive skills (VABS) and social functioning (SRS-2), and clinician rated ASD symptoms (ADOS and ADI-R).
Raymaker et al.	2020	Qualitative	Masking	Qualitative descriptions of autistic individuals' lived experiences related to 'Autistic Burnout'.
Robinson, Hull, & Petrides	2020	Mixed-Methods	Camouflage, Masking	CAT-Q
Rynkiewicz et al.	2016	Quantitative	Camouflage	Discrepancy between automated coding of non-verbal communication (gestures) during the ADOS and performance on the Eyes and Faces Test, parent rated ASD traits (AQ) and parent-rated social communication abilities (SCQ).
Schneid et al.	2020	Qualitative	Camouflage	Qualitative descriptions of autistic individuals' lived experiences.

Author(s)	Year	Study Design	PAN Variable Term	Operational Definition of PAN
Schuck, Flores, & Fung	2019	Quantitative	Camouflage	Discrepancy between an individual's 'external' behavioral presentation in social-interpersonal contexts (ADOS) and the individual's 'internal' status (i.e., dispositional traits (AQ) and social cognitive capability (RMET)).
Sedgewick, Hill, & Pellicano	2019	Mixed-Methods	Camouflage	Compared friendship and conflict experiences self-reported on the Friendship Qualities Scale, the Revised Peer Experiences Questionnaire, and qualitative descriptions of autistic individuals' lived experiences.
Sumiya, Igarashi, & Miyahara	2018	Qualitative	Masking, Other	Qualitative descriptions of autistic individuals' lived experiences.
Sutherland et al.	2017	Mixed-Methods	Masking, Other	Qualitative descriptions of autistic individuals' lived experiences.
Thiébaut et al.	2016	Quantitative	Compensation	Response accuracy and response time on a novel social faux pas task.
Tierney, Burns, & Kilbey	2016	Qualitative	Masking	Qualitative descriptions of autistic individuals' lived experiences.
Van Tiel et al.	2020	Quantitative	Other	Response accuracy and response time on a novel computer-based deception task.
Waizbard-Bartov et al.	2020	Quantitative	Camouflage, Masking	Compared ADOS scores across time.
Zalla et al.	2009	Mixed-Methods	Compensation	Discrepancy between the ability to accurately identify the presence of, and explain the role of intentionality in the occurrence of, a social faux pas.

ADOS = Autism Diagnostic Observation Schedule; ADI-R = Autism Diagnostic Interview-Revised; SRS-2 = Social Responsiveness Scale, Second Edition; SCQ = Social Communication Questionnaire; VABS = Vineland Adaptive Behavior Scales; AQ = Autism Spectrum Quotient; EQ = Empathy Quotient; SQ = Systemizing Quotient; RMET = Reading the Mind in the Eyes Test; CAT-Q = Camouflaging Autistic Traits Questionnaire.

Table 2.

Characteristics

Year	Total n	Confirmed ASD n	Method of ASD Dx Confirmation	Race/Ethnicity Reported?	% white	Female	Male	Other	Not Reported	Mean Age	Min Age	Max Age	Age Category	IQ as Inclusion Criteria	Min IQ	FSIQ M(SD)	VIQ M(SD)	Cognitive Ax	Grouped by Gender?	Broad Internalizing Measure(s)
2020	11	9	Community	No	-	7	2	2	0	-	18.00	70.00	Adults	No	-	-	-	-	No	-
2020	10		Community	No	-	10	0	0	0	14.60	12.00	18.00	Youths	No	-	-	-	-	No	-
2016	14		Community, Questionnaire	No	-	14	0	0	0	26.70	19.00	30.00	Adults	Yes	70	111.79 (11.02)	-	WTAR	No	GHQ-12, HADS-A, HADS-D
2020	58		Community, Questionnaire	Yes	94.80	18	0	0	0	25.17	18.00	42.00	Adults	No	-	114.60 (11.27)	-	WASI-II	No	DASS-21
2019	102		ADOS only	Yes	85.48	21	41	0	0	10.37	7.00	14.00	Youths	Yes	79	107.27 (10.79)	107.21 (11.53)	DAS-II, WASI-II, Abbreviated SB-5, WISC-V†	Yes	-
2019	262	252	Community, Questionnaire,	Yes	85.80	135	111	12	4	33.62	18.00	66.00	Adults	No	-	-	-	-	Yes	DASS-21
2018	111	100	Community, Self-ID	Yes	88.00	60	27	13	7	36.40	18.00	72.00	Adults	No	-	-	-	-	No	DASS-21
2018	11		None	Yes	90.90	11	0	0	0	14.45	11.00	17.00	Youths	No	-	-	-	-	No	-
2018	31		Clinical	No	-	17	14	0	0	31.70	15.00	53.00	Adults	No	-	-	-	-	No	-
2005	1		None	No	-	0	1	0	0	13.00	13.00	13.00	Youths	No	-	-	-	-	No	-
2010	45	45	None	No	-	-	-	-	45	-	-	-	-	No	-	-	-	-	No	-
2017	52	26	Clinical	No	-	13	13	0	0	5.98	4.00	8.00	Youths	Yes	80	100.54 (13.95)	102.27 (15.22)	WAIS, WPPSI-III-NL, WISC-III-NL	Yes	-

