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**Understanding Social Functioning in Autism:
The role of Theory of Mind and Social Camouflaging**

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Abstract

Autism spectrum condition (ASC) is associated with difficulties in social functioning, but the factors underlying these difficulties are not yet fully understood. Theory of Mind (ToM) and social camouflaging have both been proposed as possible contributors, although their relationships with social functioning remain unclear. This study investigated whether ToM and social camouflaging were associated with social functioning, specifically friendship quality, friendship quantity, and loneliness, in 61 Italian participants, including 24 autistic adults and 37 neurotypical adults. The study examined group differences in these domains and whether individual differences in ToM and camouflaging were related to different aspects of social functioning. Autistic adults reported lower friendship quality and fewer friendships than controls, despite similar levels of loneliness. They also reported greater social camouflaging than controls, but showed similar levels of ToM. ToM was not significantly associated with any of the three measures of social functioning, and these associations did not differ between groups. In contrast, the mediation analysis showed that higher social camouflaging partly accounted for the lower friendship quality reported by autistic participants. Within the autistic group, camouflaging also showed significantly different associations with friendship quality and friendship quantity, although neither individual association was statistically significant. Together, these findings suggest that social camouflaging may play a complex role in social functioning among autistic adults, with its relationship differing across aspects of friendship.

Keywords: autism spectrum condition, Theory of Mind, social camouflaging, friendship quality, friendship quantity, loneliness

Introduction

Autism spectrum condition (ASC) has long been associated with difficulties in social functioning, although considerable variability exists in how these difficulties are expressed across individuals (Lord et al., 2022; Wu & Wang, 2025). This variability has led to growing interest in factors that may help explain differences in social functioning, including Theory of Mind (ToM) and social camouflaging. ToM refers to the ability to infer and understand the mental states of others, and differences in ToM have been documented in autism, although findings vary across tasks and measurement approaches (Velikonja et al., 2019; Gao et al., 2023). Social camouflaging refers to strategies used to modify, suppress, or compensate for aspects of behavior in order to navigate social situations, and has also been reported at higher levels among autistic individuals (Hull et al., 2017). At the same time, social functioning is multidimensional and cannot be captured by a single aspect of social relationships. It can include the quality and quantity of friendships as well as the subjective experience of loneliness (Bishop-Fitzpatrick et al., 2018; Grace et al., 2022; Li et al., 2026). These dimensions reflect different aspects of social functioning and may not necessarily show the same pattern. However, research has rarely examined ToM and social camouflaging together across these multiple dimensions. The present study therefore addresses this gap by examining the associations of ToM and social camouflaging with friendship quality, friendship quantity, and loneliness among autistic and neurotypical adults.

ToM has been extensively investigated in autism, particularly in relation to social cognition. Meta-analytic evidence suggests that autistic adults, on average, show poorer performance on ToM measures than neurotypical adults, although the magnitude of these differences varies depending on the task and its cognitive demands (Velikonja et al., 2019; Gao et al., 2023). Importantly, performance on structured ToM tasks may not necessarily reflect how individuals navigate complex social interactions in everyday life. Autistic individuals may use learned or compensatory strategies to manage social situations, allowing them to perform relatively well in some contexts despite differences in social-cognitive processes (Livingston & Happé, 2017; Livingston et al., 2019). This raises the question of whether individual differences in ToM are reflected in everyday social relationships and experiences.

Social camouflaging may provide another perspective on this relationship between social cognition and everyday social functioning. Camouflaging can involve modifying or suppressing behaviors associated with autistic traits in order to navigate social situations and meet perceived

social expectations (Hull et al., 2017; Cook et al., 2021). It has been associated with motivations such as fitting in, avoiding negative social experiences, and facilitating social connections (Hull et al., 2017; Ridgway et al., 2025). At the same time, camouflaging can be effortful and has been linked to exhaustion, difficulties with authenticity, and challenges in interpersonal relationships (Hull et al., 2017; Cook et al., 2021; Ridgway et al., 2025). Its relationship with friendship may therefore be complex, as camouflaging may facilitate social interaction without necessarily resulting in close or satisfying relationships. Moreover, ToM may not directly determine the extent to which autistic individuals camouflage, as previous research has found no significant association between ToM and self-reported camouflaging (Hull et al., 2021).

The distinction between different dimensions of social functioning is particularly relevant when considering friendship and loneliness among autistic adults. Autistic individuals value friendship and seek meaningful social connections, although they may encounter barriers to establishing and maintaining relationships (Mazurek, 2014; Wu & Wang, 2025; Ridgway et al., 2025). Friendship quality and friendship quantity may therefore provide different information about social functioning, while loneliness captures the individual's subjective experience of their social connections. Indeed, loneliness is common among autistic adults, but it is not necessarily determined solely by the number of relationships an individual has (Grace et al., 2022). Considering these dimensions separately may therefore provide a more complete understanding of social functioning.

Taken together, ToM and social camouflaging may be relevant to social functioning in different and potentially overlapping ways. Examining them alongside friendship quality, friendship quantity, and loneliness may help clarify whether social-cognitive ability and social strategies are related to different aspects of social experience. Accordingly, the present study examines differences between autistic and neurotypical adults in ToM, social camouflaging, friendship quality, friendship quantity, and loneliness. It further investigates whether individual differences in ToM and social camouflaging are associated with these three dimensions of social functioning and whether these associations differ between the two groups.

Autism and Social Functioning

Autism Spectrum Condition (ASC) is a heterogeneous neurodevelopmental condition that is characterized by persistent deficits in social communication and social interaction, including restricted and repetitive patterns of behavior, interests or activities (American Psychiatric

Association, 2013). In addition to the central symptoms of this condition, autistic individuals often experience psychiatric or neurological disorders. These include hyperactivity and attention disorders (such as attention-deficit/hyperactivity disorder (ADHD)), anxiety, depression, and epilepsy (Lord et al., 2020). These features are present in early development and continue across the life span, although they are expressed very differently across individuals and developmental stages (Lord et al., 2022; Tafolla et al., 2025). Autism is one of the most common neurodevelopmental conditions affecting approximately 1-2% of the world's population according to current estimates (Lord et al., 2022). However, even with the same diagnostic criteria, each person with autism is quite different in terms of their cognitive functioning, language, adaptive functioning, sensory processing, emotion regulation, and social experiences. Therefore, it is established that there is a great deal of heterogeneity in the autism spectrum (Happé & Frith, 2020; Georgiades et al., 2013).

The term spectrum reflects this diversity and not a linear continuum of symptom severity. Autistic individuals show differences in the extent to which they display autistic features, and they also differ in their profile of strengths, challenges, developmental pathways and support needs (Lord et al., 2022). Some autistic adults require substantial support in daily living, while others achieve higher education, employment, intimate relationships, and independent living (Howlin & Moss, 2012; Tafolla et al., 2025). Hence, autism should be seen as a collection of heterogeneous developmental profiles resulting from complex interactions of biological, cognitive and environmental factors (Happé & Frith, 2020).

Research over the past several decades has demonstrated a strong genetic basis to autism, with heritability estimates ranging from 70 to 90% (Lord et al., 2022). Autism is a highly polygenic disorder, which results from the interaction of common and rare genetic variants with prenatal, perinatal and environmental factors, rather than as a consequence of a single causal mechanism (Lord et al., 2022; Tafolla et al., 2025). This complex etiology contributes to the remarkable heterogeneity observed between autistic individuals and may partially explain the considerable variation in developmental outcomes despite a shared diagnosis. This has caused research to focus on identifying factors that contribute to variation in cognitive, behavioral and social functioning rather than an assumption of a homogeneous autistic profile.

Historically, autism research has predominantly been framed within a deficit-oriented perspective, where differences in social communication have often been seen as signs of impaired

social functioning or reduced social interest (Baron-Cohen et al., 1985; Tager-Flusberg, 2007). Seen from this angle, problems with reciprocity, perspective-taking and relationship formation were often considered primarily to result from individual impairments. While these theoretical accounts have been essential to understanding autism, more recent conceptualizations point to the fact that autistic experiences are not fully explainable by deficit-based models (Happé & Frith, 2020; Lord et al., 2022).

Contemporary perspectives increasingly recognize autism through a neurodiversity framework, which sees neurological differences as part of normal human variation rather than solely as pathological deficits (Pellicano et al., 2022). This perspective does not deny the significant challenges that many autistic individuals experience, but it also argues that functioning is shaped by interactions between individual characteristics and environmental demands. Consequently, increasing attention has shifted toward understanding the mechanisms that facilitate successful participation, well-being, and quality of life among autistic adults rather than focusing exclusively on deficits (Lord et al., 2022; Pellicano et al., 2022).

This conceptual shift has been particularly important in relation to social functioning. Earlier theories often assumed that autistic individuals possess reduced motivation to engage in social interactions, leading to fewer or poorer interpersonal relationships (Chevallier et al., 2012). However, emerging evidence challenges this assumption. Jaswal and Akhtar (2019) argue that apparent social withdrawal should not be interpreted as a lack of desire for social relationships. Instead, many autistic individuals actively seek meaningful friendships, intimate relationships, and social belonging but encounter barriers that arise from differences in communication, sensory processing, and social expectations. Similarly, evidence from qualitative research has consistently shown that autistic adults place considerable value on close, authentic, and reciprocal relationships, even when they experience difficulties establishing or maintaining them (Sedgewick et al., 2019; Crompton et al., 2020; Wu & Wang, 2025).

Rather than reflecting an absence of social motivation, now we know that social experiences appear to be shaped by reciprocal interactions between autistic and neurotypical individuals. The growing recognition of this interpersonal context has encouraged researchers to move beyond asking whether autistic people wish to engage socially toward understanding the cognitive, behavioral, and environmental factors that influence the quality and success of these

social interactions (Crompton et al., 2020). These developments have broadened contemporary autism research from examining deficits to explaining variability in social outcomes.

Social functioning has therefore become one of the most important areas of autism research because it is closely associated with psychological well-being, mental health, independence, and quality of life (Howlin & Moss, 2012; Lord et al., 2022). But even though social functioning is important, it should not be seen as a unitary construct. Rather, it encompasses multiple dimensions of interpersonal life, including the ability to establish relationships, maintain friendships, participate in social activities, and experience belonging within one's community. Considerable variability exists across autistic adults in each of these domains, suggesting that individual differences extend beyond the diagnostic characteristics of autism itself (Tafolla et al., 2025).

Although autistic adults frequently report greater social challenges than neurotypical adults, these experiences cannot be explained solely by being diagnosed as autistic. Emerging evidence suggests that social outcomes are influenced by other interacting factors, including social cognition, communication, environmental context, compensatory strategies, stigma, and opportunities for social participation (Lord et al., 2022; Pellicano et al., 2022; Crompton et al., 2020). Consequently, identifying the mechanisms underlying this variability in social functioning has become a major priority within newer approaches of autism research. In the present study, social functioning is conceptualized through three outcomes: friendship quality, friendship quantity, and loneliness. Together, these constructs capture both the structural and subjective aspects of social relationships that provide a comprehensive framework for understanding social experiences in autistic adults.

Friendship quality

Friendship quality represents the subjective experience that defines an interpersonal friendship with another person. It includes companionship, intimacy, emotional support, trust, reciprocity, affection and satisfaction, as well as the possibility of conflict within the friendship (Parker & Asher, 1993; Bukowski et al., 1994). Friendship quality reflects the extent to which the relationships with other people are experienced as close, supportive, reciprocal and satisfying. A higher quality of friendships can provide more emotional support, companionship, opportunities for shared activities and also a sense of belonging. These characteristics make friendship quality an important aspect for social development and psychological well-being (Hartup & Stevens, 1997; Bagwell et al., 2001).

Research on friendships in autistic adults has consistently identified differences in the quality and other characteristics, although the nature of these differences varies across studies and individuals. Earlier studies have reported that autistic individuals experience greater difficulties in both establishing and maintaining reciprocal friendships and they report fewer positive qualities of their friendships than their neurotypical peers (Bauminger & Kasari, 2000; Mazurek, 2014). More recent research also indicates that autistic adults experience lower favorable outcomes from their friendships. Black et al. (2024), in a scoping review of examining lived experiences of friendships in autistic individuals, found that they desire friendships and value characteristics like shared interests, trust, respect and reciprocity, while also reporting that they experience difficulties forming and maintaining friendships. This review also indicated that these difficulties might arise because autistic adults must adapt to neurotypical environments, and this could lead to anxiety and emotional fatigue within their social interactions.

Friendships between autistic adults are diverse. In a scoping review of friendships in autistic adults, Wu and Wang (2025) emphasize that the available literature generally shows that autistic adults report lower friendship quality compared to their neurotypical peers. They also highlight that there is variability in how these friendships are formed, maintained and experienced. This review shows that friendship is a multidimensional experience while indicating that autistic adults may differ considerably from their neurotypical peers in number, type and perceived quality of their friendships. This difference is very important because it shows that some autistic adults might report having supportive relationships despite having a small social network, and although these dimensions might be related, they are distinct dimensions of social functioning.

Friendship quality may encompass somewhat different characteristics for autistic adults than neurotypicals. Research done in autistic adults' friendship experiences states that what they see as meaningful aspects of friendships are trust, acceptance, shared interests, and mutual understanding (Crompton et al., 2020; Brake, 2025). Brake's (2025) qualitative study found that autistic adults described comfort, acceptance, and trust as central aspects of a good friendship. This indicates that friendship quality should not be understood only by aspects like frequency of contact or emotional closeness, but it should also be understood in terms of whether people experience their friendships as accepting, authentic, and comfortable. Other studies also indicate that the social context and characteristics of individuals might influence friendship quality. Bolis et al. (2021) found that higher perceived friendship quality was associated with greater similarity in autistic

traits between individuals. This finding may suggest that similarity between two friendship partners might be connected to friendship quality, rather than it being determined by individual characteristics of the individual. Crompton et al. (2020) similarly has highlighted that reciprocal communication and mutual understanding are very important in shaping social experiences.

When examining friendship quality directly, Li and Shum (2025) have compared adolescents and young adults with and without autism, and they found that autistic participants reported lower friendship quality, followed by lower companionship, help, security, and closeness. Autistic participants also reported greater conflict in relationships. They found that friendship quality was related to social-cognitive and social-behavioral characteristics, highlighting that the nature of friendships can be multidimensional. However, the participants in this study were adolescents and young adults and this should be considered alongside more adult specific evidence.

The overall literature states that autistic adults tend to report lower friendship quality than their neurotypical peers. They also show considerable variability in their friendships. From the available literature, we can see that friendship quality encompasses multiple dimensions like closeness, support, reciprocity, trust, acceptance, and satisfaction. We also have seen that these dimensions might be experienced differently across individuals and social contexts. At the same time, there are not a lot of studies that examine friendship among autistic adults. This indicates that the adult literature still remains underdeveloped (Wu and Wang, 2025; Black et al., 2024).

Friendship quantity

Friendship quantity refers to the number of friends an individual currently has and it represents the structural dimension of social functioning. It is different from friendship quality which reflects the subjective experience of these relationships. We know that social relationships provide us opportunities for companionship, social support, and participation in different activities, while the absence of these relationships may restrict social connection. Studies that have examined social-network size and friendship quantity in autism have examined these variables as indicators of social connectedness, alongside more subjective variables like friendship quality and loneliness (Mazurek, 2014; Lei et al., 2025).

Previous studies have generally reported that autistic individuals have fewer friendships and smaller social networks compared to their neurotypical peers. Autistic individuals are less

likely to have reciprocal relationships, and they tend to experience more difficulties in establishing and maintaining friendships (Petrina et al., 2014; Schroeder et al., 2014). A systematic review of social-network structure found that autistic individuals frequently occupy more peripheral positions within social networks and experience greater social isolation than neurotypical individuals, although the strength of these differences varies across different studies (Lei et al., 2025). These findings suggest that differences in the number of social relationships may represent an important component of the broader social difficulties that we see associated with autism.

Throughout research we see limited evidence of friendship quantity in adults, whereas there is more evidence concerning younger autistic populations. Lei et al. (2025) in their research have highlighted that social-network research has been focused more on children and adolescents, while the size and structure of adults' social networks is still understudied. However, studies that have examined friendship quantity in autistic adults have stated that the number of friends is relevant to a person's psychological functioning. Mazurek (2014) found that greater friendship quantity is associated with lower loneliness, and that the number of friends a person has contributes to higher self-esteem and to lower depression and anxiety. From this finding we can see that friendship quantity also captures an important aspect of social functioning that goes beyond the subjective experience connected to friendship quality.

More recent evidence has stated the importance of examining friendship quantity in autistic adulthood while also demonstrating substantial variability. In their scoping review of friendships among autistic adults, Wu and Wang (2025) identified 22 empirical studies and found that friendship status and the number or availability of friendships were recurring areas of investigation. Across the literature, almost all studies reported that autistic adults had fewer friends and lower-quality friendships than neurotypical adults. At the same time, this review showed considerable heterogeneity, where estimates of autistic adults reporting at least one close friend ranged from 60.2% to 88.3%, depending on the study and how friendship was defined. The authors therefore emphasized that autistic adults do not share just one single pattern of friendship experience.

This variability is also apparent when friendships are considered within the broader social-network context. Lei et al. (2025) highlighted general differences across studies in how social networks are defined and assessed, with some research examining close or reciprocal friendships and other studies considering wider networks of social contacts. Such differences are important

because the number of close friends may differ considerably from the size of an individual's broader social network. Consequently, although autistic individuals are frequently described as having smaller social networks, the extent of this difference depends partly on which relationships are considered and how they are measured (Lei et al., 2025).

What's important is the fact that the literature suggests that although autistic adults report a lower number of friends, this does not necessarily mean that they lack meaningful social relationships. Wu and Wang (2025) found that the friendships of autistic adults are diverse, with some of them reporting a small number of friends while also describing these relationships as meaningful and supportive. A study done by Brake (2025) has also shown that autistic adults place more importance on the relationships that are important for them, particularly those that involve trust, acceptance, and comfort. Thus, we see that friendship quality and quantity are distinguishable; the number of friendships provides information about the individual's social connections, while the quality of these relationships shows us how satisfying and supporting these relationships are.

