'Autistic or not, doesn't really matter. It matters more if they're kind': An exploration of the influence of friendship within cross-neurotype dyads.

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Abstract

Research attempting to understand the social interactions of autistic people has highlighted that part of the difference in social interactions for autistic people stems from dyadic factors such as the neurotype composition of the dyad (Crompton, Sharp, et al., 2020; Crompton, Ropar, Evans-Williams, Flynn, & Fletcher-Watson, 2020). However, research has exclusively examined interactions between stranger dyads. Therefore, the current thesis used a multi-methods approach to explore social interactions for autistic people within friendship dyads. The first study (Chapter 2a) used interviews with autistic teenagers to understand their social interactions, friendships, and neurotype-specific behaviours. The second study (Chapter 2b) expanded these interviews to include a broader range of autistic perspectives. Both studies led to the development of themes centred around the social interaction and friendship experiences of these autistic people, such as autistic people feeling the emphasis is often placed on them in social interactions. Study 3 (Chapter 3) then examined differences between autistic-neurotypical friendship dyads and autistic-neurotypical stranger dyads for adults in an online setting, expanding previous research findings in this area (Rifai, Fletcher-Watson, Jiménez-Sánchez, & Crompton, 2022). Results indicated an interaction effect of both the neurotype composition of the dyad (autistic-neurotypical or neurotypical-neurotypical) and the friendship status of the dyad (friend/stranger) on overall interaction quality. However, no significant differences were found on overall behavioural measures. Finally, Study 4 (Chapter 4) examined differences between autistic-neurotypical friendship dyads and autistic-neurotypical stranger dyads for autistic adolescents within a school setting. Findings were somewhat mixed, with no overall differences in interaction quality, and only a significant main effect of neurotype composition (neurotypical-autistic/neurotypical-neurotypical) on the proportion of mutual gaze within dyads. Taken together, the findings highlight the importance of studying friendships for autistic people and the potential use of friendships as a context for understanding how cross-neurotype interactions can be successful.

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1 Introduction and Literature Review

1.1. Introduction to autism

Autism has traditionally been characterised as a neurodevelopmental condition identified in the DSM-V (American Psychiatric Association, 2013) by difficulties in social communication/interaction, unusual reactivity to sensory input or unusual interest in sensory aspects of environment, and restricted or repetitive behaviours (Volkmar & Reichow, 2013; Wing, Gould, & Gillberg, 2011). However, this is by no means an exhaustive description. Autism is characterised by individual variation in a wide range of domains, such as sensory processing (MacLennan, O'Brien, & Tavassoli, 2022; Minshew & Hobson, 2008; Talay-Ongan & Wood, 2000), social performance (Fisher, Moskowitz, & Hodapp, 2013; Usher, Burrows, Schwartz, & Henderson, 2015), executive functioning (Van Den Bergh, Scheeren, Begeer, Koot, & Geurts, 2014; Freeman, Locke, Rotheram-Fuller, & Mandell, 2017; Kenworthy et al., 2005), language skills (Brignell et al., 2018; Lind & Bowler, 2009), and emotional regulation (Bird & Cook, 2013; Kinnaird, Stewart, & Tchanturia, 2019; Mazefsky et al., 2013). This potential variation is then further increased by high co-occurences with other conditions, for example around 40-60% of autistic people have co-occuring social anxiety disorder (Baird et al., 2006; Simonoff et al., 2008). Therefore, there is a need to understand idiosyncratic differences between autistic people and the heterogenous nature of the experiences of autistic people.

The growing need to understand the varied experiences of autistic people has led to a conceptual shift in how autism is conceptualised compared to the last 20 years. These changes will be drawn upon throughout the thesis and therefore it is essential to first outline how the conceptualisation of autism itself has changed in the last few decades.

Conceptualising Autism

The traditional characterisation of autism stemmed predominantly from the medical model, or attempting to understand autism as a medical condition. This framework adopts three main stages. First, to describe the overall differences between autistic and non-autistic populations (the 'diagnosis'). Second, to understand the mechanisms of autistic characteristics within the individual (the 'etiology'). Third, once this understanding is achieved, to then intervene with these causes directly in the individual (the 'treatment').

This medical approach has been successful in describing differences between autistic and non-autistic populations on average and providing the criteria for diagnosis such that necessary support can be targeted. The biggest challenge in this area has been encapsulating variation across autistic people. Prior to the DSM-V (Rosen, Lord, & Volkmar, 2021; Wing et al., 2011) in an attempt to fractionate this variation, autism was considered as a categorical diagnosis, with sub-categories such as Aspergers, or Pervasive Developmental Disorder-Not Otherwise Specified (Rosen et al., 2021; Volkmar & Reichow, 2013). This also led to the development of different labels for autistic people based upon the degree of support practitioners felt the autistic person would need for daily functioning. For example, Aspergers was often assumed to represent a 'high functioning'[1] subgroup of autistic people due to reduced language delays relative to other autistic subgroups (Rosen et al., 2021). The assumption was then that generally less daily support would be required for this subgroup relative to 'low functioning' subgroups. However, this categorical approach was found to be unhelpful (Rosen et al., 2021) due to overlap between diagnostic subcategories (Aldinger, Lane, Veenstra-VanderWeele, & Levitt, 2015; Fernell et al., 2010; Szatmari, Bryson, Boyle, Streiner, & Duku, 2003) and poor predictive power of subcategories on later outcomes for autistic people (Szatmari et al., 2009, 2003). Similarly, functioning labels can risk appearing to minimise the support needs of those in purportedly 'high functioning' groups and the proxies used such as IQ or language have poor predictive ability for day-to-day skills (Alvares et al., 2020).

Note that there are still some arguments regarding whether autism is truly a unitary condition (Happé & Ronald, 2008), particularly based on evidence of multiple genetic pathways to different autistic traits, however there is currently not sufficient evidence that different characteristics of autism are both independent or are causally distinct (Williams & Bowler, 2014). Therefore, the prevailing medical approach has highlighted that, whilst there is substantial variation between autistic individuals, these differences are dimensional rather than categorical distinctions (Rosen et al., 2021).

[1] Note that this phrasing is used in this section to highlight how it is generally used within the medical model but will be avoided within the remainder of the thesis in favour of more specific language – see Language Statement.

However, the medical model has struggled with identifying a clear etiology, or mechanism, of autism. The overall approach was that autistic differences could be understood, used to better understand a cognitive domain more broadly, and then autistic people could be supported with interventions or support aimed at compensating for differences in these domains either directly or through other domains of relative strength. This approach has led to a wealth of cognitive research and theories attempting to understand the mechanisms underlying differences in some domains between autistic and non-autistic people (see later Introduction). However, despite a range of attempts (Baron-Cohen, 1990; Mcdowell, 2010; McGuire & Michalko, 2011; Palmer, Lawson, & Hohwy, 2017; Picci & Scherf, 2015), no existing single theory of autism can satisfactorily explain all the variation seen. This has led to increasing emphasis on a need to embrace this variation and potential causal complexity in the pathways that can lead to an outcome of being autistic (Karmiloff-Smith, 2009; Waterhouse, 2013).

There have been attempts at the third stage within the medical model: providing treatments or support. For example, there have attempts at increasing eye contact in autistic people via pharmacological or behavioural methods (Auyeung et al., 2015; Cook et al., 2017; Fonger & Malott, 2019; Hadjikhani et al., 2018; Rapp et al., 2019). However, there have been three main barriers to these treatments. First, research on these treatments has showed mixed efficacy. The interpretation of this is then further complicated by the complexity in autism etiology; in cases where these interventions may have been effective, it is unclear why this was the case. The actual mechanism for change may be distinct from the theorised pathway (e.g, having regular contact with someone who was initially a stranger could have reduced anxiety and hence increased eye contact irrespective of any training). Second, outcome measures in existing treatment studies are poor. For example, demonstrating an increase in eye contact in an eye contact intervention study is not sufficient for the intervention to then be demonstrably helpful in supporting autistic people. This would necessitate relating the specific intervention to an overarching outcome measure that is relevant for autistic people (Dawson, Franz, & Brandsen, 2022), for example quality of life (Van Heijst & Geurts, 2015; Helseth & Misvær, 2010; Mason et al., 2018). Finally, and perhaps most importantly, the assumption within the medical model is that

conditions exist within the individual. Therefore, treatments have been targeted for autistic people directly. However, this approach overlooks the socially situated nature of autism (Woods, 2017). In turn, this individualised limitation of the medical model led to the development of the social model.

The social model builds upon the medical model by suggesting that, whilst individuals may have specific impairments, it is the interaction between these impairments and the societal context that leads to an overall disability and harm for disabled people (Oliver, 2013). For example, the degree of disability of a wheelchair user is dependent on the accessibility of their environment; if everywhere was wheelchair accessible they would still have the impairment but it wouldn't be disabling or generate as much harm because the societal barriers were removed. In the context of autism, stigma is perhaps one of the largest societal barriers. The language of the medical model generally emphasised 'deficits' or the notion of 'disorder' terminology (Botha, 2021; Bottema-Beutel, Kapp, Lester, Sasson, & Hand, 2020; Bury, Jellett, Spoor, & Hedley, 2020; Sinclair, 2013). The consequence of this language use was that autism was historically pathologized and stigmatised as autistic people were discussed as a 'diminished' version of the predominant neurotype (Campbell, 2008). Therefore, the social model of autism is aimed at highlighting the societal role in the disability of autistic people and shifting the predominant focus of intervention away from the autistic person in the medical model and towards the societal barriers they may face (Woods, 2017).