Year	Total n	Confirmed ASD n	Method of ASD Dx Confirmation	Race/ Ethnicity Reported?	% white	Sex/Gender (n)				Mean Age	Min Age	Max Age	Age Category	IQ as Inclusion Criteria	Min IQ	FSIQ M(SD)	VIQ M(SD)	Cognitive Ax	Grouped by Gender?	Broad Internalizing Measure(s)
						Female	Male	Other	Not Reported											
2017	96	48	ADOS only	No	-	24	24	0	0	7.73	7.00	8.00	Youths	Yes	70	94.50 (12.31)	-	SB-5	No	-
1994	50	24	Clinical	No	-	7	17	0	0	15.00	7.83	19.00	Youths	No	-	-	51.63 (12.34)	BPVS	No	-
2014	101		Community	No	-	25	25	0	0	13.72	10.00	16.00	Youths	Yes	70	-	-	-	Yes	-
2020	778		Community	No	-	182	108	16	0	41.96	-	-	Adults	Yes	-	-	-	-	Yes	-
2018	832		Community	No	-	179	108	17	50	41.93	18.00	75.00	Adults	No	-	-	-	-	No	PHQ-9, GAD-7
2017	92		Community	No	-	55	27	10	0	43.10	18.00	79.00	Adults	No	-	-	-	-	Yes	-
2020	140		Community	No	-	23	55	0	0	15.03	13.00	18.00	Youths	Yes	-	-	-	-	Yes	-
1972	9		Community	No	-	1	8	0	0	29.13	22.00	35.00	Adults	No	-	-	-	SB, WISC	No	-
2019	4		Community	Yes	100.00	4	0	0	0	14.75	14.00	15.00	Youths	No	-	-	-	-	No	-
2019	119		Clinical	No	-	28	29	0	0	27.38	18.00	45.00	Adults	Yes	70	114.30 (14.99)	113.84 (12.16)	WASI	Yes	-
2017	60		ADI-R only, Clinical	No	-	30	30	0	0	27.50	18.00	49.00	Adults	Yes	-	115.40 (14.10)	114.30 (12.90)	WASI	Yes	BDI, BAI
2011	83		ADI-R only, Clinical	No	-	29	33	0	0	26.95	18.00	45.00	Adults	Yes	70	112.70 (16.00)	112.30 (15.35)	WASI	Yes	BDI, BAI
2015	140		ADI-R only, Clinical, Questionnaire	No	-	38	69	0	0	-	-	-	Adults	No	-	110.95 (14.15)	112.35 (12.95)	WAIS-III	Yes	-
2018	203		ADOS + ADI-R	No	-	24	112	0	0	13.28	10.00	15.00	Youths	No	-	94.78 (17.25)	92.46 (17.78)	WASI	No	RCADS Parent- & Child-Report
2019	136	77	Community, Self-ID	No	-	46	21	10	0	36.89	18.00	70.00	Adults	No	-	-	-	-	No	-
2020	117	58	Community	No	-	37	13	8	0	35.83	18.00	70.00	Adults	No	-	-	-	-	No	-
2016	66	66	Community, Questionnaire	No	-	36	29	1	0	35.96	22.00	55.00	Adults	No	-	-	-	-	No	-