So, previous research provides general support that autistic adults report a lower number of friends, with fewer friendships and less extensive social networks compared to neurotypicals (Petrina et al., 2014; Schroeder et al., 2014; Mazurek, 2014; Wu & Wang, 2025). However, the evidence is less extensive specifically in autistic adults, and substantial variability exists across individuals and measurement approaches (Lei et al., 2025; Wu & Wang, 2025). This provides a rationale for this study to examine whether autistic and neurotypical adults differ in the number of friendships they have, while stating that friendship quantity represents only one dimension of social functioning alongside friendship quality and loneliness.

Loneliness

Loneliness refers to the subjective and distressing experience that arises when our perceived social relationships do not correspond to the desired level of our social connection (Perlman & Peplau, 1981). Loneliness is different from objective social isolation, because the number of relationships an individual has does not necessarily mean they experience more loneliness. Individuals with a lower number of friends may not necessarily feel lonely if they perceive their existing relationships as meaningful, whereas the contrary is also evident. Individuals with many social networks may experience more loneliness when these relationships do not offer the desired level of closeness or belonging (Perlman & Peplau, 1981; Grace et al.,

2022). In this sense what loneliness reflects is the subjective experience of social connectedness, which is complementary to friendship quantity and relational aspects like friendship quality.

Research consistently indicates that loneliness is particularly evident among autistic adults. Grace et al. (2022), in a systematic review of 34 studies examining loneliness in autistic adults, found that autistic adults generally reported greater levels of loneliness across studies and, where control comparison groups were included, they tended to report greater loneliness than neurotypical adults. The review also identified different dimensions of loneliness, including intimate loneliness, relating to the absence of a close intimate relationship, relational loneliness, relating to insufficient connection with friends and family, and collective loneliness, referring to a lack of belonging within wider social groups (Grace et al., 2022). This distinction suggests that loneliness in autistic adults may involve difficulties in both interpersonal relationships and broader experiences of social belonging in larger social groups.

Direct comparative evidence further supports these differences in loneliness among autistic and neurotypical adults. One study comparing 220 autistic and 146 neurotypical adults showed that autistic adults reported higher levels of loneliness in the UCLA Loneliness Scale (Mazurek et al., 2023). In this study loneliness was also associated with other aspects of psychological and social functioning including perceived social support, depression, anxiety, and self-efficacy. These findings suggest that greater loneliness in autistic adults is not only a product of having a small number of friends, but it is also connected with wider aspects of social and psychological characteristics.

The relationship between friendship and loneliness is particularly relevant when considering loneliness with other social functioning outcomes that are examined in this study. Mazurek (2014) found that, among 108 autistic adults, both the number and quality of friendships were associated with lower loneliness. Individuals who reported more friendships and more positive subjective friendship experiences tended to experience less loneliness, suggesting that both the number of social relationships and the subjective characteristics of those relationships are relevant to feeling socially connected. At the same time, the fact that friendship quantity, friendship quality, and loneliness were not interchangeable constructs supports examining them as separate dimensions of social functioning.

Nevertheless, the relationship between social relationships and loneliness in autism appears to be more complex than simply having more or less friends. Grace et al. (2022) identified several

other factors associated with loneliness beyond friendship characteristics, including social difficulties, anxiety, depression, social camouflaging, negative social experiences, lack of understanding and acceptance, sensory avoidance, and reduced social participation. Conversely, having meaningful relationships, greater social participation, and greater self-acceptance were associated with lower loneliness. These findings indicate that loneliness reflects how individuals perceive and experience their social environment rather than representing a direct measure of the objective number of relationships they maintain.

Recent research further emphasizes the importance of belonging and perceived social connection in understanding loneliness among autistic adults. Autistic adults may experience loneliness when social interactions are characterized by a lack of understanding or acceptance, even if they have a larger number of friends (Grace et al., 2022). Conversely, relationships characterized by acceptance, shared understanding, and a sense of belonging may provide important sources of social connection for autistic adults (Grace et al., 2022; Watts et al., 2025; Wolpe et al., 2025). Research on autistic communities in particular suggests that interactions with other autistic individuals may be experienced as easier to navigate and more mutually understood, with shared experiences contributing to feelings of belonging and social inclusion (Watts et al., 2025). These findings indicate that loneliness cannot be fully understood through only the quantity of interpersonal relationships, but it also depends on the quality, meaning, and perceived mutual understanding within those relationships.

Despite the consistent evidence for elevated loneliness, substantial individual variability exists in how autistic adults experience and report loneliness. Grace et al. (2022) noted that the existing literature is limited by differences in samples and measures, with relatively few studies that have examined autistic adults' first-hand social experiences and limited use of measures that are specifically validated for autistic populations. More recent qualitative research has similarly emphasized variation in how autistic adults experience, interpret, and respond to loneliness (Wolpe et al., 2025). Thus, although loneliness appears to be a common social difficulty in autistic adults, it should not be regarded as an inevitable consequence of autism.

In general, the literature suggests that autistic adults tend to experience greater levels of loneliness than neurotypical adults, while also demonstrating substantial variability in the extent and nature of this experience (Grace et al., 2022; Mazurek et al., 2023). Importantly, loneliness is related to both friendship quantity and friendship quality, but it also represents a distinct, subjective

dimension of social functioning (Mazurek, 2014). While we have established the different dimensions of social functioning, an important question that arises now is which individual characteristics may contribute to the variability we see in these social functioning outcomes. Theory of Mind represents one of the most extensively studied cognitive mechanism in autism, as the ability to infer others' mental states, and it is considered a fundamental ability to navigate social interactions and maintain interpersonal relationships.

Theory of Mind and Social Functioning

Theory of Mind, hereby referred to as (ToM) reflects the ability to infer and understand the mental states of oneself and others, including their beliefs, intentions, emotions, and perspectives (Premack & Woodruff, 1978; Baron-Cohen et al., 1985). Because successful social interaction often requires individuals to anticipate how other people may think, feel, and behave, ToM has long been considered an important component of social functioning. In autism research, differences in mental-state reasoning have consequently been proposed as one possible explanation for some of the difficulties observed in social communication and relationships (Baron-Cohen et al., 1985; Tager-Flusberg, 2007).

A large body of research has examined whether autistic individuals differ from neurotypical individuals in ToM performance. Evidence from meta-analyses generally indicates that autistic individuals tend to perform more poorly on ToM tasks, although the size of these differences varies depending on the cognitive and social demands of the task. In a meta-analysis of ToM in autistic adults, Velikonja et al. (2019) found a large overall group difference, while more recent meta-analytic work has similarly reported poorer ToM performance among autistic adults compared with neurotypical adults (Gao et al., 2023). These findings support the importance of ToM within social cognition in autism, while also showing that ToM performance is not the same across all autistic individuals or across different forms of mentalizing.

Importantly, ToM may be relevant not only to differences between autistic and neurotypical individuals, but also to differences in how people experience and manage their social relationships. Being able to understand another person's perspective can help individuals interpret social situations, anticipate how others may respond, and adjust their behavior during interactions. These abilities may be particularly important for forming and maintaining friendships, where successful interactions require individuals to understand and respond to another person's thoughts, feelings, and intentions (Stiller & Dunbar, 2007; Scheeren et al., 2013). Consistent with this view,

research has linked ToM with social competence and peer relationships, suggesting that stronger mentalizing abilities may support more effective social interactions (Scheeren et al., 2013).

One area in which ToM may be particularly relevant is friendship quality. Friendships require people to understand one another, respond to each other's needs, and coordinate their behavior during social interactions. Li and Shum (2025) directly examined the relationship between ToM, social skills, and friendship quality in adolescents and young adults with and without autism. They found differences between the groups in both ToM and friendship quality, and their structural equation modelling showed that ToM was related to friendship quality, with social skills accounting for part of this relationship. This suggests that ToM may contribute to friendship experiences partly through broader social abilities rather than having a direct effect on friendship quality. However, findings are not entirely consistent. Calder et al. (2013), for example, found that autistic participants reported poorer friendship quality but did not find a significant relationship between friendship quality and ToM. Similarly, Bauminger et al. (2010) suggested that although social-cognitive abilities may play a role in friendships, friendship experiences are also influenced by other interpersonal factors. Thus, while ToM may be relevant to how individuals experience their friendships, the relationship does not appear to be straightforward.

ToM may also be relevant to the number of social relationships individuals maintain. Stiller and Dunbar (2007) proposed that mentalizing ability may place limits on the size and complexity of social networks because maintaining several relationships requires individuals to keep track of different people's thoughts, intentions, and relationships with one another. Supporting this broader idea, Fink et al. (2015) found associations between mentalizing ability and characteristics of children's social networks. More recently, Lo et al. (2025) reported that better ToM was associated with greater social connectedness in a sample including autistic and neurotypical adults, and that ToM partly accounted for the relationship between autistic traits and social isolation. These findings suggest that ToM may be relevant not only to the experience of individual friendships, but also to broader patterns of social connectedness. However, there is still limited evidence examining whether ToM is directly related to the number of friendships autistic adults maintain.

ToM has also been linked to loneliness and broader experiences of social connectedness, although research in this area remains more limited. One possible explanation is that difficulties in understanding other people's thoughts and feelings may make it harder to navigate reciprocal interactions and maintain relationships, which could in turn contribute to feeling socially

disconnected or lonely. Supporting this possibility, Lo et al. (2025) found that better ToM performance was associated with greater social connectedness in middle-aged and older autistic and non-autistic adults. Their findings also suggested that ToM partly explained the relationship between autistic traits and social isolation, indicating that mentalizing may be one factor contributing to differences in social connectedness. However, evidence specifically linking ToM to loneliness remains less consistent. Moseley et al. (2021) also examined the relationship between mentalizing and loneliness in late-diagnosed autistic adults, but their findings suggested a more complex relationship rather than a simple association between poorer ToM and greater loneliness. In addition, loneliness is influenced by many other aspects of social and emotional life, including social support, friendship experiences, negative social experiences, anxiety, depression, and acceptance (Mazurek, 2014; Grace et al., 2022). Therefore, although ToM may play a role in how people experience social connection, it is unlikely to be the only factor underlying individual differences in loneliness.

Another important consideration is that performance on a structured ToM task does not necessarily reflect how mentalizing abilities are used in everyday social situations. Autistic individuals may perform successfully on explicit ToM tasks while continuing to experience difficulties in more complex, reciprocal, or unpredictable social environments (Livingston & Happé, 2017; Livingston et al., 2019). Livingston et al. (2019) proposed that autistic individuals may develop compensatory strategies that allow them to perform successfully on explicit mentalizing tasks, despite differences in how spontaneously they apply mental-state reasoning during everyday interactions. This distinction is particularly important when considering friendship and loneliness, as these experiences develop through ongoing and reciprocal interactions rather than through isolated mental-state judgements in controlled laboratory settings. Therefore, performance on a structured ToM measure may not necessarily correspond directly to the quality or quantity of an individual's friendships or to how socially connected they feel.

Theory of Mind and Social Camouflaging

The distinction between cognitive performance and everyday social behavior also raises the question of whether ToM may be related to social camouflaging. Based on previous research, it is possible that understanding other people's thoughts and perspectives could help individuals navigate social situations in which camouflaging is used (Livingston et al., 2019; Corbett et al., 2021). Camouflaging can involve observing other people's behavior, learning social expectations,

and adjusting one's own behavior accordingly (Hull et al., 2017; Livingston et al., 2019; Corbett et al., 2021). These processes could potentially involve considering how other people perceive or respond to one's behavior (Hull et al., 2017; Livingston et al., 2019). However, there is currently little direct evidence showing that ToM is associated with the extent to which autistic individuals camouflage.

Hull et al. (2021) directly examined this relationship in 58 autistic adolescents using a cognitive ToM measure and the CAT-Q. Contrary to their expectations, ToM was not significantly associated with total camouflaging or with any of the CAT-Q dimensions. This suggests that individuals with better ToM performance do not necessarily report using more camouflaging strategies. Hull et al. (2021) proposed that ToM may be more relevant to the effectiveness of camouflaging rather than simply to how frequently an individual uses these strategies. Their findings therefore suggest that camouflaging should not be understood as a straightforward consequence of differences in ToM.

Some research has nevertheless linked ToM to broader concepts of compensation. Corbett et al. (2021), for example, examined autistic youth with different levels of behavioral compensation and found that those showing greater compensation displayed stronger social and communication abilities despite differences in underlying cognitive abilities. Similarly, Wood-Downie et al. (2021) found that autistic females showed higher social reciprocity than autistic males despite similar ToM performance. This suggests that differences in observable social behavior cannot necessarily be explained by differences in ToM alone. Instead, camouflaging and compensation may involve learning and adapting to social expectations, allowing individuals to navigate social situations even when their underlying cognitive abilities are similar.

More recent work has further emphasized the role of social and contextual factors in camouflaging. A systematic review by Klein et al. (2025) highlighted the range of motivations and circumstances associated with camouflaging and noted that its underlying cognitive mechanisms remain insufficiently understood. This is important because individuals may camouflage for different reasons and in different social environments. For example, camouflaging may be used to fit in, avoid negative social responses, or facilitate social relationships. As a result, the same level of camouflaging may reflect very different experiences or motivations across individuals.

The existing literature provides a reason to consider ToM and social camouflaging together, but it does not establish a clear relationship between the two. The direct evidence from

Hull et al. (2021) suggests that ToM performance does not necessarily predict how much autistic individuals camouflage, while research on compensation suggests that social adaptation can occur even when differences in underlying cognitive abilities are present. Thus, camouflaging may depend on a wider range of factors than mentalizing ability alone, including social experience, motivation, executive abilities, and the expectations of the social environment. The present study therefore examines the relationship between ToM and social camouflaging as an exploratory question, asking whether individual differences in ToM are associated with social camouflaging and whether this relationship differs between autistic and neurotypical adults.

The literature suggests that ToM is relevant to social functioning, but it does not provide a complete explanation for the social experiences of autistic adults. ToM may be related to aspects of friendship and social connectedness, yet these relationships appear to depend on broader cognitive, behavioral, interpersonal, and contextual factors (Livingston & Happé, 2017; Livingston et al., 2019). Similarly, the limited evidence concerning ToM and camouflaging suggests that social adaptation cannot simply be understood as a consequence of mentalizing ability. The inconsistent relationship between performance on structured ToM tasks and everyday social functioning therefore supports the need to consider ToM alongside other factors when examining why autistic individuals differ in their friendship experiences and perceived social connectedness.

Overall, we can see that ToM may be relevant to several aspects of social functioning, but that its relationship with everyday social experiences is not straightforward. Although mentalizing may contribute to friendship experiences and broader social connectedness, it is unlikely to account for the full variability in social functioning among autistic adults. The limited evidence concerning the relationship between ToM and social camouflaging further suggests that other factors may influence how autistic individuals navigate social situations. This provides a rationale for considering social camouflaging as a second potential mechanism underlying differences in social functioning.

Social Camouflaging and Social Functioning

Social camouflaging refers to the strategies autistic individuals use to mask or compensate for autistic characteristics during social interactions, often to meet social expectations or facilitate social acceptance (Hull et al., 2017; Hull et al., 2019). These strategies can include consciously

monitoring one's behavior, rehearsing conversations, copying others' social behaviors, and suppressing behaviors that may be perceived as socially inappropriate (Hull et al., 2017). In their qualitative study of 92 autistic adults, Hull et al. (2017) found that camouflaging was used in part by a desire to fit in and increase connections with other people, suggesting that it should not be understood simply as an attempt to conceal autism, but also as a strategy for navigating social environments and pursuing social relationships.

The social motivation underlying camouflaging is particularly relevant to friendship. Research suggests that autistic adults may use camouflaging specifically to make friends, gain social acceptance, and maintain social relationships (Hull et al., 2017; Cook et al., 2021). In an everyday social-context study, Cook et al. (2021) found that autistic adults described developing camouflaging strategies over time in response to a strong desire for social acceptance and connection. At the same time, participants described interpersonal and intrapersonal costs associated with camouflaging and identified more authentic forms of social interaction as an alternative. This suggests that camouflaging may initially facilitate access to social relationships without necessarily improving the individual's experience of those relationships.

Evidence concerning the social consequences of camouflaging is therefore mixed. On the one hand, camouflaging has been associated with increased social participation and connectedness, suggesting that adapting one's behavior may help autistic individuals navigate social environments and establish interpersonal relationships (Summerill & Summers, 2025). On the other hand, the same systematic review found that camouflaging is also associated with negative consequences, particularly for mental health and well-being. This apparent contradiction is important because camouflaging may provide short-term social advantages while also carrying longer-term costs for the individual using it.

The relationship between camouflaging and friendship specifically has recently been examined in a systematic review. Across eight qualitative studies involving autistic adolescents and adults, camouflaging emerged as a common strategy used in the pursuit of friendship. However, the review found little evidence that camouflaging consistently resulted in satisfactory relationships; instead, many participants described camouflaging as exhausting, ineffective, or incompatible with feeling socially authentic (Ridgway et al., 2025). These findings are particularly relevant to the distinction between friendship quantity and friendship quality. Camouflaging may help an individual gain access to or maintain social relationships, potentially increasing the number

of friendships, without necessarily resulting in relationships that are experienced as satisfying or authentic.

This distinction may also be important for understanding loneliness. Although camouflaging can be used to increase social participation, studies have linked greater camouflaging with poorer subjective social experiences, including loneliness (Cage & Troxell-Whitman, 2019; Bradley et al., 2021). The possibility that an individual can be socially engaged while still feeling disconnected highlights the difference between observable social participation and subjective social connectedness. In other words, successfully adapting one's behavior to a social environment does not necessarily mean that the individual feels understood, accepted, or able to be themselves within that environment.

The costs associated with camouflaging may help explain this discrepancy. Hull et al. (2019), in a study of 262 autistic adults, found that participants reported camouflaging for several reasons, including making friends and navigating social situations, while also identifying substantial personal costs associated with the process. Similarly, research examining camouflaging in everyday interactions has described uncertainty about social acceptance and the effort involved in maintaining a socially acceptable presentation (Cook et al., 2021). These findings indicate that the consequences of camouflaging depend not only on whether it facilitates social interaction, but also on the effort required to sustain it and how the resulting relationships are experienced.