The social model has often been adopted by researchers using the neurodiversity framework (Kapp, Gillespie-Lynch, Sherman, & Hutman, 2013; Pellicano & den Houting, 2022). Neurodiversity has a range of loosely connected definitions stemming from its origin as a social justice movement (Chapman, 2020; Dwyer, 2022). However, the predominant idea is that natural cognitive and neurological variation exists across people similar to other characteristics (e.g, height). This led to the coining of the term 'neurotypical', meaning the predominant neurotype in society (i.e, those without a diagnosed neurodevelopmental condition, but still encompassing a wide range of variation within this). In turn, many neurodevelopmental conditions also represent part of this overall diversity. Therefore, rather than representing a 'disorder', autism can be understood as part of this natural

variation across humans; a ‘difference’. Then, building on this, the social model is often used within neurodiversity theory because it provides a tool for understanding the barriers autistic people without needing to pathologise natural variation across individuals. This theoretical shift has also co-incided with an increased importance being placed on incorporating the lived experiences of autistic people on their social worlds to understand what these societal barriers may be (Pellicano & Stears, 2011; Poulsen et al., 2022). Therefore this shift away from the medical model and towards a neurodiversity-informed social model of autism has been integral in growing the voice of autistic people in current autism research.

However, one common critique of the neurodiversity-led social model is that a focus soley on difference and societal adjustments risks overlooking that some impairments may, even with perfect societal adjustments, still cause harm for the individual (Ballou, 2018; Dwyer, 2022). For example, adolescents with few or no words would likely still struggle to communicate even if society was perfectly adapted. However, recall that the social model does not rule out that impairments can exist independently of society; it was simply intended as a tool to extend the medical model (Oliver, 2013). Nonetheless, there is the risk within the social model of neurodiversity of appearing ‘dismissive’ of the experiences of some autistic people that feel that societal adjustments alone would not be sufficient (Ballou, 2018). Therefore, the social model has been further developed to attempt to explain this gap through the Ecological Model (Chapman, 2020). In this model, impairments at the individual level can be understood as potentially beneficial at a group level, for example greater cognitive diversity is associated with greater problem solving and reduced groupthink (Syed, 2019). Therefore, whilst a characteristic could be considered as an impairment at the individual level, it may be beneficial in a group or relational setting. This is perhaps plausible for some impairments (e.g, executive functioning impairments for the individual might potentially lead to a group level benefit in problem solving) however for other autism characteristics (e.g, language impairment) the potential group level benefits remain somewhat unclear.

1.2. Positionality and language statement

Given these changes in conceptualisation over time, it is essential to outline the approach taken in the current thesis. The thesis will take the stance that understanding difficulties for autistic people must take into account the environment; adopting a social model of disability in that disability emerges as a result of a mismatch between the individual and the accommodations provided by society (Woods, 2017). The thesis also appreciates that there may be impairments that influence the quality of life of some autistic people beyond interactions with society alone. Nonetheless, this interplay between society and the individual then continues across developmental time to contribute to the variation within, and differences between, autistic and non-autistic people. The author will endeavour to interpret results indicating differences neutrally, as negative or deficit-based interpretations without sufficient evidence risks perpetuating stigma in autism research (Botha, 2021).

The current thesis will also adopt identity first language throughout, following the general preference of the autistic community (Bottema-Beutel et al., 2020; Bury et al., 2020; Sinclair, 2013), although the author appreciates that individuals may have different preferences. Similarly, functioning labels will be avoided throughout as IQ tends to be considered as a proxy for functioning labels despite poor correlations (Alvares et al., 2020) and they create ambiguity in the domain in question. For example, it is not clear whether a functioning label refers to level of language, IQ, or functional skills because they are often used to refer to each interchangeably. Instead, the specific domain in question will be highlighted when this is relevant (e.g, autistic people with communication challenges). When referring to historical studies, the author will describe findings in the preferred language of the community; focusing on findings rather than the format specifically.

1.1. Social interactions in autism

Social interactions for autistic people has been a large research area since it's initial description (Kanner, 1944). Social interactions can be broadly defined as the reciprocal behaviours occurring between two or more social actors. This can be broadly understood as the culmination of 6 main processes (Hoppler, Segerer, & Nikitin, 2022): Actor (individual behaviours and cognitive processes), Partner (behaviour and cognitive processes of the

social partner), Relation (the relationship between the social actors), Activities (the shared task), and the Evaluation (the post-hoc interpretation of the interaction by both social actors). Most existing autism research has focused on individual behaviours and cognitive processes, likely reflecting the influence of the medical model in earlier autism research. However, more recent research has began to examine Partner effects and the Evaluation stages, particularly in the context of neurotypical stigma towards autistic people (Gillespie-Lynch et al., 2015; Underhill et al., 2019). Comparatively less research has examined role of the relationship between social actors (see the current thesis) and the influence of the specific Activity being shared (see Chapter 4 discussion for future directions here). Therefore, most of the current introduction will focus on individual behaviours and cognitive processes that influence social interactions for autistic people. This will then be followed by examining research examining the role of social partners and evaluations where relevant.

Given the breadth of existing research examining the influence of individual behaviours and cognitive processes on social interactions for autistic people, it is useful to first fractionate research in this area into distinct cognitive and behavioural domains. Then key theories regarding the development of these domains will be outlined. Four domains will be explored: social attention, social cognition, social motivation, and social behaviours. These represent 4 domains that have substantially contributed to our overall understanding of autism and are currently large areas of autism research. Furthermore, they have all led to the development of influential theories of autism, for example Mindblindness (Baron-Cohen, 1996) and Double Empathy Theory (Milton, 2012), Social Motivation Theory (Chevallier, Kohls, Troiani, Brodkin, & Schultz, 2012), and the use of eye contact as a model for understanding autism (Senju & Johnson, 2009a, 2009b).

Social attention

Social attention can be defined as the allocation of attention towards social stimuli. The specific definition of what constitutes ‘social’ stimuli is somewhat contentious, particularly as it’s not fully understood what it is that makes a stimuli ‘social’. For example, most studies have focused on social attention to faces (Chita-Tegmark, 2016), stemming from evidence that newborn infants appear to spend a greater proportion of time looking towards face-like

stimuli relative to other stimuli (Frank, Vul, & Johnson, 2009; Johnson, Dziurawiec, Ellis, & Morton, 1991). However, similar effects are seen for 'top-heavy' lighting schematics (Cassia, Turati, & Simion, 2004; Johnson et al., 1991), especially if that schematic is moving (Valenza et al., 2015), even though these schematics are not inherently 'social'. Nonetheless, these studies demonstrate an attentional bias in newborns towards looking towards to a loosely face-like schema. The development of social attention then persists over the first year of life, leading to greater specificity to faces and eyes specifically seen around ages 3-to-9-months (Frank et al., 2009; Hood, Douglas Willen, & Driver, 1998). Therefore, the study of social attention seeks to understand the nature, development, and mechanisms of these attentional biases towards purportedly 'social' stimuli.

These social attentional biases early in development are then thought to scaffold later development through facilitating learning (Chawarska, MacAri, & Shic, 2012; Hahn, 2016; Vivanti, Fanning, Hocking, Sievers, & Dissanayake, 2017). Most research in this area has focused on attention to eyes or faces more broadly. For example, early social attention to the eyes is thought to scaffold development of later joint attention, or sharing attention with others, through the ability to follow the social partners eyes towards a shared attentional target (Mundy, 2018; Mundy & Jarrold, 2010; Mundy & Newell, 2007; Tomasello, 1995). In turn, this is then to thought to contribute to social cognition more broadly, for example development of Theory of Mind (Carpenter & Liebal, 2019; Mundy & Newell, 2007; Mundy, Sullivan, & Mastergeorge, 2009; Tomasello, 1995). Similarly, social attention to faces may support development of reading the facial expressions of others (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001; Baron-Cohen, Wheelwright, & Jolliffe, 1997; Jarick & Kingstone, 2015). In turn, learning to interpret the facial expressions of others may then support later social interactions by understanding the intentions and emotional experiences of social partners. Therefore, understanding differences in social attention is essential to understanding the development of broader social cognition.

Whilst most research on social attention has examined looking towards faces and eyes, it is important to highlight that this may not be the only relevant attentional bias for scaffolding social development. For example, more recent studies using naturalistic head-mounted eye tracking have highlighted that 2-year-old infants rarely look towards the faces of parents

during play and instead focus largely on toys and the hands of the social partner to guide their attention (Franchak, Kretch, Soska, & Adolph, 2011; Smith, Yu, Yoshida, & Fausey, 2015; Yurkovic et al., 2021). This reflects the affordances of the child, with smaller arms and objects often held close to their faces (Smith, Yu, & Pereira, 2011; Yu & Smith, 2012). In turn, young children can also use their parents' hands to guide and coordinate attention rather than simply looking towards the eyes (Yu & Smith, 2013, 2017; Yu, Suanda, & Smith, 2019). Therefore, there has been a shift in social attention research to encompass additional avenues to achieving social attention, such as looking towards the hands of a social partner (Prezbindowski, Adamson, & Lederberg, 1998; Yu & Smith, 2012, 2013, 2017). This possibility of equifinality (achieving the same outcome via a different pathway) is essential when applying this research to neurodevelopmental conditions.