Year	Total n	Confirmed ASD n	Method of ASD Dx Confirmation	Race/Ethnicity Reported?	% white	Sex/Gender (n) Female	Male	Other	Not Reported	Mean Age	Min Age	Max Age	Age Category	IQ as Inclusion Criteria	Min IQ	FSIQ M(SD)	VIQ M(SD)	Cognitive Ax	Grouped by Gender?	Broad Internalizing Measure(s)
2019	18	18	Community, Self-ID	No	-	18	0	0	0	-	11.00	55.00	Youths & Adults	No	-	-	-	-	No	-
2018	527	254	Community	No	-	136	118	0	0	36.48	18.00	-	Adults	No	-	-	-	-	Yes	-
2017	82	82	ADOS + ADI-R + Clinician	Yes	85.00	16	49	0	0	9.96	6.00	17.00	Youths	No	-	105.00 (13.50)	106.50 (14.50)	DAS-II	Yes	-
2018	228	228	ADOS only, ADOS + ADI-R, Clinical	Yes	73.25	114	114	0	0	10.11	6.00	16.25	Youths	Yes	70	101.09 (18.87)	-	WASI, WASI-II, WISC-IV, WISC-V, WAIS-IV, WPPSI-IV, DAS-II	Yes	-
2020	21	21	Community	Yes	76.19	10	7	4	0	37.32	21.00	65.00	Adults	No	-	-	-	-	No	-
2020	508	508	Community	No	-	-	-	-	278	36.80	-	-	-	No	-	-	-	-	No	-
2016	33	33	Clinical	No	-	16	17	0	0	8.15	5.00	10.00	Youths	Yes	-	110.95 (12.40)	-	-	Yes	-
2020	24	24	Community, Self-ID	No	-	13	10	1	0	31.00	16.00	55.00	Adults	No	-	-	-	-	No	-
2019	62	62	ADOS only, ADI-R only, Community	Yes	75.00	11	17	0	0	26.93	18.00	55.00	Adults	Yes	70	102.00 (16.77)	106.00 (16.90)	SB-5	Yes	-
2019	102	102	ADOS only, Clinical, Questionnaire	Yes	71.00	27	26	0	0	14.37	11.00	17.00	Youths	Yes	70	102.04 (32.58)	99.75 (13.97)	WASI-II	Yes	-
2018	11	11	Community, Questionnaire	No	-	3	8	0	0	12.82	11.00	15.00	Youths	Yes	85	-	100.55 (NR)	WISC-III	No	-
2017	334	334	Community	No	-	171	163	0	0	-	5.00	18.00	Youths	No	-	-	-	-	Yes	-
2016	78	35	ADOS only, Clinical, Questionnaire	No	-	11	24	0	0	35.40	-	-	Adults	Yes	80	114.17 (14.54)	117.09 (13.83)	WAIS-III-UK	No	-
2016	10	10	Community	No	-	10	0	0	0	14.40	13.00	19.00	Youths	No	-	-	-	-	No	-

Year	Total n	Confirmed ASD n	Method of ASD Dx Confirmation	Race/ Ethnicity Reported?	% white	Sex/Gender (n)				Mean Age	Min Age	Max Age	Age Category	IQ as Inclusion Criteria	Min IQ	FSIQ M(SD)	VIQ M(SD)	Cognitive Ax	Grouped by Gender?	Broad Internalizing Measure(s)
						Female	Male	Other	Not Reported											
2020	53	27	ADOS only, Community	No	-	13	14	0	0	33.70	18.00	60.00	Adults	Yes	70	119.00 (16.00)	-	WAIS-IV	No	-
2020	125	125	ADOS + ADI-R, Community	No	-	36	89	0	0	4.33	2.00	9.00	Youths	No	-	73.79 (26.77)	-	MSEL	Yes	-
2009	30	30	ADI-R only, Clinical	No	-	3	12	0	0	28.00	-	-	Adults	Yes	70	114.80 (16.70)	119.20 (19.80)	WAIS-III	No	-

n Diagnostic Observation Schedule; ADI-R = Autism Diagnostic Interview-Revised; WTAR = Wechsler Test of Adult Reading; WASI = Wechsler Abbreviated Scales of Intelligence; DAS bility Scales; SB = Stanford-Binet Intelligence Scales; WISC = Weschler Intelligence Scales for Children; WAIS = Weschler Adult Intelligence Scales; WPPSI = Wechsler Preschool and of Intelligence; British Picture Vocabulary Scales (BPVS); MSEL = Mullen Scales of Early Learning; GHQ-12 = General Health Questionnaire-12; Hospital Anxiety and Depression Scale IADS-D); DASS-21 = The Depression Anxiety Stress Scales 21; PHQ-9 = Patient Health Questionnaire; GAD-7 = Generalized Anxiety Disorder 7-item scale; BDI = Beck Depression = Beck Anxiety Inventory; RCADS = Revised Child Anxiety and Depression Scale.

mples partially overlap uniqueness of participant samples is less than 100%.

ere standardized and reduced to a single FSIQ and VIQ scores by an expert licensed neuropsychologist to allow for comparison among tests.