Importantly, camouflaging should not be considered uniformly either harmful or beneficial. Recent work has increasingly described it as a context-dependent strategy, with its consequences varying according to the social environment and the individual's reasons for using it. Pyszkowska et al. (2025) in a thematic analysis of autistic adults' experiences characterized camouflaging as a "two-edged sword": participants described benefits such as gaining social acceptance and adapting to new situations, alongside exhaustion and concerns about identity and self-esteem. Similarly, research examining camouflaging toward autistic and neurotypical interaction partners suggests that autistic adults may adjust their behavior according to characteristics of the person they are interacting with, challenging the assumption that camouflaging is simply an attempt to imitate neurotypical behavior (Funawatari et al., 2024).

Taken together, the literature suggests that social camouflaging may be particularly relevant to different dimensions of social functioning in different ways. Its use in pursuit of social connection may provide opportunities to establish or maintain friendships, making its relationship

with friendship quantity potentially complex. At the same time, the effort involved in camouflaging and concerns about authenticity may be associated with poorer experiences of relationships and greater loneliness. Thus, the literature provides a stronger basis for expecting a relationship between camouflaging and friendship quality and loneliness, while the direction of its association with friendship quantity is less clear. This distinction is consistent with the broader evidence that camouflaging can simultaneously facilitate social participation and be associated with personal and interpersonal costs (Hull et al., 2017; Cook et al., 2021; Summerill & Summers, 2025).

Finally, although camouflaging has become an important concept in autism research, its relationship with social functioning remains insufficiently understood. Much of the existing literature has focused on mental health, diagnosis, or lived experiences of masking, while fewer studies have directly examined whether individual differences in camouflaging are associated with specific social outcomes such as the number and quality of friendships and loneliness. The recent systematic reviews highlight this gap, particularly the limited evidence testing whether camouflaging improves the social outcomes that individuals may be trying to achieve through it (Ridgway et al., 2025). Based on these findings, it is therefore important to examine whether social camouflaging is related to different aspects of social functioning, including friendship quality, friendship quantity, and loneliness.

The Present Study

Autism spectrum condition is characterized by substantial variability in social communication and interpersonal functioning, with autistic adults showing considerable differences in the quantity and quality of their social relationships and in their subjective experiences of social connectedness (Lord et al., 2022; Grace et al., 2022; Wu & Wang, 2025). Although autistic adults, on average, report fewer friendships, lower friendship quality, and greater loneliness than neurotypicals, these outcomes are not the same across individuals (Mazurek, 2014; Grace et al., 2022; Wu & Wang, 2025). This variability suggests that social functioning in autism cannot be fully understood by describing group differences alone, and that it is important to examine other factors that may contribute to individual differences in social functioning.

Theory of Mind (ToM) represents one of the most extensively studied cognitive mechanisms proposed to account for social difficulties in autism. ToM involves the ability to infer and understand the mental states of others, including their beliefs, intentions, emotions, and

perspectives (Premack & Woodruff, 1978; Baron-Cohen et al., 1985). Evidence from meta-analyses indicates that autistic adults tend to show poorer performance on ToM tasks than neurotypical adults, although the magnitude of these differences varies depending on the type and demands of the task (Velikonja et al., 2019; Gao et al., 2023). Importantly, ToM performance has also been associated with aspects of social functioning, including social competence and friendship-related outcomes (Scheeren et al., 2013; Li & Shum, 2025). Based on this research, the present study examines whether ToM is associated with friendship quality, friendship quantity, and loneliness, and whether autistic and neurotypical adults differ in their ToM performance.

However, ToM might not provide a complete explanation for social functioning in autism. Research has shown that autistic individuals can sometimes perform successfully on structured mentalizing tasks while continuing to experience difficulties in everyday social interactions (Livingston & Happé, 2017; Livingston et al., 2019). This discrepancy suggests that successful performance on an explicit ToM task does not necessarily translate into effective or satisfying social relationships. Social functioning is likely influenced not only by what individuals are able to understand about other people's mental states, but also by how they adapt their own behavior during social interactions. Social camouflaging therefore represents a complementary mechanism through which social functioning may be understood.

Social camouflaging involves strategies used to mask, compensate for, or adapt autistic characteristics during social interactions, and is often motivated by the desire to fit in, gain social acceptance, and establish or maintain relationships (Hull et al., 2017; Cage & Troxell-Whitman, 2019). Although camouflaging may facilitate social participation and provide opportunities for social interaction, research has also linked greater camouflaging with negative psychological and social outcomes, including greater loneliness and reduced well-being (Cage & Troxell-Whitman, 2019; Bradley et al., 2021; Moseley et al., 2021). This apparent distinction between social participation and subjective social connectedness is particularly relevant to the present study. Camouflaging may potentially help individuals establish or maintain social relationships while not necessarily resulting in relationships that are experienced as satisfying or authentic.

The relationship between camouflaging and the different dimensions of social functioning may therefore not be uniform. While camouflaging may provide opportunities to establish and maintain friendships, its psychological and interpersonal costs may be associated with poorer experiences of those relationships and greater loneliness (Hull et al., 2017; Cage & Troxell-

Whitman, 2019; Bradley et al., 2021). Consequently, a relationship between camouflaging and friendship quantity may be less straightforward than its relationship with friendship quality or loneliness. The existing literature has examined these constructs largely in isolation, and relatively few studies have considered ToM and social camouflaging together when examining multiple dimensions of social functioning in autistic adults.

The present study addresses this gap by examining Theory of Mind and social camouflaging as two potentially complementary factors associated with social functioning in autistic and neurotypical adults. First, the study investigates whether autistic and neurotypical adults differ in friendship quality, friendship quantity, loneliness, ToM, and social camouflaging. Second, it examines whether ToM is associated with friendship quality, friendship quantity, and loneliness. Third, it examines whether social camouflaging is associated with these same social functioning outcomes. Finally, the study investigates whether the relationships between ToM, social camouflaging, and social functioning differ between autistic and neurotypical adults. By examining these factors within the same study, the present study aims to determine whether social functioning is better understood through cognitive mentalizing ability or behavioral strategies alone or through a broader consideration of both cognitive and behavioral strategies involved in navigating social interactions.

Objectives and Hypotheses

The main objective of the present study is to investigate the role of Theory of Mind (ToM) and social camouflaging in social functioning among autistic (ASD) and neurotypical (NT) adults. Social functioning is considered across three related but distinct dimensions: friendship quality, friendship quantity, and loneliness. By examining ToM and camouflaging in relation to these different aspects of social functioning, the study aims to better understand how these two factors are related to social experiences among autistic adults.

Preliminary to this main objective, the study first examines whether autistic and neurotypical adults differ in social functioning, ToM, and social camouflaging. Based on previous evidence of poorer friendship experiences and social functioning, differences in ToM performance, and higher levels of camouflaging among autistic adults, it is hypothesized that p1) autistic adults will show poorer social functioning than neurotypical adults, reflected in lower friendship quality and quantity and higher levels of loneliness; p2) autistic adults will show lower ToM performance

than neurotypical adults; p3) autistic adults will report higher levels of camouflaging than neurotypical adults.

Having established these preliminary group differences, the study then examines how ToM and social camouflaging are related to social functioning. For ToM, higher performance is expected to be associated with better social functioning, reflected in higher friendship quality and quantity and lower loneliness. This expectation comes from the proposed role of mentalizing in understanding others' perspectives, navigating social interactions, and maintaining social relationships.

For social camouflaging, the expected pattern is less straightforward. Camouflaging may help autistic individuals manage social situations and make it easier to take part in social interactions, but it can also be demanding and may come with costs for how people experience their relationships. For this reason, higher levels of camouflaging are expected to be related to lower friendship quality and greater loneliness. However, no specific direction is predicted for friendship quantity. While camouflaging may help individuals make or maintain more social connections, having more friendships does not necessarily mean that these relationships are experienced as close, satisfying, or meaningful.

The study also examines whether the relationships between ToM, social camouflaging, and social functioning differ between autistic and neurotypical adults. Because previous research does not provide a clear basis for predicting which group would show stronger associations, no specific direction is expected. This allows the study to test whether ToM and camouflaging relate to social functioning in similar or different ways across groups.

Overall, the present study investigates ToM and social camouflaging together across multiple dimensions of social functioning, rather than examining these constructs in isolation. While ToM is expected to generally support social functioning, camouflaging may play a more differential role, potentially being negatively related to friendship quality and loneliness while showing a less clear relationship with friendship quantity. Looking at these dimensions together may therefore help provide a clearer picture of how ToM and social camouflaging are related to social functioning in autism.

Methods

Participants and Procedures

A total of 61 participants (31 males, 29 females, 1 non-binary individual), aged between 20 and 67 years ($M = 31.50$, $SD = 11.16$), were recruited from the adult Italian population. Participants were divided into two groups: 24 high-functioning individuals with a clinical diagnosis of autism spectrum disorder (ASD group) and 37 neurotypical individuals (the control group) (see Table 1 for the demographic characteristics). Regarding educational attainment, most participants reported a relatively high level of education. In the overall sample, 1 participant had completed elementary (lower secondary) education, 22 had obtained a high school diploma, 21 held a bachelor's degree, 13 held a master's degree, and 1 held a doctorate. All procedures were approved by the Psychological Ethics Committee of the University of Pavia (approval no. 112/22). The study was not preregistered. After providing written informed consent, participants completed a brief demographic questionnaire (age, gender, education) prior to performing the experimental tasks and questionnaires. All tasks were administered individually on a computer.

Table 1

Participant Demographics

Variable	ASD	Control	Overall
Groups	N = 24	N = 37	N = 61
Age			
Min–Max	20-67	22-63	20-67
Mean	31.39	31.57	31.5
SD	10.62	11.65	11.16
Gender			
Male	15	16	31
Female	8	21	29
Non-binary	1	0	1
Education			
Elementary school	1	0	1
High school	11	11	22
Bachelor's degree	6	15	21
Master's degree	4	9	13
Doctorate	1	0	1

Measures

Friendship Quality

Friendship quality was assessed using the Duke Social Support Index (DSSI, see Appendix A), originally developed by Koenig, Westlund, George, Hughes, Blazer, and Hybels (1993) as a multidimensional measure of social support in adult populations. The DSSI was designed to assess both the structural aspects of social networks (e.g., size and frequency of contact) and the functional or qualitative aspects of social relationships (e.g., perceived emotional support,

satisfaction, and reciprocity). Participants completed the full DSSI questionnaire individually on a computer following informed consent. Internal consistency of the DSSI total score was assessed using Cronbach's alpha and McDonald's omega. One interaction item (D2) showed no variability in the present sample and was excluded from reliability estimation. The remaining 23 items demonstrated good internal consistency ($\alpha = .60$; $\omega_t = .73$). However, for the purposes of the present study, only Items 6–12 were included in the analyses. These items specifically assess the functional quality of close relationships, focusing on perceived emotional support, satisfaction with friendships, and availability of friends. Each item was rated on a 3-point Likert scale ranging from 1 (Almost never) to 3 (Most of the time), reflecting perceived level of support. Example items include statements such as “How satisfied are you with the support you receive from your friends?”, “How often can you confide in someone close to you?”, and “How often do you feel understood by your friends?”. Higher scores reflect greater perceived emotional support and higher satisfaction with friendships. Internal consistency of the seven-item scale in the present sample was good (Cronbach's $\alpha = .84$; $\omega_t = .89$, more information is presented in Appendix I), indicating satisfactory reliability and supporting the use of a single aggregated index.

Friendship Quantity

Friendship quantity was assessed using a brief self-report measure designed to capture the size of participants' social networks. Participants reported the number of friendships they currently had and indicated who these friends were (e.g., colleagues, roommates, classmates, or other social contacts). They also reported the number of contacts stored on their mobile phone. Although information regarding friendship type and phone contacts was collected, only the self-reported number of friendships was used in the present analyses as the measure of friendship quantity, with higher scores indicating a greater number of friends.

Loneliness

Loneliness was assessed using the 20-item UCLA Loneliness Scale (Version 3; Russell, 1996, see Appendix B), a widely used self-report measure designed to capture subjective feelings of social isolation and dissatisfaction with interpersonal relationships. Participants completed the questionnaire individually on a computer. For each item, they indicated how often they experienced the described feeling using a 4-point Likert scale ranging from 1 (Never) to 4 (Often). The items included statements reflecting both negative experiences of loneliness (e.g., “How often

do you feel left out?”, “How often do you feel isolated from others?”) and positive experiences of social connectedness (e.g., “How often do you feel part of a group of friends?”, “How often do you feel close to people?”). The scale contains both negatively and positively worded items. To ensure that higher scores consistently reflected greater loneliness, positively phrased items were reverse scored prior to computing total scores. Items 1, 5, 6, 9, 10, 15, 16, 19, and 20 were reverse coded before aggregation. Reverse scoring is performed to ensure that all items contribute to the same directional meaning, namely, that higher scores consistently indicate higher loneliness. Although the UCLA Loneliness Scale is commonly treated as a unidimensional measure, previous research has identified three related components within the 20-item version: Isolation (feelings of being alone or excluded), Relational Connectedness (perceived closeness and intimacy in relationships), and Collective Connectedness (sense of belonging to broader social groups). In line with the theoretical focus of the present study, items were aggregated into a single overall loneliness index. For each participant, responses were averaged across all 20 items after reverse coding, resulting in a total loneliness score ranging from 1 to 4, with higher values indicating greater perceived loneliness. In the current sample, internal consistency was excellent (Cronbach’s $\alpha = .92$; $\omega_t = .95$, more information is presented in Appendix I). Given this high internal consistency of the total score, a single composite loneliness score was computed by averaging across all 20 items.

Theory of Mind (ToM)

Mentalizing ability was assessed using the Triangles Task, originally developed by Abell, Happé, and Frith (2000). The task is designed to measure Theory of Mind (ToM), that is, the ability to attribute mental states such as intentions, beliefs, and desires to others. Participants viewed six short (approximately 15 seconds) silent animated videos depicting two triangles (one orange and one blue) interacting within a rectangular frame. In two animations, one side of the frame contained an opening. The animations varied in the degree to which the movements implied mental states. Four videos depicted complex, mental state-based interactions (Theory of Mind condition; e.g., one triangle tricking or persuading the other), whereas two videos showed simple goal-directed movements without clear mental content (Action Understanding condition). Each animation was presented only once. After viewing each animation, participants were asked the open-ended question: “*What do you think happened in the video?*”. Responses were provided in written free-text format. Descriptions were scored for the degree of intentionality attributed to the triangles on

a scale from 0 (no attribution of intentionality) to 5 (complex and explicit attribution of mental states). Scoring was performed using the TrAIngles automated scoring software (Stagnitto, Serena Maria, 2025), which provides standardized intentionality ratings based on participants' textual responses. For each participant, mean scores were calculated separately for the four Theory of Mind animations (ToM score) and the two Action Understanding animations (Action score). Higher scores reflected greater attribution of intentional states. In addition to these condition-specific indices, a ToM difference score (ToM minus Action) was computed to capture the relative tendency to attribute mental states beyond simple goal-directed reasoning.

Social Camouflaging

Social camouflaging was assessed using the Camouflaging Autistic Traits Questionnaire (CAT-Q; Hull et al., 2019, see Appendix C), a 25-item self-report measure designed to assess the extent to which individuals engage in strategies to conceal or compensate for autistic characteristics during social interactions. The CAT-Q comprises three theoretically derived subscales: Compensation, which reflects strategies used to overcome or compensate for social and communication difficulties; Masking, which assesses the suppression or concealment of autistic characteristics during social interactions; and Assimilation, which captures efforts to fit into social situations by closely monitoring and adapting one's behavior to match perceived social expectations. In line with the aims of the present study, these subscales were not analyzed separately. Instead, responses were aggregated into a single overall camouflaging index. Several items were negatively worded and therefore required reverse scoring prior to aggregation to ensure that higher scores consistently reflected greater social camouflaging. Items 3, 12, 19, 22 and 24 were reverse coded before computing the total score. Reverse scoring ensured that all items contributed to the same directional meaning, with higher values consistently indicating greater use of camouflaging behaviors. Participants completed the questionnaire individually on a computer. For each item, they indicated the extent to which they agreed with the statement using a 7-point Likert scale ranging from 1 (Strongly disagree) to 7 (Strongly agree). The questionnaire includes items reflecting different aspects of camouflaging, such as consciously learning or rehearsing social behaviors (e.g., *"I have developed a script to follow in social situations"*), masking autistic characteristics to appear more socially typical (e.g., *"I monitor my body language or facial expressions so that I appear interested in the person I am interacting with"*), and strategies used to compensate for social or communication difficulties. For each participant, responses were

averaged across all 25 items after reverse coding, resulting in a total social camouflaging score ranging from 1 to 7, with higher scores indicating greater engagement in camouflaging behaviors. In the current sample, internal consistency was excellent (Cronbach's $\alpha = .93$; $\omega_t = .93$, more information is presented in Appendix I). Given this high internal consistency, a single composite social camouflaging score was computed by averaging responses across all 25 items.

Data Analyses

All statistical analyses were conducted in R (version 4.6.0; R Core Team, 2026). Statistical significance was evaluated using a two-tailed α level of .05. Analyses were conducted using the available complete cases for the variables included in each model, consequently, sample sizes varied slightly across analyses due to missing data.

Group Differences in Theory of Mind and Social Functioning

The first analyses examined whether autistic (ASD) and neurotypical control participants differed in Theory of Mind (ToM), social functioning, and social camouflaging. Social functioning was assessed across three indicators: friendship quality, friendship quantity, and perceived loneliness. To examine group differences, separate linear models were fitted for ToM, friendship quality, friendship quantity, loneliness, and social camouflaging, with Group (ASD vs. control) included as the predictor in each model. Type III tests of effects were used to determine whether the ASD and control groups differed significantly on each outcome. For each model, estimated marginal means (EMMs) and their corresponding 95% confidence intervals were obtained using the *emmeans* package, providing an estimate of the mean for each group while taking the fitted model into account. Pairwise comparisons between the ASD and control groups were then conducted using the estimated marginal means. Finally, Cohen's d was calculated for each group comparison, together with its 95% confidence interval, to provide an estimate of the standardized size of the difference between the ASD and control groups.