Social attention in autism has been studied extensively because of the potential for differences in these early attentional biases to cascade into later differences in social cognition and outcomes across developmental time (Bruinsma, Koegel, & Koegel, 2004; Hanley et al., 2014; Keehn, Müller, & Townsend, 2013; Mundy et al., 2009). In particular, much of the research in this area has focused on eye gaze and attention to stimuli such as faces (Riby & Hancock, 2009; Speer, Cook, McMahon, & Clark, 2007; Sterling et al., 2008) or eyes (Jones & Klin, 2013; Moriuchi, Klin, & Jones, 2017) relative to neurotypicals. A meta-analysis of 20 studies of eye gaze in autism has shown that autistic people demonstrate less attention to the eyes relative to neurotypicals with a large Hedges g effect size of 0.83 (Papagiannopoulou, Chitty, Hermens, Hickie, & Lagopoulos, 2014) and a similar meta-analysis of 68 studies found a Cohens d effect size of face looking of around 0.4 (Chita-Tegmark, 2016). However, an exact figure for these effect sizes should be interpreted with some caution because of high variation in neurotypical proportions of face looking across studies. For example, neurotypical adults have been found to spend between 40% (Nadig, Lee, Singh, Bosshart, & Ozonoff, 2010) to 50% (Hanley et al., 2014, 2015) to 70% (Fletcher-Watson, Leekam, Benson, Frank, & Findlay, 2009) of an interaction looking towards faces depending on task setup. These studies are often interpreted in terms of a difference in the autistic group. However, it is essential to consider that differences in social attention between autistic and neurotypical groups is partially driven by this neurotypical variation.

Nonetheless, there does appear to be evidence of reduced attention to faces and eyes in autistic people relative to neurotypicals.

This finding of reduced social attention led to the development of two major theories. First, the hypoactive amygdala theory suggests that reduced activity of the amygdala may mean that social stimuli is simply less salient for autistic people (Baron-Cohen et al., 2000; Sweeten, Posey, Shekhar, & Mcdougle, 2002). For example, there is evidence of reduced amygdala activity in autistic people relative to neurotypicals when they are instructed to look directly at the eyes (Moriuchi et al., 2017), suggesting that there may be a difference in how this stimuli is processed for autistic people. This theory originally stemmed from animal models, noting that lesions within the amygdala in young primates would lead to social withdrawal and difficulties in emotional recognition (Bachevalier, 1996). This led to a prevalence of similar mouse models examining amygdala activity, mutations, and lesions (Kazdoba, Leach, & Crawley, 2016). This thesis will not examine these lines of evidence, as using animal models to understand neurodevelopmental conditions is limited given the vast differences between human and other mammalian brains (Zhao & Bhattacharyya, 2018), the developmental complexity of autism (Waterhouse, 2013; Wozniak, Leezenbaum, Northrup, West, & Iverson, 2017), and the unique life history of humans such as extended adolescence and offspring stacking (Reiches, 2019; Wells, 2012). Perhaps more importantly, ethically these models often follow the medical model, with an implied or explicit aim to 'cure' autism, which has led to great unease in the autistic community (Botha & Cage, 2022; Pellicano & Stears, 2011). In terms of human studies, reduced activity in the left amydala for autistic people relative to neurotypicals has been found when viewing emotional faces, albeit with small sample sizes of less than 20 participants (Baron-Cohen et al., 2000; Critchley et al., 2000).

The second major theory of social attention in autism is hyperarousal theory (Tanaka & Sung, 2016). This argues that amygdala overactivation leads to social stimuli being too salient and overwhelming, and hence is avoided as an emotional regulation strategy for autistic people. A recent meta-analysis evaluated 11 neuroimaging studies and highlighted that 8 of these provided evidence in favour of hyperactivity in the amygdala for autistic people, particularly demonstrating increased amygdala activity when viewing fearful faces

(Stuart, Whitehouse, Palermo, Bothe, & Badcock, 2023). However, note that differences in amygdala activation for autistic people are difficult to disentangle from anxiety, with 40% of autistic people also having co-occuring anxiety (van Steensel, Bögels, & Perrin, 2011) and subclinical anxiety on average is higher in autistic people than neurotypicals (Gillot, Furniss, & Walter, 2001). In turn, anxiety is also associated with amygdala differences (Rauch, Shin, & Wright, 2003) that can then interact with autism. For example, a longitudinal study of 71 autistic children aged 3-12 years found that co-occuring anxiety and autism was associated with a larger right amygdala, and this size difference increased over developmental time (Andrews et al., 2022). However, autistic people without co-occuring anxiety saw a decrease over time in the size of the right amygdala. This highlights the difficulties in attempting to create an overarching theory of social attention given developmental complexities and potential individual differences in trajectories across autistic people.

Finally, it is also essential to note the potential risk of over-emphasising the role of gazes to the eyes and face in social attention research. Whilst the eyes are known to convey social information, especially regarding emotions (Baron-Cohen, 1995; Baron-Cohen, Wheelwright, et al., 1997), this alone does not rule out the possibility that social information can be conveyed through other pathways. For example, coordination on a task may require attention to hands, objects, and eyes in tandem and flexibly depending on the task. Autistic people have been shown to not perform significantly differently relative to neurotypicals in their ability to attend to and respond to hand-based cues for joint attention (Caruana et al., 2023). This raises the question of whether social attention differences are specific to face-based cues for autistic people and, if so, whether the general domain of ‘social attention’ is different across neurotypes or there is simply a difference in preferred strategies implemented. These questions remain open for future exploration. Nonetheless, this highlights the importance of acknowledging potential diversity in how social attention can be implemented to achieve equifinality across neurotypes.

A second reason to be cautious of over-emphasising gaze to faces/eyes is the risk of encouraging a normative view of social interactions, rather than appreciating potential heterogeneity. This point will be discussed further when exploring differences in communication styles for autistic and non-autistic people. Nonetheless, it is essential to

acknowledge that there is currently no studies relating differences in eye gaze patterns to the face or eyes and later quality of life outcomes. Despite this, encouraging gaze to faces/eyes has been suggested as a key intervention for autism, particularly to 'train' autistic children to show greater face looking and eye gaze (Miller, Wyatt, Casey, & Smith, 2018; Moriuchi et al., 2017). However, without appropriate evidence linking changes in social attention to beneficial outcomes relevant to autistic people (Poulsen et al., 2022), these interventions risk being at best misguided and at worst potentially distressing (see Social Behaviour section regarding autistic masking). This highlights the necessity of increasing the autistic voice within social attention research to ensure the goals of the research community and the autistic community are aligned.

Social cognition

Social cognition can be defined as the processes underpinning the ability to decode the intentions and behaviours of others to plan actions (Arioli, Crespi, & Canessa, 2018). This can be understood as related to, but distinct from, social attention (Mundy, 2018; Mundy & Newell, 2007; Tomasello, 2014). For example, social attention would be the process of looking towards the face of a social partner. However, social cognition would then be actively processing and interpreting their expression (e.g, they look to be upset) then using this to plan out a behaviour (e.g, considering the best way to comfort this person). Given the breadth of processes likely involved in social cognition, these processes have been subdivided further into distinct subprocesses. This thesis will focus on two of the most well studied cognitive processes in autism; namely Theory of Mind and emotional processing. Finally, a more recent approach highlighting Double Empathy theory will be discussed as a contrast to these individualised accounts of social cognition.

Theory of Mind. Theory of Mind can be defined as the ability to understand the minds of others as separate to our own (Baron-Cohen, 1991; Call & Tomasello, 2011; Premack & Woodruff, 1978; Wellman, Cross, & Watson, 2001). This represents a core component of social cognition as it centres around the understanding of the cognitive processes of others. In turn, this understanding can then guide behaviour, for example through identifying deception or using perspective-taking. Theory of Mind has been most commonly measured through false belief tasks (Wellman et al., 2001) wherein the participating child must

understand that another child holds a 'false belief'. For example, a common task format is that the participant sees Child A place a toy in a box. Child A then leaves and Child B enters and moves the toy into a different box. Then Child A re-enters and the participant is asked where Child A would look to find the toy (Wellman et al., 2001). These studies have demonstrated that neurotypical children pass these tasks at around age 4 years (Baron-Cohen, 1996), therefore to decrease ceiling effects in older children often additional levels of recursive thinking are added, also known as second, third, or fourth level Theory of Mind tasks (Valle, Massaro, Castelli, & Marchetti, 2015). Similarly, in adolescents and adults, tests of sarcasm, hidden meanings, or faux-pas such as The Awareness of Social Interference Test, TASIT, (McDonald, Flanagan, Rollins, & Kinch, 2003) are often used to probe more advanced forms of Theory of Mind. These tasks involve watching a video and then the adolescent or adult making judgements on whether statements were genuine or sarcastic, for example.