Preliminary Analysis: Theory of Mind and Social Camouflaging

A preliminary analysis examined whether Theory of Mind (ToM) was associated with social camouflaging. A linear regression model was fitted with social camouflaging as the outcome and ToM, Group, and the ToM $\times$ Group interaction as predictors. The main effect of ToM was used to examine whether individual differences in mentalizing were related to social camouflaging, while the ToM $\times$ Group interaction tested whether this association differed between ASD and control participants. To further examine the pattern of the association within each group, group-

specific regression slopes were estimated using the *emtrends* function, together with their corresponding 95% confidence intervals (see Appendix F).

Associations Between Theory of Mind, Social Camouflaging, and Social Functioning

To examine whether ToM and social camouflaging were related to social functioning, and whether these relationships differed between ASD and control participants, separate linear regression models were conducted for friendship quality, friendship quantity, and loneliness. For each outcome, models including ToM and models including social camouflaging were fitted separately. In the ToM models, ToM and Group were entered as predictors, together with the ToM $\times$ Group interaction. Similarly, the social camouflaging models included social camouflaging, Group, and the Social Camouflaging $\times$ Group interaction.

The main effects of ToM and social camouflaging were used to examine whether individual differences in either variable were associated with each measure of social functioning. The interaction terms tested whether the strength or direction of these associations differed between ASD and control participants. To further understand these interactions, group-specific regression slopes were estimated using the *emtrends* function, together with their 95% confidence intervals. Pairwise comparisons were then used to determine whether the estimated slopes differed between the two groups. Model fit was assessed using the multiple and adjusted R^2 values, while regression coefficients and their 95% confidence intervals were examined to describe the direction and size of the associations. For the figures, LOESS curves were also included to provide a visual representation of the observed relationships within each group.

Exploratory Mediation Analysis

Following the analyses examining social camouflaging and social functioning, and given the observed group differences in both social camouflaging and friendship quality, an exploratory mediation analysis was conducted to further investigate whether social camouflaging could help explain the relationship between Group and friendship quality. In the mediation model, Group was entered as the predictor, social camouflaging as the mediator, and friendship quality as the outcome. The model examined the association between Group and social camouflaging (path *a*), the association between social camouflaging and friendship quality while controlling for Group (path *b*), the total association between Group and friendship quality (path *c*), and the direct association between Group and friendship quality after accounting for social camouflaging (path

c'). The indirect effect (ab) was estimated using non-parametric bootstrapping with 5,000 simulations. The indirect effect was considered statistically different from zero when its 95% bootstrap confidence interval did not include zero. Standardized coefficients were also calculated to make it easier to compare and interpret the magnitude of the effects. Because this analysis was conducted as a follow-up to the observed findings for social camouflaging and social functioning, rather than being based on a pre-specified mediation hypothesis, it was treated as an exploratory analysis.

Follow-Up Analysis of Social Camouflaging, Friendship Quality and Friendship Quantity

A follow-up generalized linear mixed-effects model (GLMM) was conducted within the ASD group to further explore whether social camouflaging was differently associated with friendship quality and friendship quantity. Friendship quality and friendship quantity were standardized and included in the same model as two repeated measures of social functioning for each participant. Social camouflaging, outcome type (friendship quality vs. friendship quantity), and their interaction were included as fixed effects, while a random intercept for participant was added to account for the fact that the two observations came from the same individuals. The model was fitted using a Gaussian distribution. Type III Wald χ^2 tests were used to examine the fixed effects. To better understand the interaction, estimated slopes for social camouflaging were calculated separately for friendship quality and friendship quantity using *emtrends*, together with their 95% confidence intervals. A pairwise comparison was then used to test whether the two slopes differed from each other, indicating whether the relationship between social camouflaging and social functioning was different for friendship quality compared with friendship quantity. Model fit was assessed using marginal R^2 , representing the variance explained by the fixed effects, and conditional R^2 , representing the variance explained by both the fixed and random effects.

Data Screening and Diagnostic Analyses

Prior to the primary analyses, the study variables were examined for missing data, distributional characteristics, and potentially influential observations. Histograms were used to visually inspect the distributions of the continuous variables and identify any notable departures from the expected distribution. Potentially influential observations were assessed using Cook's distance and standardized residuals. These checks were used to identify observations that might have an unusually strong influence on the results rather than to selectively exclude observations based on their effect on statistical significance. The histograms and influential-point diagnostics

are provided in Appendix D. Pearson correlation matrices were also examined to explore the relationships between the main study variables and to provide an overview of the associations among Theory of Mind, social camouflaging, friendship quality, friendship quantity, and loneliness. The correlation matrices are presented in Appendix E.

Supplementary Gender Analyses

Given previous evidence suggesting that gender may be related to social cognition and social functioning, supplementary analyses were conducted to explore whether gender influenced the primary findings. The relevant models were re-estimated with Gender included as an additional factor, together with the corresponding Group $\times$ Gender interactions and, where appropriate, interactions between Gender and the other predictors. Only participants with available gender information were included in these analyses. As these analyses were supplementary to the primary research questions, they were not part of the main hypothesis testing. Detailed results from the gender analyses are reported in Appendixes J, K, L.

Sensitivity Analyses

Sensitivity analyses were conducted to evaluate whether the regression findings were robust to potentially influential observations. Relevant regression models were re-estimated after removal of observations identified as influential according to diagnostic criteria. The resulting models were compared with the full-sample models to determine whether the direction and statistical significance of the findings were substantially altered. For visualization, the full-sample and sensitivity models were plotted using LOESS curves, with solid lines representing models including all observations and dashed lines representing models after the removal of potentially influential observations. The full results of the sensitivity analyses, including the models with influential observations removed, are reported in Appendixes G and H. The main results section reports the models based on the full available sample.

All analyses were conducted in R version 4.6.0 (R Core Team, 2026). Linear regression models were fitted using the base R *stats* package. Type III tests were conducted using the *car* package. Estimated marginal means, pairwise comparisons, and estimated trends were obtained using the *emmeans* package. Cohen's *d* and standardized effect sizes were calculated using the *effectsize* package. Model performance indices were obtained using the *performance* package. The exploratory mediation analysis was conducted using the *mediation* package, with 5,000 bootstrap simulations. The ASD-only mixed-effects model was fitted using the *glmmTMB* package. Data

manipulation and reshaping were conducted using *dplyr* and *tidyr*, and data visualization was performed using *ggplot2*.

Results

Group Comparisons of ToM, Social Camouflaging, and Social Functioning

The first analyses examined whether the ASD and control groups differed in Theory of Mind (ToM), social functioning, and social camouflaging. Group differences were tested using linear models with group as the predictor, and Type III ANOVA was used to evaluate the group effect. Social functioning was assessed using three outcomes: friendship quality, friendship quantity, and loneliness. The group comparisons are illustrated by the estimated marginal mean bar plots in Figure 1.

The groups differed significantly in friendship quality, $F(1, 55) = 23.14, p < .001$. Participants in the ASD group reported lower friendship quality ($M = 1.99, 95\% \text{ CI } [1.81, 2.18]$) than participants in the control group ($M = 2.56, 95\% \text{ CI } [2.42, 2.71]$). The between-group difference was large, $d = -1.31, 95\% \text{ CI } [-1.89, -0.72]$. This finding supported the hypothesis that autistic participants would report poorer friendship quality than control participants (Figure 1, Panel A).

A similar pattern was observed for friendship quantity. There was a significant group difference, $F(1, 55) = 8.25, p = .006$, with ASD participants reporting fewer friendships ($M = 7.23, 95\% \text{ CI } [4.93, 9.52]$) than control participants ($M = 11.43, 95\% \text{ CI } [9.61, 13.25]$). The between-group effect was moderate to large, $d = -0.78, 95\% \text{ CI } [-1.33, -0.23]$. Thus, the hypothesis that autistic participants would report fewer friendships was also supported (Figure 1, Panel B).

For loneliness, the difference between the groups did not reach statistical significance, $F(1, 55) = 3.41, p = .070$. Although the ASD group reported slightly lower loneliness ($M = 2.25, 95\% \text{ CI } [2.00, 2.50]$) than the control group ($M = 2.54, 95\% \text{ CI } [2.34, 2.74]$), this difference was not statistically significant. The effect size was moderate, $d = -0.50, 95\% \text{ CI } [-1.04, 0.04]$. Therefore, the hypothesis that autistic participants would report higher levels of loneliness was not supported (Figure 1, Panel C).

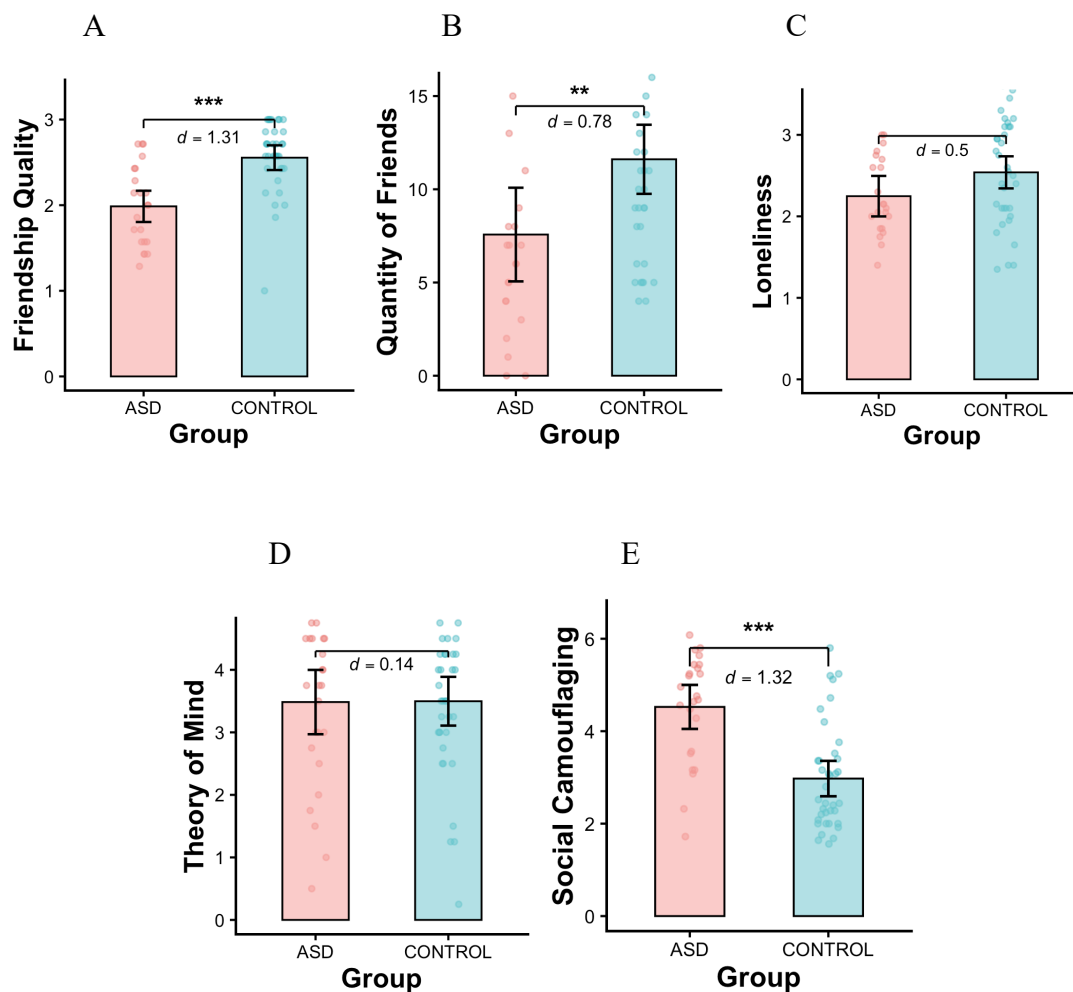
The two groups also showed very similar performance in Theory of Mind. There was no significant group difference, $F(1, 59) = 0.27, p = .606$. The ASD group had a mean ToM score of 3.33 ($95\% \text{ CI } [2.85, 3.81]$), compared with 3.49 ($95\% \text{ CI } [3.11, 3.88]$) in the control group. The between-group effect was very small, $d = -0.14, 95\% \text{ CI } [-0.65, 0.38]$. Thus, the hypothesis that

the ASD and control groups would differ in ToM performance was not supported (Figure 1, Panel D).

In contrast, a clear group difference was found in social camouflaging, $F(1, 59) = 25.36$, $p < .001$. ASD participants reported substantially higher levels of camouflaging ($M = 4.50$, 95% CI [4.03, 4.98]) than control participants ($M = 2.98$, 95% CI [2.60, 3.36]). The difference was large, $d = 1.32$, 95% CI [0.75, 1.88]. This finding supported the hypothesis that autistic participants would report greater use of social camouflaging than control participants (Figure 1, Panel E). Overall, the group comparisons provided partial support for the hypotheses. The expected differences were found for friendship quality, friendship quantity, and social camouflaging, whereas the hypotheses concerning ToM and loneliness were not supported.

Figure 1

Group differences in Social Functioning, Theory of Mind, and Social Camouflaging



Note. Bars represent estimated marginal means from the corresponding models, with error bars indicating 95% confidence intervals. Individual points represent participant-level observations. Asterisks indicate significant between-group differences ($p < .05$, $*p < .01$, $**p < .001$).

As a preliminary step, the relationship between ToM and social camouflaging was examined to determine whether the two constructs were associated and whether this association differed between the ASD and control groups (see Appendix F). The overall model was significant, $F(3, 57) = 8.86$, $p < .001$, explaining 31.8% of the variance in social camouflaging ($R^2 = .318$, adjusted $R^2 = .282$). However, ToM was not significantly associated with social camouflaging, $F(1, 57) = 1.34$, $p = .251$, and there was no significant main effect of group, $F(1, 57) = 1.08$, $p = .304$. The ToM $\times$ Group interaction was also not significant, $F(1, 57) = 0.43$, $p = .515$, indicating that the association between ToM and social camouflaging did not differ significantly between the two groups. Thus, there was no evidence of a significant association between ToM and social camouflaging.

The role of Theory of Mind on social functioning in ASD and controls

To further examine the role of ToM in social functioning, the next analyses tested whether individual differences in ToM were associated with friendship quality, friendship quantity, and loneliness. The analyses also examined whether these relationships differed between the ASD and control groups.

For friendship quality, the overall regression model was significant, $F(3, 53) = 9.59$, $p < .001$, explaining 35.2% of the variance in friendship quality ($R^2 = .352$, adjusted $R^2 = .315$). However, ToM was not significantly associated with friendship quality, $F(1, 53) = 0.34$, $p = .563$. A significant main effect of group was observed, $F(1, 53) = 24.18$, $p < .001$, reflecting that the groups differed in friendship quality after accounting for ToM. The ToM $\times$ Group interaction was marginally non-significant, $F(1, 53) = 3.93$, $p = .053$. The estimated relationship between ToM and friendship quality was negative in the ASD group ($b = -0.079$, 95% CI $[-0.247, 0.089]$, $p = .350$) but positive in the control group ($b = 0.145$, 95% CI $[-0.007, 0.296]$, $p = .061$), hence the marginally significant difference between the two slopes ($b = -0.191$, $p = .053$). Thus, although the direction of the relationship appeared to differ between the two groups, there was not enough evidence to conclude that the association between ToM and friendship quality differed significantly between ASD and control participants (Figure 2, Panel A).

The corresponding models for friendship quantity and loneliness showed a similar pattern. For friendship quantity, the overall model did not reach conventional statistical significance, $F(3, 53) = 2.73, p = .053$, explaining 13.4% of the variance ($R^2 = .134$, adjusted $R^2 = .085$). ToM was not significantly associated with friendship quantity, $F(1, 53) = 0.08, p = .783$, and the ToM $\times$ Group interaction was also not significant, $F(1, 53) = 0.17, p = .685$. However, there was a significant main effect of group, $F(1, 53) = 7.75, p = .007$, indicating that the groups differed in friendship quantity after accounting for ToM (Figure 2, Panel B). The model for loneliness was also not significant, $F(3, 53) = 1.30, p = .284$, explaining 6.8% of the variance ($R^2 = .068$, adjusted $R^2 = .016$). Neither ToM, $F(1, 53) = 0.29, p = .592$, nor group, $F(1, 53) = 3.28, p = .076$, showed a significant main effect, and the ToM $\times$ Group interaction was not significant, $F(1, 53) = 0.42, p = .522$. The estimated slopes were close to zero in both the control group ($b = 0.009$, 95% CI $[-0.198, 0.216], p = .932$) and the ASD group ($b = -0.099$, 95% CI $[-0.365, 0.166], p = .456$). Thus, there was no evidence that ToM was associated with friendship quantity or loneliness, or that these relationships differed between the two groups (Figure 2, Panels B–C).

Taken together, ToM was not significantly associated with any of the three indicators of social functioning. The only result marginally significant involved the ToM $\times$ Group interaction for friendship quality, where the estimated direction of the association differed between the two groups, albeit not significantly ($p = .053$). Overall, the hypothesis that higher ToM would be associated with better social functioning was not supported, and there was no clear evidence that the strength of these associations differed between autistic and neurotypical adults.

The role of social camouflaging on social functioning in ASD and controls

The same analyses were then conducted for social camouflaging to assess its associations with the three indicators of social functioning and whether these associations differed between groups.

For friendship quality, the overall regression model was significant, $F(3, 53) = 9.63, p < .001$, and explained 35.3% of the variance in friendship quality ($R^2 = .353$, adjusted $R^2 = .316$). Social camouflaging was significantly associated with friendship quality, $F(1, 53) = 4.52, p = .038$, with higher levels of camouflaging associated with lower friendship quality. A significant main effect of group was also observed, $F(1, 53) = 8.55, p = .005$, reflecting that groups differed in friendship quality after accounting for social camouflaging. The Social Camouflaging $\times$ Group

interaction was not significant, $F(1, 53) = 0.004, p = .951$, indicating that the association between camouflaging and friendship quality did not differ between the two groups (Figure 2, Panel D).

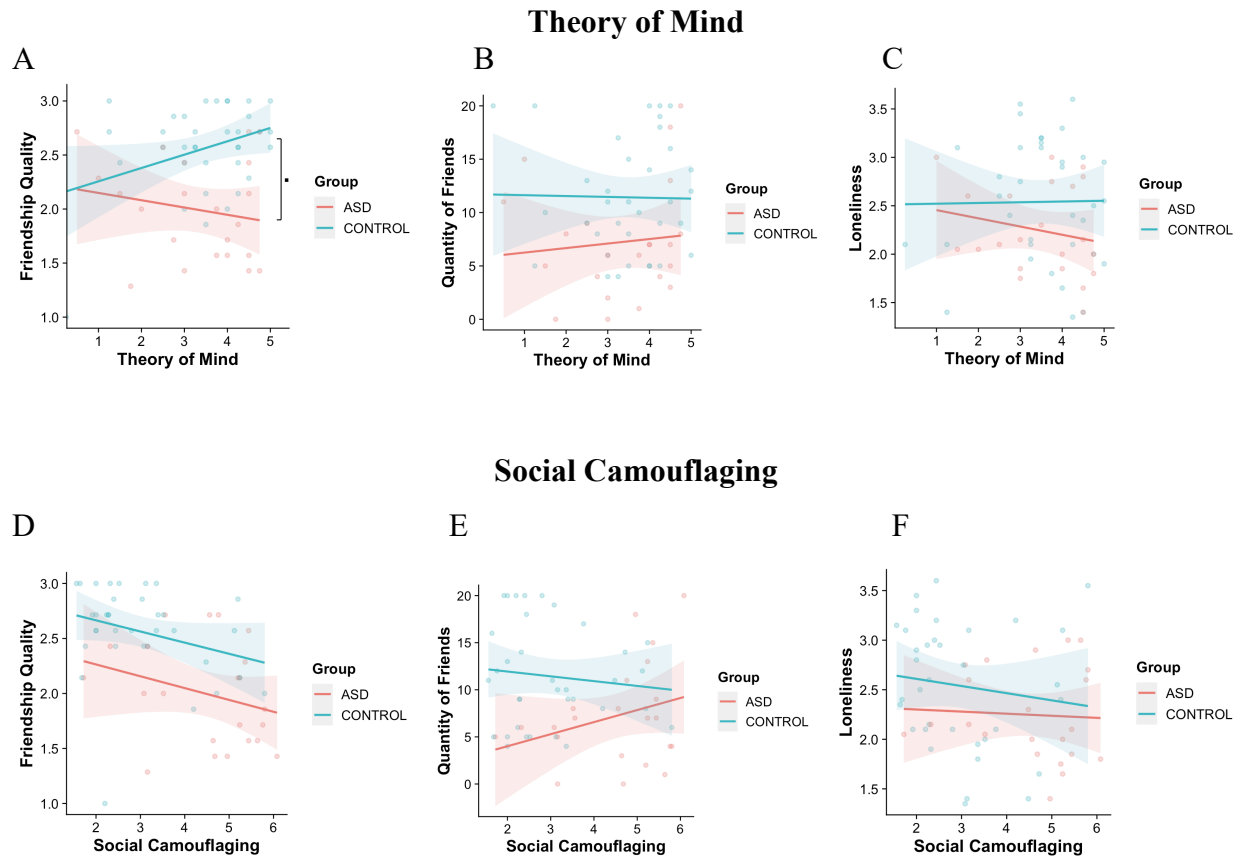
For friendship quantity, the overall regression model was significant, $F(3, 53) = 3.49, p = .022$, explaining 16.5% of the variance ($R^2 = .165$, adjusted $R^2 = .118$). Social camouflaging itself was not a significant predictor of friendship quantity, $F(1, 53) = 0.39, p = .537$. There was, however, a significant main effect of group, $F(1, 53) = 8.29, p = .006$, indicating that the groups differed in friendship quantity after accounting for camouflaging. The Social Camouflaging $\times$ Group interaction was not significant, $F(1, 53) = 2.08, p = .155$. The estimated association between camouflaging and friendship quantity was negative in the control group ($b = -0.698$, 95% CI $[-2.862, 1.47]$, $p = .521$) and positive in the ASD group ($b = 1.754$, 95% CI $[-0.877, 4.38]$, $p = .187$). Thus, although the estimated direction of the relationship differed between the groups, there was insufficient evidence to conclude that social camouflaging was associated with friendship quantity or that this association differed significantly between ASD and control participants (Figure 2, Panel E).

For loneliness, the overall regression model was not significant, $F(3, 53) = 1.36, p = .264$, and explained 7.2% of the variance ($R^2 = .072$, adjusted $R^2 = .019$). Social camouflaging was not significantly related to loneliness, $F(1, 53) = 0.47, p = .494$, and there was no significant main effect of group, $F(1, 53) = 1.38, p = .245$. The Social Camouflaging $\times$ Group interaction was also not significant, $F(1, 53) = 0.14, p = .707$. Thus, there was no evidence of a significant relationship between social camouflaging and loneliness, or of a difference in this relationship between the two groups (Figure 2, Panel F).

The regression analyses provided evidence that social camouflaging was significantly associated with friendship quality, but it was not significantly associated with friendship quantity or loneliness. There was also no evidence that these associations differed significantly between the ASD and control groups. Although the estimated slopes showed some differences in direction across the outcomes, none of the Group $\times$ Camouflaging interactions reached statistical significance. Taken together, these findings suggest that social camouflaging may be related to how individuals experience the quality of their friendships, but there was no evidence that this association differed between autistic and neurotypical participants.

Figure 2

Associations between Theory of Mind, Social Camouflaging and Social Functioning



Note. Panels A–C show the associations between Theory of Mind and social functioning, whereas Panels D–F show the corresponding associations for social camouflaging. Each point represents an individual participant. Solid lines represent the fitted linear regression models, and shaded bands indicate 95% confidence intervals. The dot in Panel A marks the marginal ToM $\times$ Group interaction for friendship quality ($p = .053$).

The role of social camouflaging on social functioning in ASD and controls: an exploratory mediation model

The preceding analyses showed significant group differences in both friendship quality and friendship quantity, with ASD participants reporting lower friendship quality and fewer friendships than control participants. However, social camouflaging was significantly associated with friendship quality but not friendship quantity. Therefore, an exploratory mediation model was conducted to examine whether social camouflaging statistically accounted for part of the

association between group and friendship quality. The mediation model specified group as the predictor, social camouflaging as the mediator, and friendship quality as the outcome (Figure 3).

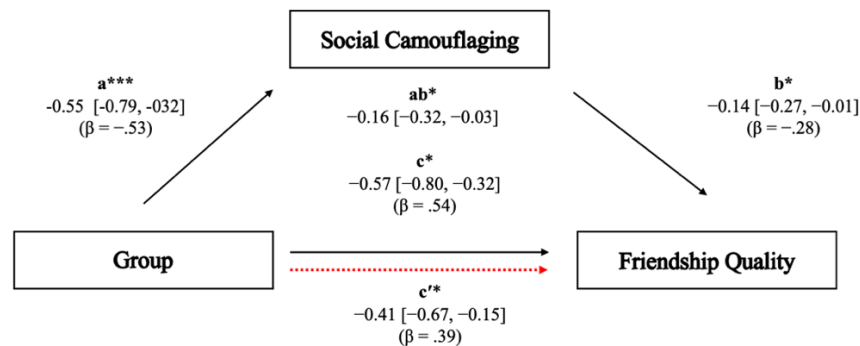
The analysis included 57 participants with complete data for all three variables, and the indirect effect was estimated using 5,000 bootstrap simulations. The association between group and social camouflaging (path *a*) was significant, $b = -0.55$, $p < .001$, with ASD participants reporting higher levels of social camouflaging. Higher social camouflaging was also significantly associated with lower friendship quality after controlling for group (path *b*), $b = -0.14$, $p = .034$.

The total association between group and friendship quality (path *c*) was significant, $b = -0.57$, 95% CI $[-0.80, -0.32]$, $p < .001$. After social camouflaging was included in the model, the direct association between group and friendship quality (path *c'*) remained significant, $b = -0.41$, 95% CI $[-0.67, -0.15]$, $p < .001$. The indirect effect of group on friendship quality through social camouflaging was also significant, $b = -0.16$, 95% CI $[-0.32, -0.03]$, $p = .020$. Approximately 27.6% of the total association was accounted for by the indirect pathway through social camouflaging.

Because both the indirect and direct effects were significant, the pattern of results was consistent with partial mediation. However, this analysis was conducted as an exploratory follow-up to the patterns observed in the primary regression and group-comparison analyses rather than being based on a pre-specified mediation hypothesis. Therefore, the findings should be interpreted as exploratory.

Figure 3

Mediation model of the association between group, social camouflaging, and friendship quality.



Note. Values represent unstandardized path coefficients with 95% confidence intervals; standardized coefficients are reported in parentheses. *a* represents the association between group and social camouflaging, *b* represents the association between social camouflaging and friendship quality controlling for group, *c* represents the total effect of group on friendship quality, and *c'* represents the direct effect after accounting for social camouflaging. The indirect effect (*ab*) was estimated using 5,000 bootstrap simulations. $p < .05$, $p < .01$, $p < .001$.

The distinct role of social camouflaging on friendship quality and quantity in ASD: a follow-up analysis

To further explore the pattern observed in the regression analyses, a follow-up generalized linear mixed-effects model (GLMM) was conducted within the ASD group. This analysis focused specifically on whether the relationship between social camouflaging differed depending on how social functioning was measured, by comparing friendship quality and friendship quantity. Friendship quality and friendship quantity were standardized and modeled simultaneously as two repeated measures of social functioning. Social camouflaging, outcome type (friendship quality vs. friendship quantity), and their interaction were included as fixed effects, while a random intercept for participant was included to account for the fact that each participant contributed to both friendship outcomes (see Figure 4).

There was no significant main effect of social camouflaging, $\chi^2(1) = 1.89$, $p = .169$, and no significant main effect of outcome type, $\chi^2(1) = 0.0004$, $p = .983$. However, the Social Camouflaging $\times$ Outcome Type interaction was significant, $\chi^2(1) = 5.01$, $p = .025$. This indicates that the relationship between social camouflaging and social functioning differed depending on whether social functioning was measured in terms of friendship quality or friendship quantity.

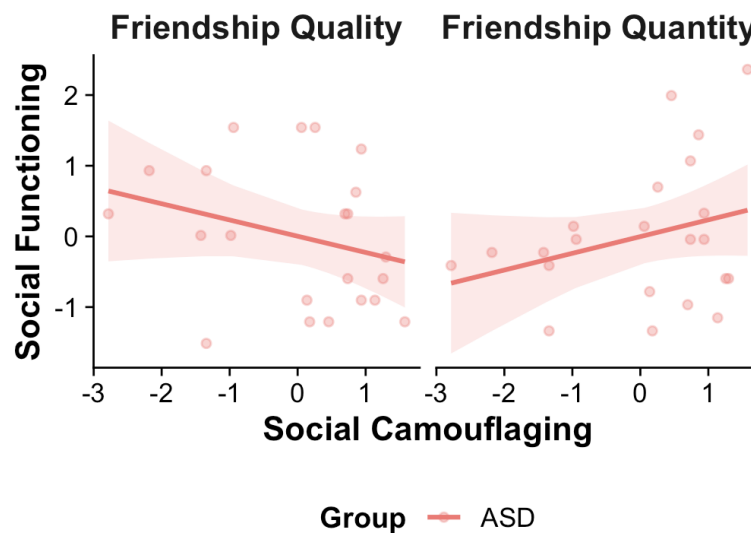
Follow-up estimated trends showed a negative association between social camouflaging and friendship quality, $b = -0.230$, 95% CI $[-0.557, 0.098]$, $p = .169$, and a positive association between social camouflaging and friendship quantity, $b = 0.237$, 95% CI $[-0.091, 0.564]$, $p = .156$. Neither of these individual associations was statistically significant. However, the difference between the two slopes was significant, $b = -0.467$, $p = .025$. The model explained 8.3% of the variance through the fixed effects (marginal $R^2 = .083$) and 28.6% when both fixed and random effects were considered (conditional $R^2 = .286$).

These findings suggest that the relationship between social camouflaging and social functioning was not the same across the two friendship measures. Within the ASD group, higher

camouflaging was associated with lower friendship quality but higher friendship quantity, although neither individual association was statistically significant. The significant difference between the two slopes suggests that the relationship with camouflaging may depend on which aspect of friendship is considered.

Figure 4

The association between Social Camouflaging and Social Functioning in the ASD group



Discussion

The present study examined differences between autistic and neurotypical adults in Theory of Mind (ToM), social camouflaging, and three aspects of social functioning: friendship quality, friendship quantity, and loneliness. It also examined whether individual differences in ToM and social camouflaging were related to these aspects of social functioning and whether these relationships differed between the two groups. An additional exploratory analysis considered the relationship between ToM and social camouflaging.

In line with our preliminary hypotheses, autistic adults reported poorer social functioning than neurotypical adults, particularly in terms of friendship quality and quantity, and also reported higher levels of social camouflaging. In contrast to p2, we did not find evidence that autistic adults had lower ToM performance than controls. The main hypotheses concerning the relationships between ToM, camouflaging, and social functioning received less support. ToM was not

significantly related to friendship quality, friendship quantity, or loneliness. There was, however, a difference in the estimated direction of the relationship between ToM and friendship quality across the two groups, with the interaction approaching significance ($p = .053$). This pattern was not strong enough to conclude that the relationship differed significantly between the groups. Similarly, social camouflaging was significantly associated with friendship quality, but not with friendship quantity or loneliness in the regression analyses.

The additional analyses nevertheless pointed to a more complex picture of the relationship between social camouflaging and friendship. The mediation model suggested that camouflaging accounted for part of the difference in friendship quality between the autistic and control groups. Higher levels of camouflaging were associated with lower friendship quality after accounting for group, while the remaining direct effect of group was still significant, resulting in a pattern consistent with partial mediation. The follow-up analysis within the autistic group also showed different estimated directions for friendship quality and friendship quantity: the association with friendship quality was negative, whereas the association with friendship quantity was positive. Neither association was significant on its own, but the difference between the two slopes was significant. Overall, these findings suggest that camouflaging may relate differently to different aspects of friendship. In particular, it may be more closely related to how autistic individuals experience the quality of their friendships than to the number of friendships they have.

The clearest group differences in the present study were seen in friendship outcomes. Autistic adults reported both poorer friendship quality and fewer friendships than neurotypical adults. The finding for friendship quality was consistent with the hypothesis and with previous research showing that friendship is an important part of autistic adults' social and emotional functioning (Mazurek, 2014; Wu & Wang, 2025). Similarly, the lower friendship quantity observed in the autistic group is consistent with research suggesting that autistic adults may have smaller friendship networks than neurotypical adults (Mazurek, 2014; Lei et al., 2025).

These two findings are related, but they should not be treated as measuring the same thing. Friendship quantity reflects the size of an individual's friendship network, whereas friendship quality captures characteristics such as closeness, reciprocity, support, and satisfaction (Parker & Asher, 1993; Bukowski et al., 1994). Previous research has similarly emphasized that these dimensions provide different information about social relationships (Mazurek, 2014; Lei et al., 2025). The present findings therefore suggest that group differences were evident at both a

structural level, reflected in fewer reported friendships, and a subjective level, reflected in lower perceived friendship quality.

At the same time, these findings should also not be interpreted as suggesting that autistic adults lack interest in friendships or meaningful relationships. Research consistently shows considerable variability in autistic adults' friendship experiences and indicates that autistic adults commonly value and seek meaningful social relationships (Mazurek, 2014; Wu & Wang, 2025; Ridgway et al., 2025). Thus, having fewer friendships or reporting lower friendship quality does not necessarily translate to reduced social motivation. Instead, these differences may reflect the difficulties autistic adults can encounter when trying to establish and maintain relationships that are important for them.

These results become particularly interesting when friendship is considered alongside loneliness. Despite reporting fewer friendships and lower friendship quality, autistic participants did not report significantly greater loneliness, as hypothesized in p1. This contrasts with previous research showing that loneliness is common among autistic adults and is associated with difficulties in social relationships and social connection (Grace et al., 2022; Mazurek, 2014). However, the relationship between friendship and loneliness may be more complex than the number or quality of friendships alone. Recent qualitative research suggests that autistic adults use a range of strategies to cope with loneliness, including seeking social contact, maintaining contact with friends and family, and connecting with other autistic or neurotypical people, with social contact often perceived as particularly helpful (Su et al., 2025). It is therefore possible that autistic adults may draw on alternative forms of social connection or coping strategies that help protect against loneliness, even when their friendships are fewer or experienced as lower in quality. However, because the present study did not directly assess coping strategies or other sources of social support, this interpretation remains speculative.

This may explain why the three measures of social functioning did not produce an identical pattern. An individual may have relatively few friendships but still feel sufficiently socially connected, while someone with a larger network may experience loneliness if their relationships do not provide the level of closeness or understanding they want. Social connection may also occur through forms of social participation that extend beyond conventional friendships, including common-interest groups, community settings, and online networks (Orsmond et al., 2022; Wu & Wang, 2025). Therefore, the present findings support treating friendship quantity, friendship

quality, and loneliness as related but distinct aspects of social functioning. The nonsignificant difference in loneliness should nevertheless be interpreted cautiously, particularly given the moderate effect observed in the present sample. This null finding should be replicated in larger samples to determine whether the same pattern is observed more consistently across autistic and neurotypical adults.