Research into Theory of Mind in autism has found that whilst four-year-old neurotypical children often pass false-belief tasks (Baron-Cohen, 1996), this is often not the case with autistic 4-year-olds (Baron-Cohen, 1996; Surian & Leslie, 1999; Wellman et al., 2001; Westra, 2017). Similarly, a large scale study of 103 autistic adults and 95 neurotypical adults showed that autistic adults scored lower on the TASIT relative to neurotypicals, indicating less understanding of sarcasm and hidden meanings with a medium to large Cohens d effect size of 0.7. This research led to the conceptualisation of autism as a specific difference in Theory of Mind, often referred to as Mindblindness theory (Baron-Cohen, 1996; McGuire & Michalko, 2011). This interpretation was heavily influenced by both debates around the 'modularity of mind' in the 80s and 90s (Fodor, 1983) and the medical model attempting to highlight Theory of Mind as key to the etiology of autism. However, evidence of Theory of Mind differences in autism have two key limitations. First, it is difficult to determine the extent to which failure on these Theory of Mind tasks can be adequately interpreted as being distinct from other domains (e.g, attentional differences). Second, the evidence linking these tasks to relevant outcomes for autistic people is unclear.

First, for failure of Theory of Mind tasks to demonstrate that autistic people have differences in Theory of Mind relative to other domains, it is essential to first rule out the possibility that failures can be explained through other domains (i.e, a co-variate). For false

belief tasks, this has been a challenge. For example, performance on a false-belief task does not require solely Theory of Mind abilities, but also necessitates working memory to keep track of social actors (Aboulafia-Brakha, Christe, Martory, & Annoni, 2011; Carlson, Moses, & Claxton, 2004; Jones et al., 2018), language skills (Hale & Tager-Flusberg, 2003; Lind & Bowler, 2009), and selective inhibition of task-irrelevant information such as where the object may truly be (Bloom & German, 2008; Carlson et al., 2004; Wellman et al., 2001). Similarly, tasks such as the TACIT intended to measure understanding of sarcasm or hidden meanings in presented videos often equally rely on language and semantic processing (Hale & Tager-Flusberg, 2003; Lind & Bowler, 2009). This is a key issue because there are systematic differences in these other domains in autistic and non-autistic people (Apfel & Sifneos, 1979; Freeman et al., 2017; Jones et al., 2018; Kenworthy et al., 2005). A final co-variate of note is that both autistic and non-autistic participants in Theory of Mind tasks are viewing videos of neurotypicals. This means that there is systematic variation in whether the actor is the same neurotype as the participant or not (see Double Empathy theory discussed later). Taken together, these explanations highlight that it is difficult to effectively identify what may be the limiting factor leading to differences in performance on these tasks.

Second, if we are to assume that Theory of Mind is an integral part of social cognition and hence social functioning, it would be expected that performance on tasks requiring Theory of Mind would relate to social functioning overall. However, evidence of this is somewhat mixed for both autistic and non-autistic people. False belief performance is significantly correlated with teacher-rated social performance of 10-to-11-year-old neurotypical children (Liddle & Nettle, 2006), however other measures such as the TASIT (McDonald et al., 2003) do not correlate with peer rated social performance for neither autistic nor neurotypical adults (Morrison, DeBrabander, Jones, Ackerman, & Sasson, 2020). Similarly, a large study of 136 autistic adolescents identified that a subgroup of autistic people scored low on Theory of Mind tests but had comparatively higher scores on the social component of the Autistic Diagnostic Observation Schedule (Livingston, Colvert, Bolton, & Happé, 2019). This suggests that these adolescents, despite scoring lower on Theory of Mind, were nonetheless able to appear ‘more neurotypical’ socially. In turn, this subgroup tended to show higher average executive functioning scores but also higher anxiety overall (Livingston et al., 2019), likely reflecting masking behaviours (see Social Behaviours section). This highlights that Theory of

Mind is potentially not the only pathway to more neurotypical-like social functioning and that there is likely substantial variability across autistic people depending on other relative domains of strength.

Emotional Processing. Emotional processing can be defined as the processes involved in the identification of, and responses to, the emotions of others. This is an essential component of social cognition because emotions serve to guide attention and behaviour towards survival-relevant information in the environment (e.g, drawing attention to a potentially harmful snake). This also applies to the social domain, for example fears of rejection are survival relevant because potential ostracization from the group would be a survival risk (Solomon, 1977). Furthermore, when interacting with others, understanding the emotional processes of social partners is integral to decoding their intentions and subsequent actions; by understanding their emotional state it is then easier to use Theory of Mind skills to predict how they may act. Processing emotional information from others requires several distinct but overlapping processes (Bird & Cook, 2013; Bird & Viding, 2014). First, there is an emotional contagion process, or feeling the emotions of others. Second, this emotional contagion must be regulated to enable it to guide cognitive processing. Third, this feeling is then identified and then cognitively labelled (e.g, as anger). Finally, this internal labelling is then attributed to the social partner and thus can be used to guide broader social cognition and behaviour.

The emotional processing of autistic people has been a key area of interest. In particular, there has been interest in following-up on social attention differences to determine the consequences this may have for emotional labelling (Baron-Cohen et al., 2001). Two common tasks are often used for this purpose. First, the Reading the Mind in the Eyes test (Baron-Cohen et al., 2001; Baron-Cohen, Wheelwright, et al., 1997) wherein participants are shown small cut-outs of the eye region and are asked to identify the emotion expressed from 4 separate options. These studies have found that autistic people perform on average 4 questions worse out of 25 relative to neurotypicals (Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997). The second approach involves presenting participants with images of whole actor faces showing specific emotions. These images are then digitally edited depending on the specific question, and then participants are asked to label the emotion

presented in the edited image (Wang & Adolphs, 2017). This approach has shown that autistic people are often less specific in their labelling of emotions (Wang & Adolphs, 2017), particularly requiring more intense emotional expression to correctly label disgust and anger (Smith, Montagne, Perrett, Gill, & Gallagher, 2010).

However, note that evidence that autistic people score lower on both these emotional labelling tasks relative to neurotypicals is mixed overall (Harms, Martin, & Wallace, 2010). In particular, autistic adults and those with high executive functioning or IQ scores have been highlighted as performing more similarly to neurotypical participants (Harms et al., 2010). Likewise, in children, performance on these emotional labelling tasks is strongly associated with receptive and expression language and executive functioning performance (Dyck, Piek, Hay, Smith, & Hallmayer, 2006). This mirrors the debate in Theory of Mind in that it is difficult to rule out potential co-variates when interpreting differences between autistic and non-autistic people and the challenge in incorporating potential equifinality (see Theory of Mind discussion). Furthermore, recall that processing the emotions of others requires four distinct processes. To further understand potential differences in emotional processing it is essential to break down these processes to highlight where the challenge may be for autistic people.

Existing autism research has predominantly focused on the labelling of emotions in a social partner. However, recall that there are four stages in this process: emotional contagion, regulation, self-labelling, and attribution to the social partner. Therefore, understanding these distinct stages may clarify differences between autistic people and neurotypicals and potential compensatory strategies. A few studies can be drawn upon as guidance here. First, research on emotional contagion using physiological recordings has highlighted that there is no difference in emotional contagion for pain across autistic and neurotypical people (Hadjikhani et al., 2014). However, for positive emotional behaviours such as laughter there was reduced emotional contagion for autistic people relative to neurotypicals, but this difference disappeared when autistic people were instructed to look towards the eyes of the figure on the monitor (Helt, Fein, & Vargas, 2019). Therefore, whilst there doesn't appear to be an overall difference in emotional contagion, it is nonetheless essential to

control for differences in social attention when attempting to understanding wider social cognition.

The next stage in emotional processing is the ability to regulate this emotional contagion. Therefore, differences in emotional regulation between autistic and non-autistic people could contribute to differences in the ability to label emotions and broader social cognition. Emotional regulation can be defined as the automatic or intentional modification of an individuals emotional state to enable goal directed behaviour (Thompson, 1994). Existing studies in this area are somewhat limited, with few studies overall, small sample sizes (Mazefsky et al., 2013), and do not explore emotions in specifically social contexts. Nonetheless, a study of 28 autistic and 150 neurotypical adults found that autistic participants reported that they were less likely to use cognitive reappraisal as an emotional regulation strategy, were less efficacious in this strategy, and were more likely to use suppression as an emotional regulation strategy relative to neurotypicals (Samson, Huber, & Gross, 2012). Emotional suppression has been associated with poorer interpersonal functioning and negative wellbeing in neurotypicals (Gross & John, 2003), however the implications for this for autistic groups have not yet been explored. Similarly, a study of 20 autistic and 20 neurotypical 5-year-olds found that autistic children were more likely to use avoidance and venting strategies when given an intentionally frustrating lockbox to open (Jahromi, Meek, & Ober-Reynolds, 2012). They were also less likely to engage with the experimenter as a source of potential emotional support and, when they did, this was less effective as an emotional regulation strategy relative to neurotypicals (Jahromi et al., 2012). Whilst research in this area is somewhat limited, they nonetheless provide tentative evidence of potential differences in emotional regulation that could also form a barrier to understanding the emotions of others and hence broader social cognition.