In contrast to the clear differences in friendship, autistic and neurotypical participants did not differ significantly in ToM. This finding was not consistent with the initial hypothesis or with meta-analytic evidence indicating ToM differences in autistic adults (Velikonja et al., 2019; Gao et al., 2023). One possible explanation concerns the nature of the measure used in the present study. The Triangles Task assesses mentalizing under relatively structured laboratory conditions, whereas we know that everyday social interactions are dynamic, unpredictable, and dependent on contextual information. Different ToM measures also place different demands on language, working memory, executive functioning, and contextual interpretation, which may contribute to variability in findings across studies (Gao et al., 2023).

Compensation may provide another explanation for not finding differences in ToM performance between groups. Livingston and Happé (2017) proposed that autistic individuals may develop strategies that allow them to perform successfully on structured cognitive tasks despite differences in the processes underlying social cognition. From this perspective, similar performance on a ToM task does not necessarily mean that autistic and neurotypical individuals use the same cognitive processes to arrive at that performance (Livingston & Happé, 2017; Livingston et al., 2019). This possibility is particularly relevant to the present findings because autistic participants showed significantly poorer friendship outcomes despite performing similarly to neurotypical participants on the ToM task. In other words, what participants were able to demonstrate in a structured mentalizing task did not necessarily correspond to how they experienced their social relationships. This does not mean that ToM is completely irrelevant to social functioning, but it does suggest that performance on a single structured measure may not capture the full range of social-cognitive processes involved in real-world interactions (Livingston & Happé, 2017; Livingston et al., 2019).

The regression analyses provided further support for this interpretation. ToM was not significantly associated with friendship quality, friendship quantity, or loneliness, and none of these associations differed significantly between the autistic and neurotypical groups. The ToM $\times$ Group interaction

for friendship quality approached significance ($p = .053$), with the estimated association being negative in the autistic group and positive in the control group. However, this interaction did not meet the predefined significance criterion and therefore cannot be interpreted as evidence of a group difference. Overall, the findings did not support our hypothesis that poorer ToM would be associated with poorer social functioning. Instead, substantial group differences were observed in friendship outcomes despite no corresponding group difference in ToM, suggesting that performance on the ToM measure did not explain individual differences in social functioning in this sample. Although this pattern was not statistically significant, it may be worth considering whether stronger ToM could, in some circumstances, be related to greater awareness of difficulties within one's social relationships (Scheeren et al., 2013). For example, greater awareness of interpersonal problems, unmet expectations, or a lack of reciprocity could influence how individuals evaluate their friendships. If this pattern were replicated in a larger sample, future research could examine whether ToM is related not only to the ability to understand others' mental states, but also to how individuals perceive and evaluate their own social relationships.

This may be because friendships and loneliness involve considerably more than just mental-state reasoning. Relationships depend on communication, reciprocity, shared interests, social opportunities, acceptance, compatibility, and the characteristics of the interaction partner (Wu & Wang, 2025; Lei et al., 2025). Loneliness is additionally influenced by factors such as anxiety, depression, social support, negative social experiences, and social acceptance (Grace et al., 2022). ToM may therefore contribute to successful social interactions without being sufficient to determine whether someone develops friendships, how satisfying those friendships are, or whether they feel lonely.

The Double Empathy Problem provides a particularly useful framework for interpreting this pattern. Milton (2012) proposed that social difficulties between autistic and neurotypical individuals may partly result from mismatches in communication styles, experiences, and ways of interpreting one another, rather than just being caused exclusively by difficulties within the autistic individual. This perspective is relevant to the present findings because friendship outcomes differed between groups even though ToM performance did not. If poorer ToM was the main explanation for poorer friendships, one might expect that lower ToM performance would be directly associated with lower friendship quality or quantity. This straightforward relationship was not seen in this study.

Research by Crompton et al. (2020) provides empirical support for considering social interaction as an interpersonal process. They found that more effective information is transferred in same-neurotype communication chains than in mixed-neurotype chains, suggesting that communication difficulties may partly reflect a mismatch between interaction partners. This is particularly important when considering friendship because friendship is inherently relational, with the quality of a relationship depending on characteristics of the interaction between individuals rather than solely on one person's abilities (Black et al., 2022; Wu & Wang, 2025). Its quality depends not only on one individual's ability to understand another person's mental state, but also on whether both people understand one another, communicate effectively, respond to each other's needs, and feel comfortable in the relationship. An individual may therefore perform well on a structured ToM task while still experiencing difficulties in a friendship if their communication style or expectations are not well matched with those of their interaction partner.

A different but equally important pattern emerged for social camouflaging. Autistic participants reported substantially higher levels of camouflaging than neurotypical participants, consistent with previous research identifying camouflaging as a common feature of autistic adults' social experiences (Hull et al., 2017). This was one of the strongest group differences observed in the present study. In the regression analyses, higher levels of social camouflaging were significantly associated with lower friendship quality, but were not significantly associated with friendship quantity or loneliness. There was also no evidence that these associations differed between autistic and neurotypical participants. The exploratory analysis examining ToM and camouflaging similarly found no significant association between the two. Taken together, these results do not support a straightforward model in which poorer ToM is associated with greater camouflaging, which in turn is associated with poorer social functioning. Instead, they suggest that camouflaging may be influenced by factors other than mentalizing ability and may relate differently to different aspects of social functioning.

This interpretation is consistent with research showing that autistic adults may camouflage for several reasons. Hull et al. (2017) found that camouflaging could be used to fit into social environments, avoid negative responses, and facilitate social relationships. Ridgway et al. (2025) similarly highlighted the use of camouflaging in pursuit of friendships while emphasizing uncertainty about whether these strategies actually result in satisfying or authentic relationships. This provides a useful way of understanding the present findings. Camouflaging may sometimes

provide a social advantage by helping an autistic person navigate social expectations, initiate interactions, or maintain relationships (Hull et al., 2017; Ridgway et al., 2025). On the other hand, continuously monitoring and modifying one's behavior may be tiring and effortful and may not necessarily result in relationships that feel close or authentic (Hull et al., 2017; Hull et al., 2019; Cook et al., 2021). In this sense, camouflaging may have both socially facilitating and socially costly implications.

The follow-up analysis of the distinct role of social camouflaging in friendship quality and quantity in ASD provides an especially interesting perspective on this possibility. Within the autistic group, the estimated association between camouflaging and friendship quality was negative, whereas the estimated association with friendship quantity was positive. Neither individual slope was statistically significant, but the difference between the two slopes was significant. These results therefore do not demonstrate that camouflaging increases the number of friendships or reduces their quality. Rather, they suggest that the relationship between camouflaging and social functioning may differ depending on which aspect of friendship is considered. One possible interpretation is that camouflaging may facilitate social access or the maintenance of social connections without necessarily improving how satisfying or authentic those relationships feel (Hull et al., 2017; Ridgway et al., 2025). However, this interpretation remains speculative, and the present findings should not be taken as evidence that camouflaging is beneficial for friendship quantity or harmful to friendship quality.

One explanation could be that camouflaging may facilitate social access. Adapting one's behavior to expected social norms could make it easier to enter social situations, initiate interactions, and maintain contact with others (Hull et al., 2017; Ridgway et al., 2025). This could potentially be reflected in the positive estimated association between social camouflaging and friendship quantity observed in the present study. However, having more relationships does not necessarily mean that those relationships are experienced as close, satisfying, or authentic. This may help explain why the estimated association with friendship quality went in the opposite direction. Maintaining relationships through extensive behavioral adaptation may require continuous self-monitoring and effort and may be associated with exhaustion or reduced feelings of authenticity (Hull et al., 2017; Hull et al., 2019; Cook et al., 2021). If an individual feels that they need to modify their behavior in order to be accepted, the resulting relationships may not necessarily feel comfortable or authentic.

This interpretation is broadly consistent with Ridgway et al. (2025), who found that autistic individuals may use camouflaging to pursue friendships while also highlighting uncertainty about whether these strategies lead to satisfactory relationships. It also fits with Hull et al. (2017), who described social connection as one motivation for camouflaging. Importantly, however, the present study does not show that camouflaging is always harmful. The individual associations were not significant. The significant difference between the slopes only indicates that the pattern of association differed between friendship quality and quantity. The most appropriate interpretation is therefore that camouflaging may have different implications for different aspects of social functioning, rather than that it necessarily improves one outcome and worsens the other. This distinction is particularly important because studies that consider only the number of friendships may reach a different conclusion about someone's social functioning than studies that focus on how satisfying or meaningful those relationships are. The present findings therefore support the importance of treating social functioning as a multidimensional aspect.

The mediation analysis adds another perspective to the relationship between social camouflaging and friendship quality. Social camouflaging was significantly associated with lower friendship quality in the regression analysis, and the mediation analysis further suggested that it statistically accounted for part of the association between group and friendship quality. Autistic participants reported higher levels of camouflaging, and greater camouflaging was associated with lower friendship quality after controlling for group. The direct effect of group remained significant, resulting in a pattern consistent with partial mediation. This finding is broadly compatible with research suggesting that camouflaging may facilitate social connection while simultaneously being associated with interpersonal and psychological costs, including exhaustion and reduced authenticity (Hull et al., 2017; Hull et al., 2019; Cook et al., 2021; Ridgway et al., 2025).

However, the direction of this relationship cannot be determined from the present study. Camouflaging may be associated with poorer friendship quality if the effort involved in adapting one's behavior makes relationships feel less natural or satisfying, consistent with qualitative research describing the effort, exhaustion, and difficulties associated with sustained camouflaging (Hull et al., 2017; Hull et al., 2019). At the same time, individuals who experience difficulties in their friendships may be more likely to camouflage because they feel a greater need to adapt their behavior in order to maintain social relationships. Previous research has identified motivations for camouflaging that include fitting in, avoiding negative social experiences, and improving social

connections (Hull et al., 2017; Hull et al., 2019). Other factors, such as social anxiety, stigma, previous experiences of rejection, or perceived pressure to conform, could also influence both camouflaging and friendship quality (Cook et al., 2021; Summerill & Summers, 2025). Therefore, although the significant indirect effect suggests that social camouflaging may partly account for the association between group and friendship quality, it should not be interpreted as evidence that camouflaging causes poorer friendship quality.

The association between ToM and social camouflaging is theoretically unclear. On the one hand, effective camouflaging may require an understanding of social expectations and other people's mental states, suggesting that stronger ToM could be associated with greater use of camouflaging (Livingston et al., 2019; Corbett et al., 2021). On the other hand, camouflaging may reflect learned or compensatory strategies that do not necessarily depend directly on ToM ability (Hull et al., 2017; Livingston et al., 2019; Corbett et al., 2021). In the present study, no significant association was found between ToM and social camouflaging, either overall or between groups. This finding is consistent with the results of Hull et al. (2021), who likewise found no significant association between ToM and self-reported camouflaging in autistic adolescents. Thus, the present findings, together with previous evidence, suggest that ToM performance may not be systematically related to the extent to which autistic individuals engage in camouflaging.

This is important because it challenges the idea that camouflaging is simply a compensatory response to difficulties in understanding other people's mental states. Camouflaging can involve learning social rules, monitoring one's own behavior, anticipating social expectations, and adapting one's presentation based on previous experiences (Hull et al., 2017; Livingston & Happé, 2017). These processes may occur relatively independently of performance on a structured ToM task. The present findings therefore suggest that ToM and camouflaging are better understood as distinct aspects of social experience. This interpretation is also consistent with the broader pattern of the study that ToM was not significantly associated with social functioning, and it was also not associated with camouflaging.

Overall, the findings support a multidimensional view of social functioning in autism (Bishop-Fitzpatrick et al., 2018; Bottema-Beutel et al., 2019; Li et al., 2026). ToM, camouflaging, friendship quality, friendship quantity, and loneliness capture different aspects of social experience, and none of these constructs appears to provide a complete explanation of social functioning on its own. Social functioning may reflect the interplay between individual abilities,

learned strategies, interpersonal compatibility, social expectations, and the wider environment (Bottema-Beutel et al., 2019; Li et al., 2026). This broader perspective may be particularly important when interpreting social functioning in autistic adults. Rather than assuming that poorer social outcomes necessarily reflect poorer individual social-cognitive ability, the present findings suggest that it is also important to consider how people interact with one another, the strategies they use to navigate those interactions, and whether their social environments allow them to experience genuine understanding and connection.

Limitations and future directions

Several limitations should be considered when interpreting the findings of the present study. First, the relatively small sample size, particularly within the autistic group, may have limited the statistical power to detect small-to-moderate associations and interaction effects. This is especially relevant for the analyses examining whether the relationships between Theory of Mind (ToM), social camouflaging, and social functioning differed between autistic and neurotypical participants. The same consideration applies to the nonsignificant associations observed throughout the study, which should not necessarily be interpreted as evidence that these relationships do not exist. A larger sample would provide greater statistical power and more precise estimates of effect sizes and would also allow potential moderating factors to be examined more reliably.

Second, the generalizability of the findings is limited by the characteristics of the sample. The present study focused on relatively high-functioning autistic adults who were able to complete the cognitive and self-report measures used in the study. As a result, the sample does not necessarily represent the full heterogeneity of the autism spectrum. The findings may therefore not generalize to autistic individuals with higher support needs, co-occurring intellectual disability, substantially different language abilities, or to younger or older age groups. Future research should include larger and more diverse samples that represent different levels of support needs and different stages of development.

Third, the way Theory of Mind was measured is an important limitation. The Triangles Task provides a structured measure of mentalizing performance under controlled laboratory conditions. This allows ToM to be assessed systematically, but it may not fully reflect how people use social-cognitive processes in everyday interactions. This distinction is particularly relevant to the present findings, as autistic and neurotypical participants did not differ significantly in ToM

despite showing clear differences in friendship quality and quantity. Future research could therefore combine standardized ToM measures with more ecologically valid approaches, such as naturalistic social interactions, spontaneous mentalizing paradigms, or measures of social cognition within dynamic interpersonal contexts.

Fourth, the study relied substantially on self-report measures. Friendship quality, friendship quantity, loneliness, and social camouflaging were all assessed through participants' own reports and may therefore be influenced by differences in how individuals interpret questions, remember their experiences, understand their own behavior, or respond to questionnaires. This is particularly relevant to the friendship measures, as what constitutes a friendship may differ considerably between individuals. Loneliness is inherently subjective and is therefore appropriately assessed through self-report, but the responses may still be influenced by their expectations about their relationships or what they consider sufficient social connection. Similarly, camouflaging can be difficult to assess objectively because it involves internal strategies and behavioral adaptations that may not always be visible to other people. Future studies could therefore combine self-report measures with behavioral observations, informant reports, and other objective measures where possible.

Fifth, the friendship measures used in the present study may not fully capture the diversity of friendship experiences among autistic adults. Many conventional measures of friendship and social functioning have been developed around predominantly neurotypical understandings of social relationships. They may therefore place greater emphasis on factors such as the frequency of face-to-face contact, conventional forms of reciprocity, or the amount of social interaction, which may not always reflect how autistic individuals experience meaningful relationships. For this reason, having a relatively small number of friendships should not automatically be interpreted as evidence of poor social functioning or a lack of meaningful social connection. Future research should develop and validate autism-informed measures of friendship and social connectedness that capture a wider range of relationship experiences, including online relationships, autistic–autistic friendships, shared-interest communities, and relationships that involve less frequent but meaningful interaction.

Finally, the present study focused primarily on ToM and social camouflaging as potential factors related to social functioning, but social functioning is likely to be shaped by a much broader range of individual and contextual factors. Previous research has identified factors such as social

anxiety, depression, stigma, social acceptance, sensory experiences, social support, and autistic identity as potentially relevant to social experiences and loneliness among autistic adults. Future research should therefore move beyond models that focus primarily on individual cognitive characteristics and adopt broader, multidimensional models of social functioning. Such models could consider ToM and camouflaging alongside factors such as social anxiety, stigma, sensory experiences, autistic identity, social support, social acceptance, and characteristics of interaction partners. This broader approach may provide a better understanding of why autistic adults can differ substantially in their friendship experiences and social connectedness, even when they show similar performance on structured measures of social cognition.

Conclusion

This study provides preliminary evidence of differences in social functioning among autistic adults, particularly in their friendships. Autistic participants reported fewer friendships and lower friendship quality than neurotypical adults, while also reporting substantially higher levels of social camouflaging. However, these differences were not accompanied by differences in loneliness. Together, these findings suggest that social functioning in autistic adults cannot be understood solely in terms of the number of social relationships they have, but also involves how those relationships are experienced.

The findings also point to a potentially important and complex role of social camouflaging in friendship. Higher levels of camouflaging were significantly associated with lower friendship quality, but were not significantly associated with friendship quantity or loneliness. The mediation model further suggested that social camouflaging statistically accounted for part of the group difference in friendship quality. Within the autistic group, the estimated association between camouflaging and friendship quality was negative, whereas its estimated association with friendship quantity was positive. Although neither individual association was statistically significant, their difference was significant, suggesting that camouflaging may relate differently to the quality and quantity of friendships. The absence of a significant relationship between ToM and camouflaging further suggests that camouflaging may not simply reflect differences in mentalizing ability.

Overall, these findings highlight the importance of viewing social functioning in autism as more complex than a direct reflection of individual social-cognitive ability. In particular, they point to social camouflaging as a potentially important factor in how autistic adults experience their

friendships. Camouflaging may allow individuals to navigate social situations and maintain social connections, while potentially being associated with less satisfying or meaningful friendship experiences. However, the present findings cannot establish whether camouflaging contributes to poorer friendship quality, whether difficulties in friendships increase the use of camouflaging, or whether both are influenced by other factors. Future research using larger and more diverse samples, together with more ecologically valid measures of social cognition and everyday social interaction, will be important for clarifying how ToM, social camouflaging, interpersonal relationships, and social context come together to shape friendship and social connectedness in autistic adults.

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Appendix A: Duke Social Support Index (DSSI)

Q3.5 Seleziona una risposta:

	Quasi Mai (1)	A volte (2)	La maggior parte del tempo (3)
D6. Ti sembra che la tua famiglia e i tuoi amici (persone importanti per te) ti capiscano? (1)	☐	☐	☐
D7. Ti senti utile per la tua famiglia e i tuoi amici (persone importanti per te)? (2)	☐	☐	☐
D8. Sei al corrente delle cose che succedono alla tua famiglia e ai tuoi amici? (3)	☐	☐	☐
D9. Quando parli con la tua famiglia e i tuoi amici, senti di essere ascoltato? (4)	☐	☐	☐
D10. Senti di avere un ruolo (un posto) definito nella tua famiglia e tra i tuoi amici? (5)	☐	☐	☐
D11. Puoi parlare dei tuoi problemi più intimi con almeno alcuni dei tuoi familiari e amici? (6)	☐	☐	☐

D12. Quanto sei soddisfatto/a del tipo di relazioni che hai con la tua famiglia e i tuoi amici?

- ☐ Molto insoddisfatto/a (1)
- ☐ Abbastanza insoddisfatto/a (2)
- ☐ Soddisfatto/a (3)

Appendix B: Loneliness Scale UCLA- Version 3

Istruzioni	Mai	Raramente	A volte	Spesso
*1. Quanto spesso ti senti “in sintonia” con le persone intorno a te?	1	2	3	4
2. Quanto spesso senti che ti manca la compagnia?	1	2	3	4
3. Quanto spesso senti che non c'è nessuno a cui puoi rivolgerti?	1	2	3	4
4. Quanto spesso ti senti solo/a?	1	2	3	4
*5. Quanto spesso ti senti parte di un gruppo di amici?	1	2	3	4
*6. Quanto spesso senti di avere molto in comune con le persone intorno a te?	1	2	3	4
7. Quanto spesso senti di non essere più vicino/a a nessuno?	1	2	3	4
8. Quanto spesso senti che i tuoi interessi e le tue idee non sono condivisi da chi ti sta intorno?	1	2	3	4
*9. Quanto spesso ti senti estroverso/a e amichevole?	1	2	3	4
*10. Quanto spesso ti senti vicino/a alle persone?	1	2	3	4
11. Quanto spesso ti senti escluso/a?	1	2	3	4
12. Quanto spesso senti che le tue relazioni con gli altri non sono significative?	1	2	3	4
13. Quanto spesso senti che nessuno ti conosce davvero bene?	1	2	3	4
14. Quanto spesso ti senti isolato/a dagli altri?	1	2	3	4
*15. Quanto spesso senti di poter trovare compagnia quando lo desideri?	1	2	3	4
*16. Quanto spesso senti che ci sono persone che ti capiscono davvero?	1	2	3	4
17. Quanto spesso ti senti timido/a?	1	2	3	4
18. Quanto spesso senti che le persone ti sono intorno ma non sono con te?	1	2	3	4
*19. Quanto spesso senti che ci sono persone con cui puoi parlare?	1	2	3	4
*20. Quanto spesso senti che ci sono persone a cui puoi rivolgerti?	1	2	3	4

Note. The items with an asterisk are reverse scored.

Appendix C: Camouflaging Autistic Traits Questionnaire (CAT-Q)

Please read each statement below and choose the answer that best fits your experiences during social interactions.

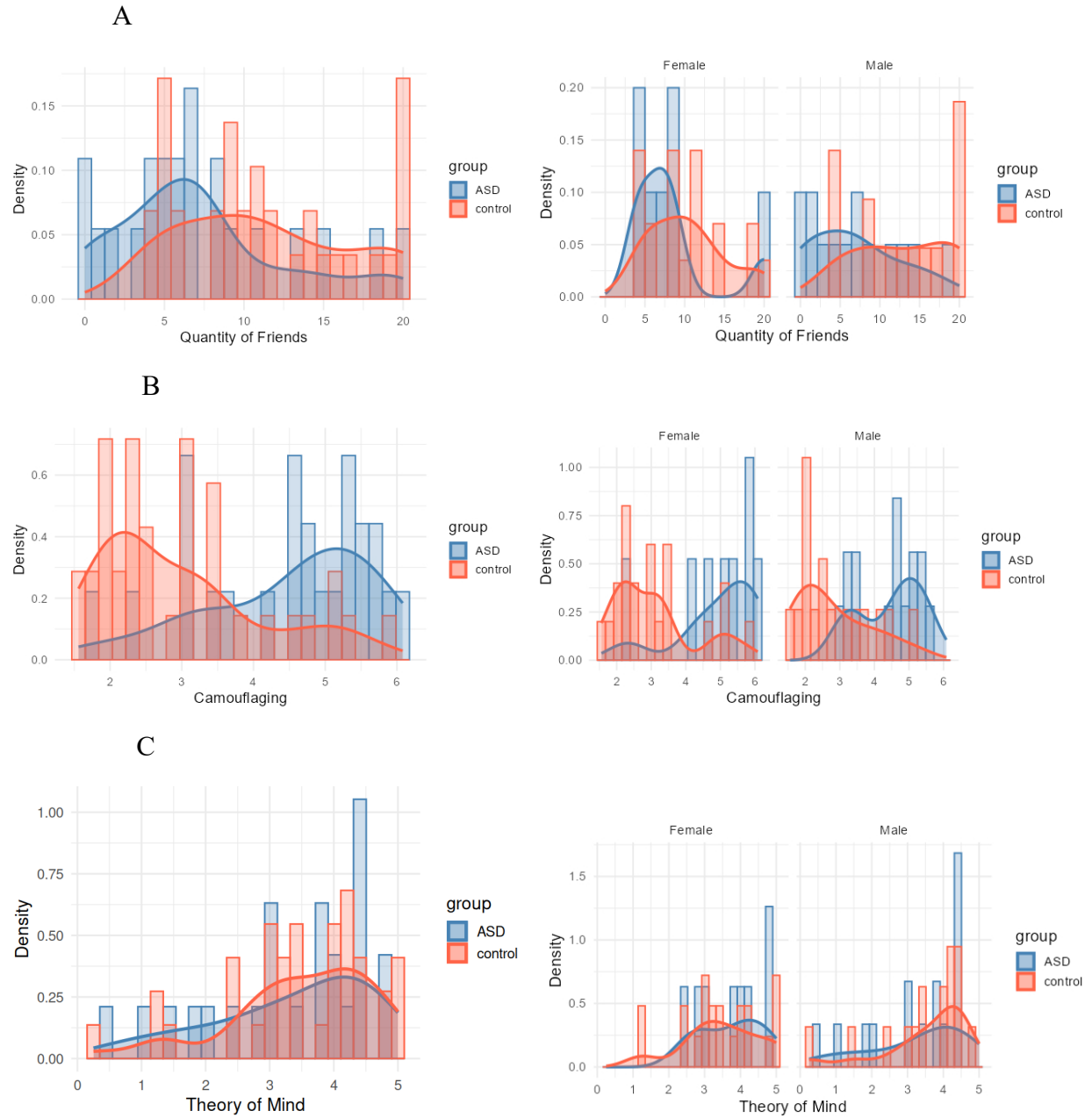
Strongly Disagree		Somewhat Disagree		Neither Agree nor Disagree	Somewhat Agree		Strongly Agree
(1)	(2)	(3)	(4)	(5)	(6)	(7)	

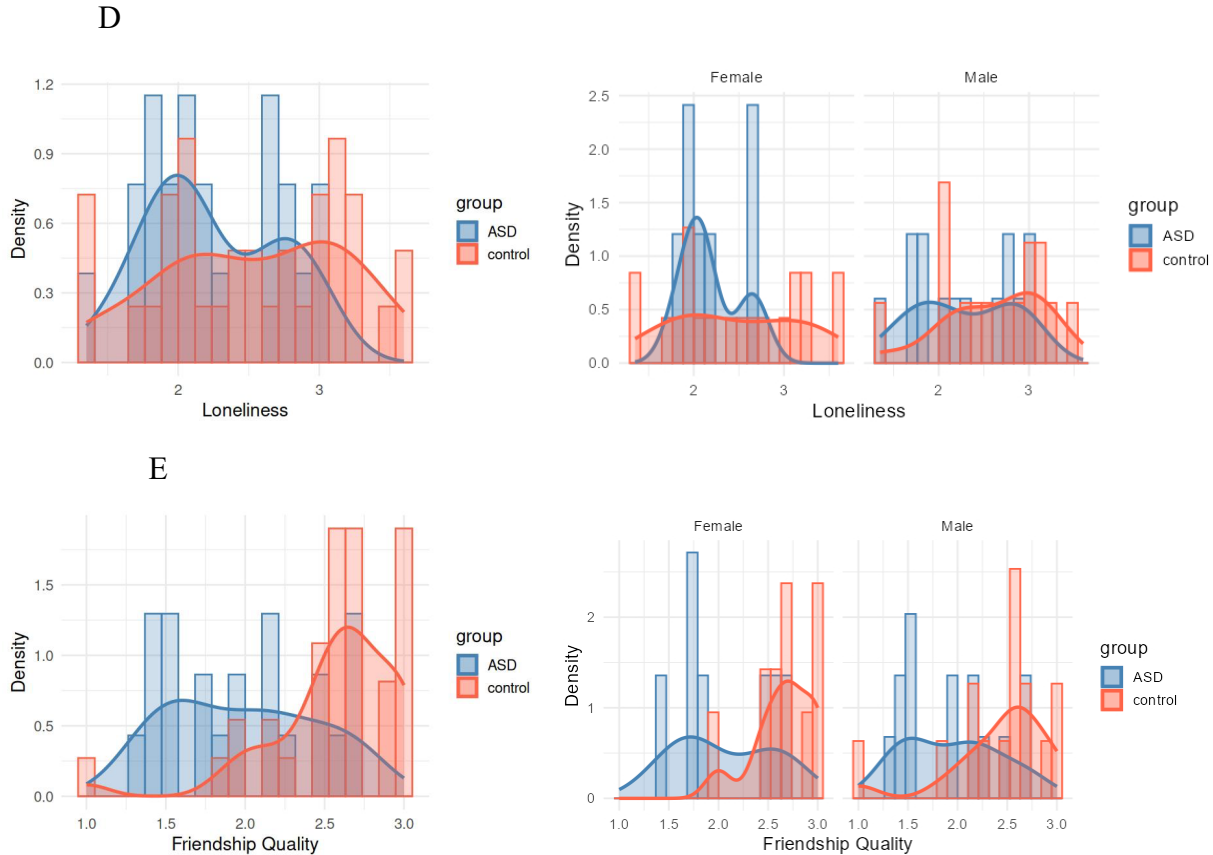
1. When I am interacting with someone, I deliberately copy their body language or facial expressions
2. I monitor my body language or facial expressions so that I appear relaxed
3. I rarely feel the need to put on an act in order to get through a social situation*
4. I have developed a script to follow in social situations (for example, a list of questions or topics of conversation)
5. I will repeat phrases that I have heard others say in the exact same way that I first heard them
6. I adjust my body language or facial expressions so that I appear interested by the person I am interacting with
7. In social situations, I feel like I'm 'performing' rather than being myself
8. In my own social interactions, I use behaviors that I have learned from watching other people interacting
9. I always think about the impression I make on other people
10. I need the support of other people in order to socialize
11. I practice my facial expressions and body language to make sure they look natural
12. I don't feel the need to make eye contact with other people if I don't want to*
13. I have to force myself to interact with people when I am in social situations
14. I have tried to improve my understanding of social skills by watching other people
15. I monitor my body language or facial expressions so that I appear interested by the person I am interacting with
16. When in social situations, I try to find ways to avoid interacting with others
17. I have researched the rules of social interactions (for example, by studying psychology or reading books on human behavior) to improve my own social skills
18. I am always aware of the impression I make on other people

19. I feel free to be myself when I am with other people*
20. I learn how people use their bodies and faces to interact by watching television or films, or by reading fiction
21. I adjust my body language or facial expressions so that I appear relaxed
22. When talking to other people, I feel like the conversation flows naturally*
23. I have spent time learning social skills from television shows and films, and try to use these in my interactions
24. In social interactions, I do not pay attention to what my face or body are doing*
25. In social situations, I feel like I am pretending to be 'normal'

Note. The items with an asterisk are reverse scored.

Appendix D: Distribution of the variables by group and gender

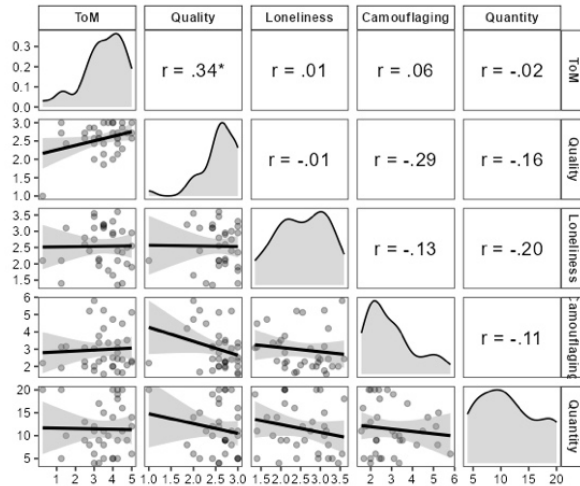




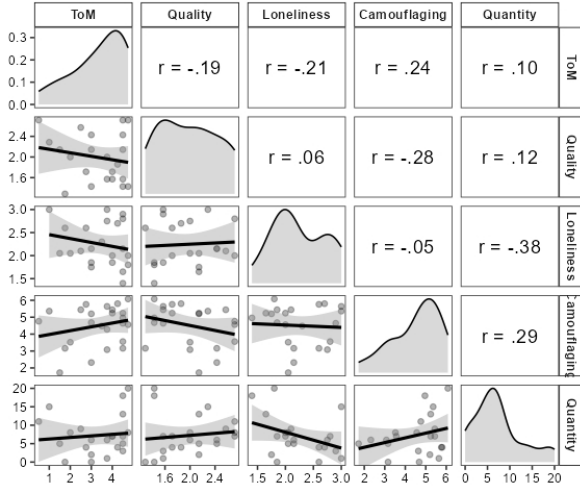
Note. Histograms show the distribution of the variables (Panel A for friendship quantity, Panel B for social camouflaging, Panel C for Theory of Mind, Panel D for loneliness and Panel E for friendship quality) in ASD and control participants, both overall and separately for females and males. Bars show the observed distributions, with density curves overlaid to illustrate the overall shape of the data. These plots are included to provide a visual check of the distributions of the variables used in the regression analyses.

Appendix E: Correlation matrix

Controls

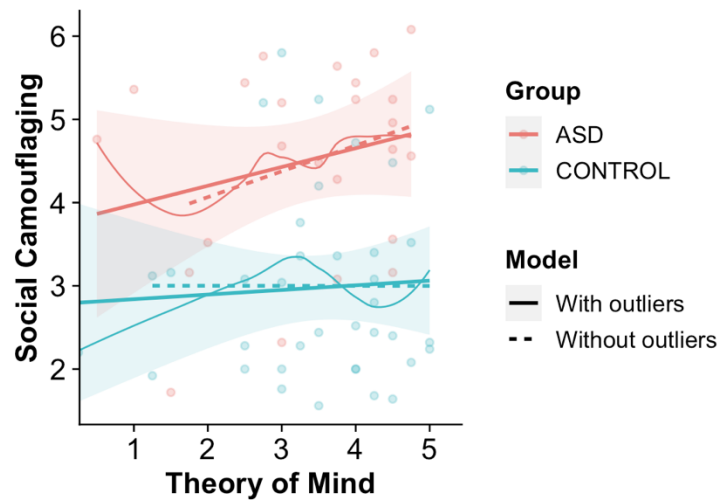


ASD



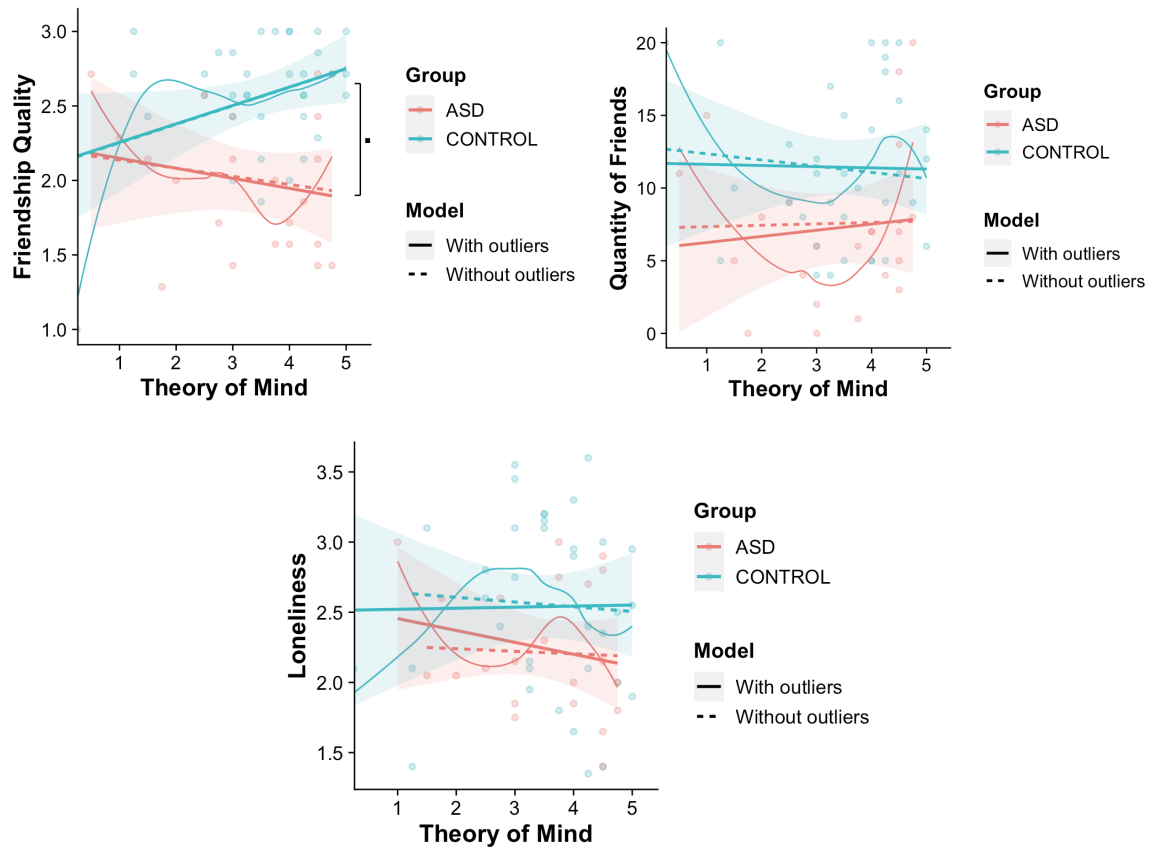
Note. The correlation matrixes show the Pearson correlations between Theory of Mind (ToM), friendship quality, loneliness, social camouflaging, and friendship quantity in both ASD and control participants. Diagonal panels show the distribution of each variable, lower panels show the corresponding scatterplots with fitted regression lines, and upper panels report the Pearson correlation coefficients (r). The matrix provides a descriptive overview of the associations among the study variables.