The final stage before emotions can be labelled in others is the labelling of this regulated emotional contagion in the self. Therefore, difficulties in labelling emotions in the self could contribute to difficulties in labelling the emotions of others and hence broader social cognition. This is often referred to as alexithymia, or a difficulty in labelling and describing your own emotions (Apfel & Sifneos, 1979), and a meta-analysis of 63 studies has found a significant correlation between alexithymia scores and emotional labelling scores (Pisani et

al., 2021). In terms of autism, 55% of autistic adolescents also have co-occuring alexithymia (Milosavljevic et al., 2016), with an Cohens d effect size difference of 1.5 relative to neurotypicals (Kinnaird et al., 2019). This led to the alexithymia hypothesis of autism that states that the emotional difficulties sometimes seen in autism may stem from co-occuring alexithymia rather than a core characteristic of autism (Bird & Cook, 2013). For example, in a study of 16 autistic and 16 neurotypical adults it was found that scores on the Toronto alexithymia scale (Bagby, Taylor, & Parker, 1994), but not Autism Diagnostic Observation Scale scores correlated with difficulty in labelling emotions from images of faces (Cook, Brewer, Shah, & Bird, 2013). These results overall suggest that co-occuring alexithymia, rather than autism specifically, may explain some variation in emotional processing because if emotions cannot be labelled in the self it would then be particularly challenging to label these emotions in others. In turn, this difference in emotional processing may then have a cascading effect on overall social cognition and behaviour.

In conclusion, whilst there may be overall differences in Theory of Mind and processing the emotions of others for autistic people relative to neurotypicals, there are multiple pathways that may lead to the emergence of these differences. In turn, this contributes to the variability across autistic people and highlights the influence of a range of domains on potential social cognition. However, both Theory of Mind and emotional processing approaches to social cognition focus specifically on the cognitive abilities of the autistic person. This limitation is key given that successful social interactions involve multiple components, including the characteristics of the social partner and the overall dyad (Hoppler et al., 2022). This led to the development of a key concept focused on the emergence of barriers between neurotypes: Double Empathy Theory.

Double Empathy Theory. Double empathy theory argues that social difficulties for autistic people emerge due to potential mismatch between autistic and non-autistic people in social interactions (Milton, 2012). More specifically, the differing experiences and worldviews between autistic and non-autistic represents a barrier to shared understanding between neurotypes rather than differences that can be attributed to the autistic person specifically. There is some evidence for this approach, for example neurotypicals are more likely to rate

autistic people as less empathetic (Alkhaldi, Sheppard, Burdett, & Mitchell, 2021; Alkhaldi, Sheppard, & Mitchell, 2019) and are less likely to report a desire to want to interact further with an autistic person relative to a neurotypical based on short videos (Sasson et al., 2017). These social judgements from neurotypicals in turn may form a barrier to successful social interactions for autistic people beyond differences in their own social cognition. Similarly, neurotypicals are also less accurate at labelling the emotions of autistic people relative to other neurotypicals (Brewer et al., 2016). Therefore, the barriers within the emotional processing component of social cognition are likely bidirectional. There is evidence that information transfer between autistic and non-autistic people is less accurate, however there is no significant difference between autistic-autistic dyads and neurotypical-neurotypical dyads (Crompton, Ropar, et al., 2020). Finally, from qualitative reports, there is a wealth of evidence emerging of autistic people reporting successful social interactions with other autistic people (Crompton, Hallett, Ropar, Flynn, & Fletcher-Watson, 2020; Davidson, 2008; Stone, Mills, & Saggers, 2019). In turn, this emphasises that some of the earlier findings on social cognition could reflect dyadic features of the interaction rather than specific differences in social cognition in the autistic group.

However, one current limitation within Double Empathy theory is that the theoretical boundaries are currently unclear. For example, despite over 300 papers examining double empathy theory being published in 2022 alone (Livingston, Hargitai, & Shah, 2024), it is still unclear to what exactly the 'empathy' refers to within the theory. For example, it could refer to Theory of Mind barriers (sometimes called 'cognitive empathy'), emotional processing (sometimes called 'emotional empathy'), or perhaps a third factor such as initial stigma barriers. The consequence of this theoretical ambiguity is that the methods used across studies are often inconsistent and there is the risk of broad generalisations that may not be justified. For example, the outcomes in these studies have examined social judgements (Sasson et al., 2017), information transfer (Crompton, Ropar, et al., 2020), rapport (Crompton, Sharp, et al., 2020; Rifai et al., 2022), or qualitative reports (Crompton, Hallett, et al., 2020) but have generally not drawn upon the pre-determined definitions and methods within the social cognition literature. None of these approaches have adapted the approaches within the Theory of Mind literature, despite there being potential to adapt these measures (e.g, by having autistic co-producers develop measures of how they would

think about others, and administering these tasks to neurotypicals). In turn, this theoretical ambiguity has made it difficult to falsify the theory and generate new knowledge given that the boundaries of what constitutes 'empathy' remains unclear (Popper, 1963). Therefore, there is a strong need to integrate the Double Empathy literature within the broader social cognition literature to narrow definitions and hence ensure the theory can be potentially falsified (Livingston et al., 2024).

One of the only studies that has adopted wider social cognition approaches used the face morphing paradigm outlined within emotional processing. In this study, they found that neurotypicals performed lower at labelling the emotional expressions of autistic people relative to neurotypicals and that autistic participants also performed lower at labelling both autistic and neurotypical participants (Brewer et al., 2016). This appears to be somewhat consistent with Double Empathy Theory given that the neurotypicals also struggled with reading the emotions of the autistic participants. However, the autistic participants struggling to label the emotions of other autistic people is more difficult to interpret. It may be that facial expressions could be less important to reading emotions within autistic-autistic pairs, or perhaps facial expression labelling and production is idiosyncratic across autistic people (see Emotional Processing section). Nonetheless, this enables the generation of new knowledge through a study that could test this (e.g, conducting a study that examined the relationship between emotional labelling and interaction quality across neurotype dyads). Therefore, by integrating double empathy theory within the social-cognition literature new insights could be gained.

A second limitation of Double Empathy theory is that this notion of 'Double' empathy highlights two main groups; generally autistic and neurotypical people (Livingston et al., 2024). However, first, this may inadvertently give the appearance of homogeneity across autistic and non-autistic groups (note this limitation also applies to other socio-cognitive theories). Second, and more specific to Double Empathy Theory, the boundaries of this in terms of diagnostic groups and hence generating testable predictions is unclear. For example, if an interaction between autistic and someone with Attention Deficit Disorder was successful, this could be interpreted as consistent with Double Empathy Theory because both groups differ from the predominant neurotype in society and hence may have

some shared experiences of being a minority neurotype. In turn, this may facilitate developing shared understanding. However, if that same interaction was unsuccessful, this could also be interpreted as consistent with Double Empathy Theory because both groups do have different neurotypes and hence different worldviews so this could form a barrier to potential shared understanding. This makes it somewhat difficult to empirically test of the theory due to this theoretical ambiguity. Therefore, there needs to be greater clarity within Double Empathy theory on which neurotypes this may apply to, what is meant by these barriers to shared understanding, and what the appropriate outcome measure should be.

In conclusion, social cognition has been a large area of autism research, following a trajectory of individually focused medical approaches towards more dyadic, socially informed approaches. There does appear, overall, to be differences in social cognition across autistic people relative to neurotypicals however these are highly idiosyncratic and depend on a wealth of domains both within and beyond social cognition. Furthermore, there does appear to be a key role of dyadic processes in the social performance of autistic people, with neurotypicals often making more negative judgements towards autistic people (Sasson et al., 2017). However, there is currently a research gap between these two stances; there is a need to bridge the gap between more clearly defined but individually focused theories and less clearly defined but dyadically focused theories to bring the field of social cognition in autism forward. In turn, a greater understanding of interactions between autistic and neurotypical people can be achieved and hence used to improve the quality of life of autistic people.

1.2. Social motivation

Social motivation can be understood as the motivational processes that drive individuals to engage socially with others (Pittman, 1987). The need to form attachments and interact with others has been described as a fundamental human motivation (Baumeister & Leary, 1995; Rudolph, 2021), often stemming from a human need to belong (Pickett, Gardner, & Knowles, 2004). The Social Motivation Hypothesis (Chevallier et al., 2012) argues that autistic people have lower motivation for engaging in social interactions and therefore are less likely to seek them out relative to neurotypicals. Then, over time, the individual receives less social stimuli from the environment (as they are less likely to seek it out), which in turn

may provide less stimuli and reinforcement learning for development of the social brain and social reward networks (Chevallier et al., 2012; Clements et al., 2018). Note that this differs from Theory of Mind-based accounts in that autistic people are not necessarily less skilled in reading the minds of others and hence potentially become less motivated over time, but rather the motivations underlying social interactions is reduced relative to neurotypicals (Chevallier et al., 2012). In turn, this produces a potentially vicious cycle across later social development (Masten & Cicchetti, 2010). Two approaches have been most commonly adopted in the literature: neuroimaging studies of social motivation networks and questionnaires intended to specifically examine social motivation.

Measurement of social motivation often relies neuroimaging, typically fMRI, because of the difficulty in empirically measuring motivation separately from general reward and broader social cognition. Importantly, neuroimaging allows the 'wanting' response (prior to the reward and associated with motivation) to be distinguished from the 'reward' response (occuring with the actual reward and more associated with simply 'liking'). In most cases autistic participants are given a specific task with a reward stimuli that is either 'social' (e.g, a picture of a happy face) or 'non-social' (e.g, monetary). Then the BOLD signal during responses are collected alongside a response time measure (Bottini, 2018). One study adopting this approach showed that autistic people do show reduced responses in the dorsolateral prefrontal cortex, orbitofrontal cortex, and parietal cortex in anticipating of social rewards relative to neurotypicals (Choi et al., 2015). Therefore, this could be interpreted as lower social motivation at the neural level for autistic participants, consistent with Social Motivation Theory.