Appendix F: Preliminary Analysis of the Association Between Theory of Mind and Social Camouflaging



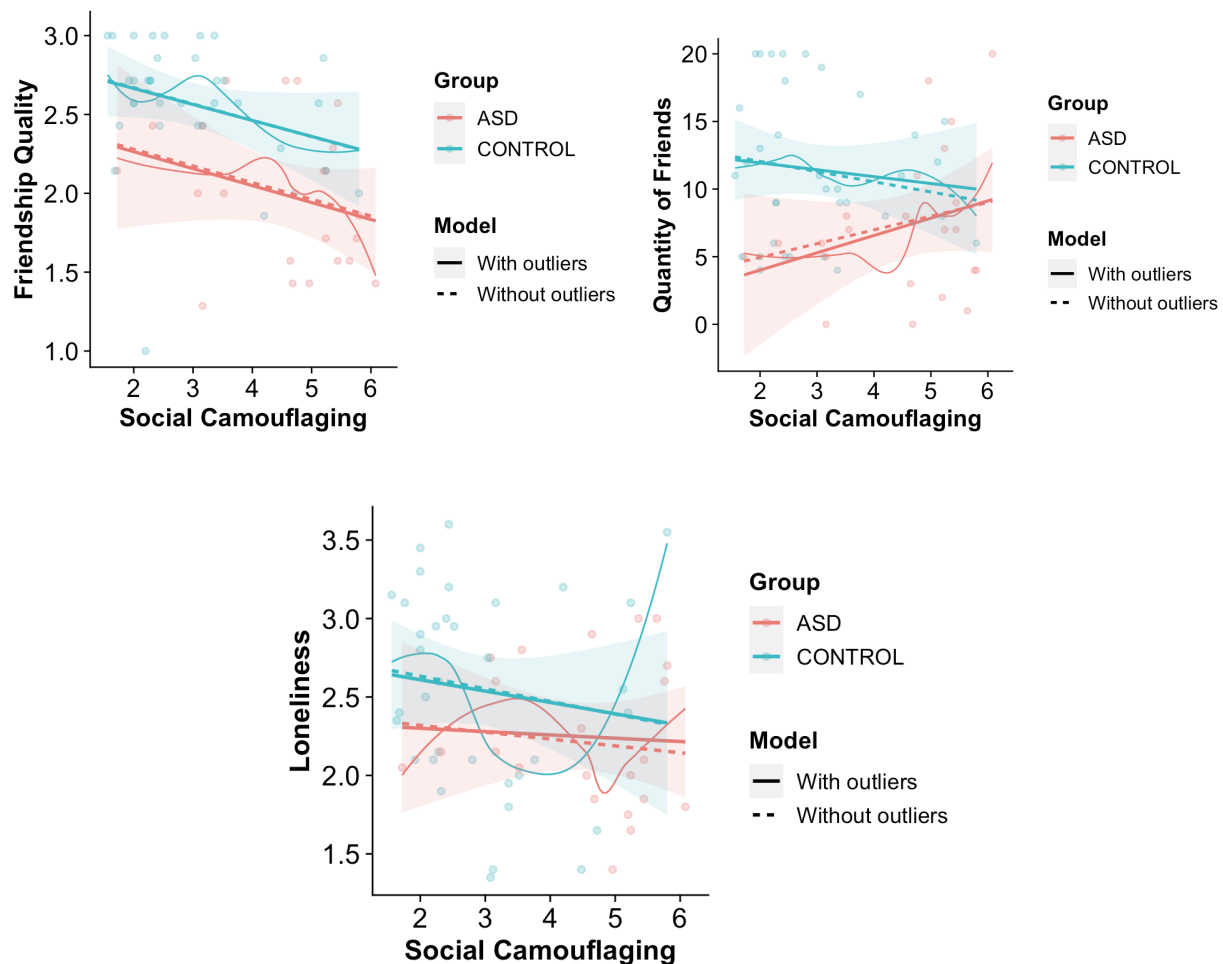
Note. The figure illustrates the association between Theory of Mind and social camouflaging across ASD and control participants. The solid and dashed regression lines allow comparison of the estimated association before and after removal of influential observations, respectively. Shaded areas represent 95% confidence intervals. LOESS curves are shown as a descriptive, non-parametric representation of the observed data pattern. The regression results did not indicate a significant association between Theory of Mind and social camouflaging even after removing influential observations.

Appendix G: Sensitivity Analyses of Theory of Mind and Social Functioning



Note. Regression models are shown separately by group. Solid lines represent models including all observations, whereas dashed lines represent models after removal of influential observations. Shaded bands indicate 95% confidence intervals, and points represent individual participants. LOESS curves are included here to illustrate the patterns observed in the data. The sensitivity analyses showed that the overall results remained unchanged after removal of influential observations, with no significant associations between Theory of Mind and the three indicators of social functioning.

Appendix H: Sensitivity Analyses of Social Camouflaging and Social Functioning



Note. Regression models are shown separately for the ASD and control groups. Solid lines represent the models including all observations, while dashed lines show the models after potentially influential observations were removed. Shaded areas represent the 95% confidence intervals, and points show individual participants. LOESS curves are included to illustrate the patterns observed in the data. The results remained consistent after the removal of potentially influential observations, with no significant associations between social camouflaging and friendship quality, friendship quantity, or loneliness.

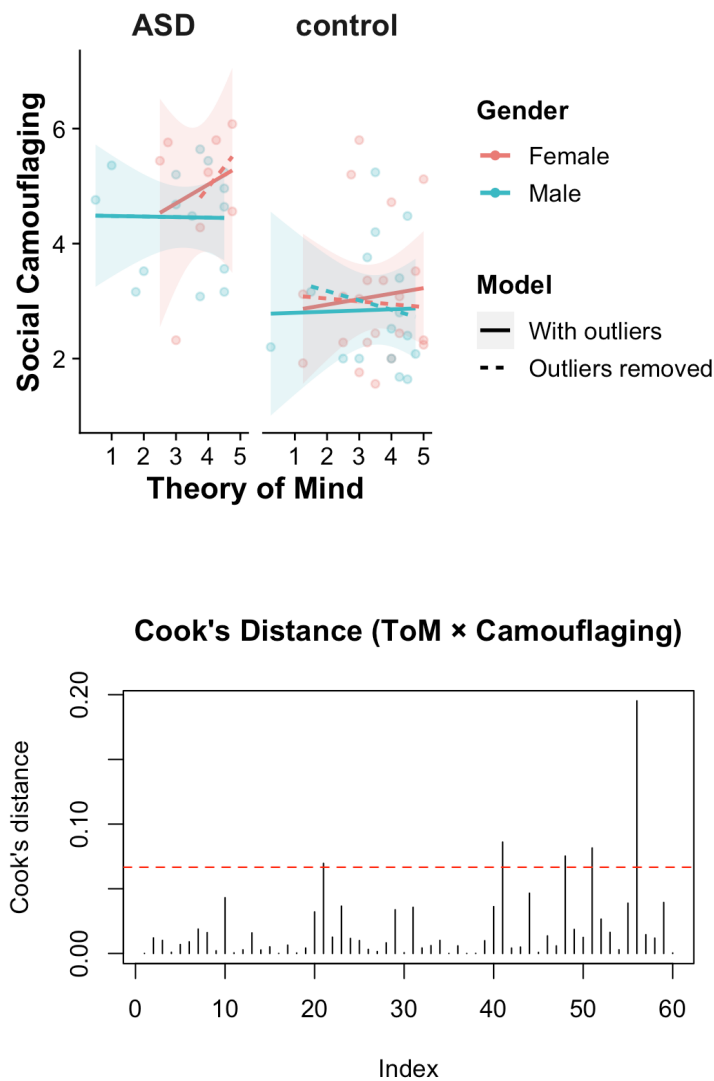
Appendix I: Internal Consistency Estimates for Study Measures Across Groups

Variable	Questionnaire	Alpha/Omega	Alpha/Omega	Alpha/Omega
		All participants	Autism Group	Control Group
Theory of Mind (ToM)	Triangles Task	N/A	N/A	N/A
Social Camouflaging	CAT-Q	$\alpha = .93$	$\alpha = .89$	$\alpha = .92$
	Camouflaging Autistic Traits Questionnaire	$\omega_t = .93$	$\omega_t = .90$	$\omega_t = .93$
Loneliness	UCLA Loneliness Scale (Version 3)	$\alpha = .92$ $\omega_t = .95$	$\alpha = .92$ $\omega_t = .95$	$\alpha = .91$ $\omega_t = .95$
Quality of friendships	Duke Social Support Index DSSI	$\alpha = .84$ $\omega_t = .89$	$\alpha = .80$ $\omega_t = .88$	$\alpha = .77$ $\omega_t = .87$

Friendship quantity	Self-reported- colleagues, roommates, the number of contacts on their phone	N/A	N/A	N/A
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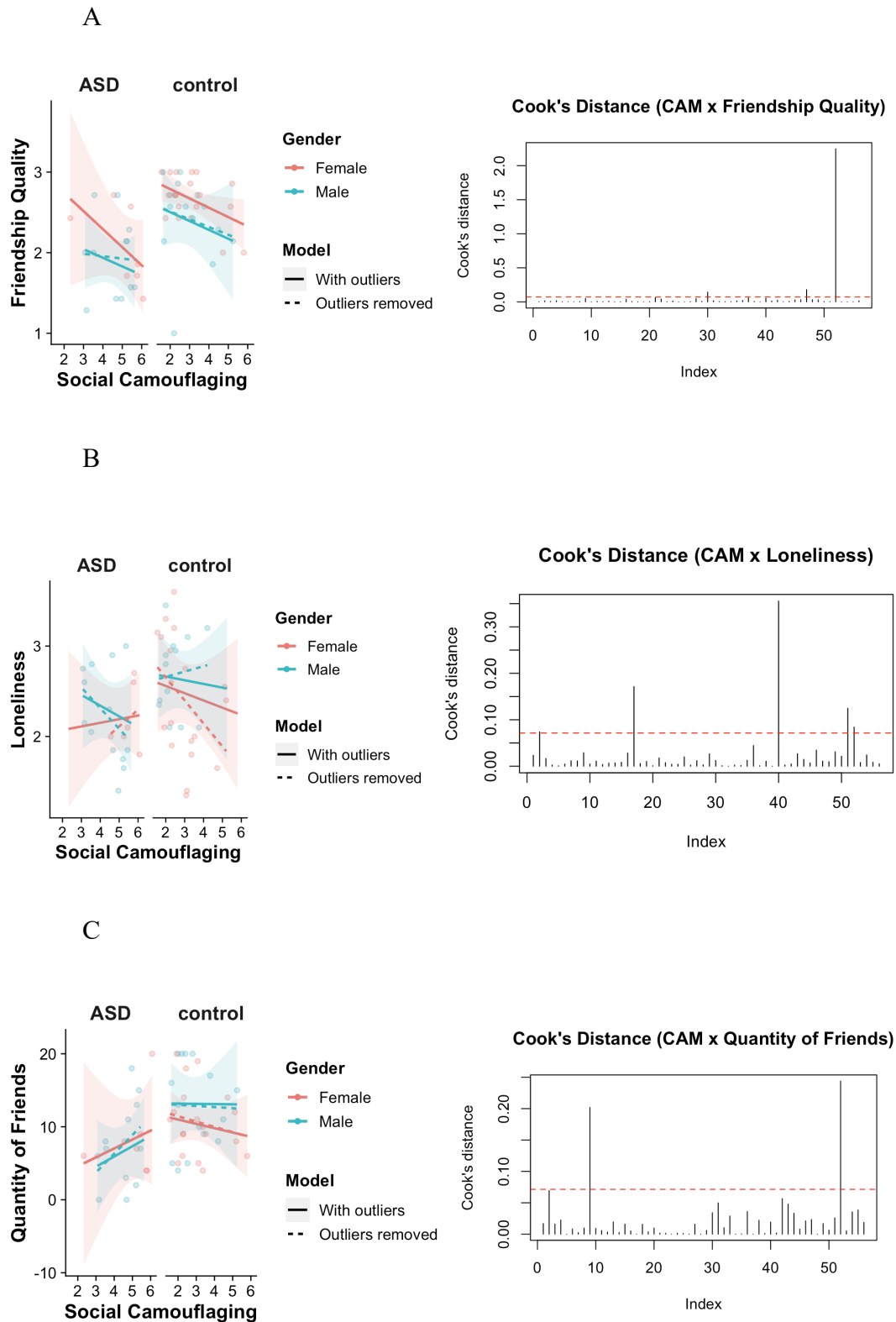
Note. α = Cronbach's alpha; ω = McDonald's omega.

Appendix J: Sensitivity Analyses of ToM and Social Camouflaging by Gender



Note. Associations between Theory of Mind and social camouflaging across ASD and control groups, shown separately by gender. Pink points represent female participants, and teal points represent male participants. Solid lines represent regression models including all observations, whereas dashed lines represent models after removal of influential observations. Shaded bands indicate 95% confidence intervals around the fitted regression lines. Cook's distance plots show the influence of individual observations on the corresponding regression models, with the dashed red line indicating the conventional influence threshold ($4/n$).

Appendix K: Sensitivity Analysis of Social Camouflaging and Social Functioning by Gender



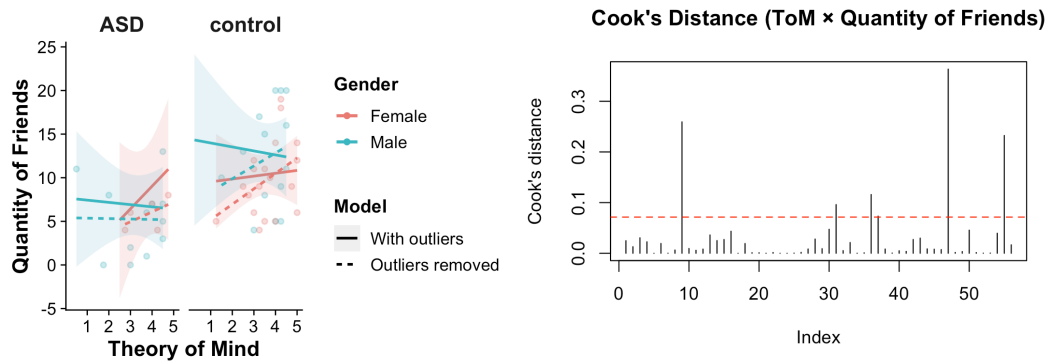
Note. Sensitivity analyses examining associations between social camouflaging and social functioning (Panel A cam x friendship quality, Panel B cam x loneliness, Panel C cam x quantity) across ASD and control groups. Regression plots show associations separately by gender, with pink points and lines representing female participants and teal points and lines representing male participants. Solid lines represent models including all observations, whereas dashed lines represent models after removal of influential observations; shaded bands indicate 95% confidence intervals. Corresponding Cook's distance plots show the influence of individual observations on each regression model, with the dashed red line indicating the conventional influence threshold ($4/n$). None of the examined associations reached statistical significance. The sensitivity analyses were conducted to assess the robustness of the regression findings to potentially influential observations.

Appendix L: Sensitivity Analysis of ToM and Social Functioning by Gender

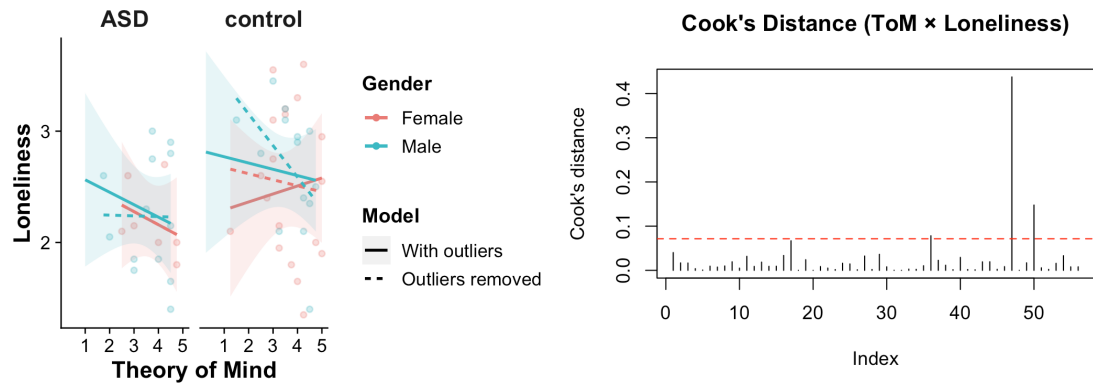
A



B



C



Note. Sensitivity analyses examining associations between Theory of Mind and social functioning (Panel A ToM x friendship quality, Panel B ToM x quantity, Panel B ToM x loneliness) across ASD and control groups. Regression plots show associations separately by gender, with pink points and lines representing female participants and teal points and lines representing male participants. Solid lines represent models including all observations, whereas dashed lines represent models after removal of influential observations; shaded bands indicate 95% confidence intervals. Corresponding Cook's distance plots show the influence of individual observations on each regression model, with the dashed red line indicating the conventional influence threshold ($4/n$). None of the examined associations reached statistical significance.