However, overall neuroimaging evidence of social motivation differences in autism relative to neurotypicals is mixed. A meta-analysis of 27 neuroimaging studies on social motivation highlighted that only 57% of studies provided evidence of lower motivation to social stimuli in autistic people relative to neurotypicals using this set-up (Bottini, 2018). This could be due to large individual differences within studies, particularly given that neuroimaging studies tend to have small sample sizes and hence detecting an effect within this 'noise' can be difficult. Nonetheless, the meta-analysis did show an overall increased reward anticipation to non-social stimuli for autistic people relative to neurotypicals (Bottini, 2018).

However, this is difficult to interpret because there is large variation between 'non-social' conditions between studies, for example monetary rewards, videos, audio, or pictures (Bottini, 2018). In turn, differences between studies in the reward value of the 'non-social' stimuli makes it difficult to determine whether potential differences are driven by social motivation or simply broader motivation differences. Therefore, it remains a challenge to fractionate specific social reward differences from general differences in reward processing for autistic people. This could be resolved through greater standardisation of reward stimuli between studies, in particular non-social stimuli to serve as a consistent 'baseline' between studies.

An alternative approach to measurement of social motivation is through the use of questionnaires. These are much cheaper, faster, and convenient to administer relative to neuroimaging techniques and therefore tend to be more widespread in the literature. The most common questionnaire method used to assess social motivation in autism is the social motivation subscale of the Social Responsiveness Scale (Constantino, 2002; Constantino & Gruber, 2012). This consists of 11 items attempting to measure "the extent to which an individual is generally motivated to engage in social-interpersonal behaviour" (Constantino & Gruber, 2012). A study using this questionnaire in 36 autistic and 18 neurotypical 8-12 years olds found that the autistic participants did score significantly lower on social motivation across all questionnaires relative to neurotypical males (Neuhaus, Bernier, & Webb, 2021). However, differences were larger for autistic males compared to autistic girls and there was significant individual differences between autistic participants. Similarly, a study of 79 autistic and 60 non-autistic 3-12-year-olds found that the autistic participants scored as less socially motivated relative to neurotypicals (Itskovich et al., 2021). Furthermore, this reduced social motivation significantly correlated with poorer social skills scores on the Vineland Adaptive Behaviour scales. However, it is important to note that this questionnaire is parentally reported. Parents must rely on the external behaviours of their child when making judgements on their social motivation. This limitation is essential given that appearing socially uninterested is not the same as actually being less socially motivated (Jaswal & Akhtar, 2019), particularly when overall social behaviours may differ for autistic people (see Social Behaviours).

The Friendship Motivation scale (Richard & Schneider, 2005) is an alternative, self-report questionnaire aimed at adults that directly assesses intrinsic (e.g, I find pleasure in talking to my friends) and extrinsic (e.g, I have friends to be invited to parties) motivation to form friendships. A study of 67 autistic and 58 neurotypical participants did find that autistic adults scored significantly lower on the Friendship Motivation Scale relative to neurotypicals, however their social motivation score did not correlate with how they were socially evaluated by peers or their own social evaluations (Morrison, DeBrabander, Jones, Ackerman, et al., 2020). This may suggest that social motivation is not associated with broader social outcomes. Or, alternatively, it may reflect that participants knew they were within a research study and hence didn't expect to befriend their assigned partner within the study. The Friendship Motivation scale may be more predictive in a context wherein friends are expected to be made (e.g, perhaps when attending a new hobby) or within a pre-existing friendship, however this is uncurrently untested. However, unexpectedly, neurotypicals higher in social motivation were significantly more likely to rate the autistic person as untrustworthy, potentially reflecting neurotypical participants with high interest in engaging with others being uncertain in how to interpret the behaviours of the autistic person (Morrison, DeBrabander, Jones, Ackerman, et al., 2020). This highlights one of the limitations of Social Motivation theory; it omits the social context that autistic people are within.

One key limitation of Social Motivation theory can be highlighted using the medical and social models highlighted earlier in the introduction (see Conceptualising autism). Social Motivation theory assumes that reduced social motivation is a characteristic of autism. However, the social model can also be used to suggest that differences in social motivation may stem from an interaction with the environment (Oliver, 2013). For example, differences in social cognition and behaviour for autistic people may lead to negative judgements, rejection, or stigma from the predominant societal neurotype. In turn, this negative societal feedback may lead to reduced social motivation relative to neurotypicals. For example, autistic people report fears of rejection based on past experiences (Acker, Knight, & Knott, 2018) and stigma from neurotypicals towards autistic people has been found (Gillespie-Lynch et al., 2015; Mitter, Ali, & Scior, 2019; Underhill et al., 2019). Likewise, autistic people

are more likely to experience difficulties navigating relational aggression within school (Sedgewick, Hill, & Pellicano, 2019) or 'mate crime' wherein autistic people may be taken advantage of by their peers who are ostensibly their friend (Forster & Pearson, 2020). These negative experiences may then reduce overall motivation to engage with peers. This social approach also highlights that one potential intervention strategy for increasing social motivation for autistic people would be to minimise stigma and rejection from neurotypicals. For example, a few small-scale intervention studies have attempted to reduce neurotypical stigma and have increased their self-reported willingness to engage with autistic peers (Gillespie-Lynch et al., 2015; Holloway, Munro, Cossburn, & Ropar, 2022; Jones, Morrison, et al., 2021).

One key mechanism within this social approach is the role of expectations of peer rejection, with this then potentially cascading into reduced overall social motivation. Most research examining this expectation of social rejection has been qualitative in nature (Acker et al., 2018; Forster & Pearson, 2020), highlighting that autistic people sometimes do have a strong fear of rejection and the anxiety this causes often forms a barrier to engaging with peers (Acker et al., 2018). Some quantitative evidence can also be found. For example, a study of 20 autistic and 40 non-autistic adults found that the autistic participants were more likely to anticipate that others will dislike them based upon an image of their face (Gurbuz, Riby, South, & Hanley, 2024). Furthermore, across the autistic and non-autistic sample, there was a significant correlation between this expectation of rejection and anxiety but not with Autism Quotient scores. This may suggest that anxiety, rather than autism specifically, may be the main contributing factor to increased anticipating of rejection and potentially reduced social motivation. Anxiety is common in autism, at both clinical (Simonoff et al., 2008) and subclinical levels (Bejerot, Eriksson, & Mörtberg, 2014; Spain, Sin, Linder, McMahon, & Happé, 2018; White & Roberson-Nay, 2009), therefore this co-occurrence may further contribute to potentially reduced social motivation due to fears of rejection.

However, the second key finding, that expectation of rejection did not correlate with Autism Quotient scores should be interpreted with some caution, particularly because both autistic and non-autistic participant scores were combined. The Autism Quotient assumes that 'empathising' subscales (e.g, social questions) are negatively correlated with systematising

subscales (e.g, attention to detail) which has some evidence within autistic populations (Auyeung, Baron-Cohen, Wheelwright, & Allison, 2008; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001). However, this correlation is much weaker and can even be reversed in neurotypical populations (Kloosterman, Keefer, Kelley, Summerfeldt, & Parker, 2011). In turn, this makes it difficult to interpret what an Autism Quotient score for a neurotypical may mean, and the score could simply reflect personality dimensions such as openness or extraversion (Kloosterman et al., 2011). This issue is exacerbated by the fact that the neurotypical sample was also twice as large as the autistic sample in this study. Therefore, these measurement issues of the Autism Quotient when used in neurotypical populations may have masked a specific correlation within the autistic group. Therefore, the relationship between autistic characteristics, expectations of rejection, and social motivation must be confirmed with other measures.

Overall, these studies demonstrate that the finding of differences in social motivation for autistic people relative to neurotypicals are somewhat mixed and it is difficult to disentangle overall social motivation from the social environment autistic people are acting within. It is also important to note that lower social motivation, if it were to exist, is not inherently negative. There is the potential risk that encouraging greater social motivation may indirectly promote masking (Morrison, DeBrabander, Jones, Ackerman, et al., 2020), defined as consciously or unconsciously attempting to behave in a more 'neurotypical' manner. In turn, masking may have a negative impact on the wellbeing of autistic people (Miller, Rees, & Pearson, 2021; Tubío-Fungueiriño, Cruz, Sampaio, Carracedo, & Fernández-Prieto, 2021). Indeed, some have argued that masking itself is inconsistent with poorer social motivation for autistic people because if autistic people were not motivated to engage with peers then why would they adapt their own behaviour to fit in with others (Livingston & Happé, 2019)? Indeed, this highlights an additional caveat within social motivation research: social motivation is typically measured in contexts where the social partner is, or could be assumed to be, neurotypical. This may omit potential differences in social motivation for autistic people when engaging with other autistic people instead of neurotypicals, with some qualitative evidence for this (Crompton, Hallett, et al., 2020). Therefore, it is essential to develop measures of social motivation that are co-produced with autistic people to ensure outcomes are meaningful for the community (Poulsen et al., 2022). An example of

this approach is the Suicidal Behaviours Questionnaire – Autistic Spectrum Condition (Cassidy, Bradley, Cogger-Ward, & Rodgers, 2021); an example of a pre-existing measure that was effectively adapted for autistic people with the help of the autistic community.

1.3. Social behaviours

Finally, building upon social cognition and motivation, autism research has often focused on behavioural differences between autistic and non-autistic groups. Social behaviours, in the broadest sense, can be defined as behaviours intended (consciously or not) to influence a social partner towards a particular goal (which may or may not be a shared goal). A vast range of different types of behaviours within social interactions fit this definition and can be considered as social behaviours. For example, backchannelling can be used to indicate interest and develop rapport (Rifai et al., 2022), eye contact is frequently used to communicate and receive information regarding attention and emotions (Jarick & Kingstone, 2015), and facial expressions such as smiling are often used to communicate emotional information (Gironzetti et al., 2016). These different types of behaviours are then coordinated both within an individual (e.g, smiling and nodding at the same time) and with the social partner (e.g, responding to a verbalisation with “mhm” to indicate attention). These different types of behaviours must also be of an appropriate nature depending on the context. For example, they must be appropriately timed, of an appropriate duration, an appropriate frequency, and responsive to the social partner in the interaction to have their intended effect. This leads to a complex interplay of factors between social actors in real time over the course of an interaction.

The complexity of both the types and natures of social behaviours raises the key question of how best to measure social behaviours. More specifically, which behaviours and what aspects of them should researchers examine to determine whether an interaction is ‘successful’. There is little consensus in the current literature regarding which behaviours are most important within social interactions and it is simply not feasible for a study to measure every aspect of a social interaction. Therefore, most researchers have chosen specific types or aspects of behaviours and attempted to establish their relationship to a specific outcome. In doing so, the role of specific behaviours can be understood by relating them to a key outcome measure. Then, potentially, the outcome measure can be targeted

through interventions aimed at the associated behaviours. For example, some studies have measured eye gaze following, pointing, and language and their relationship to joint attention and language development (Mundy, Delgado, et al., 2003; Mundy, Fox, & Card, 2003; Mundy & Gomes, 1998; Mundy & Newell, 2007). Some studies have examined behaviours such as backchannelling or eye contact and their relationship to rapport (Rifai et al., 2022a). Some have examined face and hand following and their relationship to attention and language (Fausey, Jayaraman, & Smith, 2016; Franchak, Kretch, Soska, Babcock, & Adolph, 2010; Yu & Smith, 2017). Others still have examined proportions of attention to a social partner and the relationship this has to language and symbolic development (Adamson & Bakeman, 1984; Adamson & Bakeman, 1999, 2016). This highlights the complexity and diversity of existing research examining social behaviours.

This approach of relating specific behaviours to specific outcomes, whilst necessary for feasibility, does come with two key limitations. First, the examination of different behaviours tends to take place within different paradigms across research teams. For example, diffusion chains (Rifai et al., 2022), conversation contexts (Jones et al., 2017), play contexts (Adamson & Bakeman, 2016), and more standardised structured settings (Mundy, Delgado, et al., 2003). In turn, this makes comparisons across studies difficult because both the behaviours measured and the social context both systematically vary. This may also lead to potentially underestimating differences in behaviours across contexts because specific behaviours tend to be measured within specific paradigms. Second, demonstrating that a specific behaviour relates to a specific outcome does not rule out alternative pathways to that same outcome, particularly across different neurotypes (Karmiloff-Smith, 1998; Karmiloff-Smith, 2009). For example, language has been a common outcome measure in a lot of social behaviour research in children. Yet there is evidence that there are differences in the pathways of language development across a range of neurodevelopmental conditions (D'Souza, D'Souza, Jones, & Karmiloff-Smith, 2020; D'souza, D'souza, & Karmiloff-Smith, 2017). Therefore, interventions aimed at encouraging a specific behaviour to support the development of an outcome such as language may not generalise across different neurotypes. These limitations highlight the need for greater collabration between distinct research groups exploring social behaviours to improve comparability within social

behaviour research and to explore potential equifinality in how the same outcomes can be achieved via a range of social behaviours across neurotypes.

When examining social behaviours it is also essential to note that behaviour doesn't occur in a vacuum; instead it depends on the social context of the interaction such as the social partner and the overall composition of the dyad (e.g, two males). For example, the same social behaviour may be perceived as positive with one social partner but negative with another. A range of partner and dyad characteristics can influence the social interaction, for example gender (Williams, 1984), culture (Uono & Hietanen, 2015), race (Pittman, 2020), weight (Carr, Jaffe, & Friedman, 2008), and familiarity (Motomura et al., 2015). Particularly relevant for the current thesis is the role that neurotype composition of the dyad can have on the social interaction. One way this has been explored is using Double Empathy theory (see Social Cognition section), often through examining the influence of changing neurotype on social behaviours and rapport building (Crompton, Sharp, et al., 2020; DeBrabander et al., 2019; Morrison, DeBrabander, Jones, Faso, et al., 2020; Rifai et al., 2022).

Theoretically, the different perspectives and experiences of different neurotypes may lead to distinct 'communication styles' across neurotypes. More specifically, behaviours that may be important within neurotypical communication styles, such as eye contact, may be less important or less informative within autistic communication styles. Instead, there may be an emphasis placed on other behaviours to gain that information, such as language or contextual cues. A communication barrier then emerges as a dyadic result of both social actors using these different communication styles (Crompton, Sharp, et al., 2020; Crompton, Hallett, et al., 2020; Milton, 2012) with their own built-in assumptions (e.g, eye contact indicating interest from the neurotypical perspective, but not from an autistic person perspective). This has predominantly been explored in terms of two main behaviours: eye contact and backchanneling. Therefore, these two key social behaviours will be explored in terms of their overall importance, and then how greater understanding of neurotype-specific communication styles has informed research in this area.

Eye contact

Eye contact is defined as mutual looking towards the eyes of a social partner (Jongerius, Hessels, Romijn, Smets, & Hillen, 2020). Importantly, eye contact can be distinguished from face gaze which is merely looking at a face of another individual and from eye gaze which is looking towards the eyes in a video or image on a screen (see Social Attention). Neither gaze to faces nor eyes require another social partner. However, eye contact necessitates a social partner who is mutually holding the eye contact (thus by necessity it is a two-way process). Eye contact also differs from face gaze in that it requires high enough spatial resolution to rule out looking towards other areas of the face (Jongerius et al., 2020).

This separation between gazes towards the face or eyes and eye contact is essential for both empirical and theoretical reasons. First, in empirical terms, two studies directly compared 'live' eye contact to eye gaze to a photograph (Hirsch et al., 2022; Kikuchi et al., 2022). These studies involved an experimenter seated opposite a participant with a screen between them, the screen would then present either the photographs of a face or would become transparent, revealing the eyes of the 'real' person seated opposite. Both studies found greater pupil dilation and autonomic responses from the real person relative to videos across both autistic and non-autistic participants, with no significant differences between neurotypes. However, autistic people showed reduced cross-brain synchronicity measured by fNIRS for eye contact relative to neurotypicals, but this effect was not present for video stimuli. Similarly, eye contact led to greater activation in the dorsal parietal and lateral prefrontal cortex for neurotypicals, but greater activation in occipital-temporal regions for autistic participants, but neither of these effects were seen for eye gaze (Hirsch et al., 2022). This demonstrates the distinctive nature of eye contact over simple eye gaze. Second, from a theoretical perspective, eye contact in a naturalistic interaction likely entails a broader range of potential domains and informational processing relative to a video or photograph. For example, eye contact necessitates acknowledgement of a social partner, and hence knowledge of being observed and the knowledge that the individual not just receiving, but also providing, social information (Jarick & Kingstone, 2015). This 'audience effect' (feeling of being looked at) then influences social cognition and social behaviour (Bond, 1982; Cañigueral & Hamilton, 2019). These additional levels of processing, and

potential differences in their mechanisms across neurotypes, can only be explored through examination of eye contact directly.

Eye contact research has been of particular interest within autism. For neurotypicals, looking behaviours are modulated across the social interaction – with eye contact then occurring at key points within the interaction. For example, eye contact often occurs during periods of high synchrony between social partners, and provides a marker for shared attention (Wohltjen & Wheatley, 2021). In turn, this eye contact is then associated with ratings of partner engagement (Wohltjen & Wheatley, 2021). Therefore, differences in autistic eye contact may contribute to lower engagement from neurotypical social partners and in turn feedback into the overall cross-neurotype interaction. For example the neurotypical may alter their own behaviour in response to this perceived lower interest, which in turn may influence the behaviour of the autistic person, which may further feedback into the behaviour of the neurotypical. Therefore, understanding eye contact has been seen as key to understanding overall differences between autistic and neurotypical social interactions.

However, one barrier to understanding eye contact in autism is that there are relatively few studies that meet the full criteria for examining eye contact, with studies often instead measuring general social attention. Indeed, the studies that do measure eye contact are often have small sample sizes and limited power. For example, a proof of concept study of 8 3-year-old autistic children did show less eye contact relative to non-autistic children during play with an experimenter (Edmunds et al., 2017), however a larger scale study of 20 autistic and 20 non-autistic participants aged 4-12 years showed no difference in eye contact between autistic and non-autistic participants during either play or conversations (Jones et al., 2017). One relatively large study of 37 autistic and 37 non-autistic people did find significantly higher eye contact for neurotypicals relative to autistic people in a cross-neurotype semi-structured interview conversation, with an overall Cohens d effect size difference of 0.66 (Auyeung et al., 2015). However, there was significant variability within the autistic and neurotypical groups. Furthermore, this study had a limitation in that whilst the interaction was ‘live’ and had sufficient spatial resolution to determine eye contact, it nonetheless took place via a video call (Auyeung et al., 2015). It is debatable whether this

can be considered eye contact, given that during a video call the dual purpose of eye contact (Jarick & Kingstone, 2015) is disrupted because looks towards the 'eyes' on the screen do not appear as looks towards the social partner (see Chapter 3 for further discussion of this limitation). Nonetheless, taken together, these findings highlight that evidence of eye contact differences in autism compared to neurotypicals are somewhat mixed.

All of the aforementioned studies on eye contact in autism found substantial individual variation within both the autistic and non-autistic groups. In turn, this 'noise' from individual variation could make it difficult to detect differences where they may exist, particularly within small sample sizes. For example, a range of individual characteristics may influence eye contact. Some of these individual differences, for example in social attention, cognition or motivation could emerge as a result of neurotype differences and the interaction this has had with wider society over the lifespan of the individual. Other individual differences may be associated with autism but not a core characteristic of it, for example social anxiety (Schneier, Rodebaugh, Blanco, Lewin, & Liebowitz, 2011; Wieser, Pauli, Alpers, & Mühlberger, 2009). Finally, some contributing factors to these individual differences may be more separate from the neurotype, for example cultural background can influence perceptions of eye contact and how much may be deemed appropriate (Uono & Hietanen, 2015). Therefore, there is a need for eye contact studies that can control for some of these factors (e.g, via matching on social anxiety or making this a co-variate within the analysis).

Autistic people's reports of their own eye contact also tend to show high individual differences. One content analysis of the comments of autism-related websites (Trevisan, Roberts, Lin, & Birmingham, 2017) some describe eye contact as painful or invasive, others describe it as not painful but are 'indifferent' towards it, whereas others report no difficulties with eye contact (Trevisan et al., 2017). Importantly, many of the autistic people described interventions intended to 'improve' their eye contact as anxiety-provoking or even painful. Indeed, recall that demonstrating that a social behaviour such as eye contact is related to a specific outcome (e.g, social judgements) does not necessitate that this is the only pathway to that specific outcome. In turn, this potential equifinality has direct relevance for social interventions for autistic people because interventions should not

simply attempt to make their communication more similar to the predominant societal neurotype (Keates, 2022), but rather should focus on achieving outcomes that are relevant to autistic people. Therefore, it is essential incorporate the voice of the autistic community into autism research to ensure social outcomes are relevant to the community and appreciate the potential diversity in the pathways to achieving this (see Chapter 2a and 2b).

Backchannelling

A second behaviour that may be relevant for cross-neurotype communication is backchannelling (Rifai et al., 2022). This can be defined as behaviours, either verbal or non-verbal, acting as interjections within a conversation to provide additional information to the speaker; for example, responding "Mhm…" or nodding of the head to indicate understanding. This behaviour has been studied comparatively less than eye contact, but nonetheless was an integral measure within an influential study on social behaviours across neurotypes. In the study, backchannelling was explored across neurotype dyads in 21 autistic-neurotypical pairs, 21 autistic-autistic pairs and 21 cross-neurotype social pairs in the context of a diffusion chain (Rifai et al., 2022). The diffusion chain in this study involved a neurotypical experimenter telling a story to a participant, and then that participant would need to tell the story to the next participant and so on until the eighth person in the 'chain'. Dyads within the chain were then either autistic-autistic, neurotypical-neurotypical, or autistic-neurotypical, and behaviours were compared across these dyads. They found that frequency of backchannelling predicts rapport during neurotypical-neurotypical dyads but does not appear to do so for interactions between autistic-autistic dyads (Rifai et al., 2022). In turn, this suggests that backchannelling may be perceived as important for developing rapport within neurotypical communication styles but is less important within autistic communication, at least within a storytelling context.

This is consistent with some evidence that autistic people may use different strategies within social communication, which in turn may be effective with other autistic people but less effective within interactions with neurotypicals. For example, verbal backchannelling utterances for autistic people tend to be less common, less diverse, and show a different mapping of intonation onto these utterances (Wehrle, Vogeley, & Grice, 2023). However, autistic people do state that silence appears more acceptable in interactions with other

autistic people (Crompton, Hallett, et al., 2020). This may suggest a difference in strategies for signalling attention and engagement amongst autistic people, perhaps relying more on contextual cues (e.g, knowing someone is paying attention without needing this behavioural feedback). These autistic-autistic strategies do seem to be effective, for example there is no difference in the amount of information that can be effectively transferred and rapport building within autistic-autistic dyads relative to neurotypical-neurotypical dyads (Crompton, Sharp, et al., 2020; Crompton, Ropar, et al., 2020). Likewise, autistic people do report feeling more comfortable and understood within same-neurotype dyads relative to interactions with neurotypicals (Crompton, Hallett, et al., 2020; Pellicano et al., 2021; Stone et al., 2019). However, these differences in strategies may present a barrier to cross-neurotype communication when they are misunderstood in cross-neurotype communication.

Yet, despite these potential communication barriers across neurotypes, cross-neurotype interactions can be successful and cross-neurotype friendships do occur. Indeed, cross-neurotype friendships are perhaps particularly common in mainstream high schools wherein an autistic adolescent will have predominantly neurotypical peers (Sedgewick, Hill, et al., 2019; Sedgewick, Hill, Yates, Pickering, & Pellicano, 2016). But, if this is the case, how do these friendships overcome these barriers to cross-neurotype communication? Answering this question is a key aim of the current thesis, and hence first it is essential to outline the nature and importance of friendships within and across neurotypes.

1.4. Friendship

Friendship can be defined as the affective bonds between two people (Hartup & Stevens, 1999). Friendships occur across the lifespan, become increasingly stable over developmental time (Poulin & Chan, 2010; Youniss & Haynie, 1992), and play a key role in both providing a context for the development of social cognition (Berndt, 1982; De Goede, Branje, & Meeus, 2009; Youniss & Haynie, 1992), providing socio-emotional support (Almquist, Östberg, Rostila, Edling, & Rydgren, 2014; Bishop & Inderbitzen, 1995; Lodder, Scholte, Goossens, & Verhagen, 2017; Whitehouse, Durkin, Jaquet, & Ziatas, 2009), and improving quality of life (Van Heijst & Geurts, 2015; Helseth & Misvær, 2010). Friendships can also have cascading effects across development, for example having few or no friends in childhood may provide

fewer contexts for developing subsequent social cognition, which in turn may lead to further difficulties making friends. This potential difficulty, in turn, may feedback into overall social motivation. There is some evidence of this from developmental cascade models, for example having friends in early childhood is a significant predictor of late childhood friendships (Blandon, Calkins, Grimm, Keane, & O'Brien, 2010). Therefore, this potential for friendships to cascade into broader social cognition and the direct links between friendship and subsequent quality of life mean this represents an essential area of current research. This section will provide a brief overview of the methods commonly used in friendship research (including the current thesis) before demonstrating how these have been applied to understanding autistic friendships.

One method for measuring friendships is self-report questionnaires. For example, this typically includes self report of features such as self-disclosure, perceived social support, and degree of conflict in the Unidimensional Relationship Closeness Scale (Dibble, Levine, & Park, 2012) or the degree of 'overlap' between social partners in the Inclusion of the Self in the Other test (Aron, Aron, & Smollan, 1992). Scores on these questionnaires are then summed to produce an overall composite friendship quality 'score' for comparison. This approach has the benefit of gaining potentially detailed information regarding a specific friendship through these subscales. However, the approach does assume a linearity of friendship such that friendship quality could theoretically be 'ranked' across respondents. This may overlook the highly individual and subjective nature of friendships. For example, some people may have different friends for different purposes or there may be variation in which aspects of a friendship are most important across individuals.

Peer nomination approaches involve examining who children or adolescents nominate to do a specific task with, or highlight specifically as their friend. This is then typically measured either though examining the degree of reciprocity (i.e, whether both people nominated one another), or through examining the degree of overlap between friendship groups and interconnectedness of individuals through Social Cognitive Mapping (Pijl, Koster, Hannink, & Stratingh, 2011). Reciprocity enables the examination of individuals that believe they are someone elses friend but the other social partner does not; for example, due to differences in friendship expectations. Social Cognitive Mapping takes these nominations and enables

the building of social networks across the classroom. In turn, this enables identification of 'outliers' within the classroom. These outliers are not well connected to broader peer social networks based on these nominations, and therefore may be of interest for targeting potential support. However, this peer nomination approach is perhaps less informative regarding individual friendships (e.g, why they may have nominated that specific person). Therefore, there is somewhat of a trade-off in scale, with questionnaires providing greater information regarding an individual friendship but broader peer nomination studies enabling the exploration of friendship on a wider scale.

Both these methods have been applied across the lifespan (Hartup & Stevens, 1999), however the current thesis will focus on the friendship experiences of autistic and non-autistic adolescents and young adults. This is significant, as adolescence is characterised by both an intensification of friendships (De Goede et al., 2009; Youniss & Haynie, 1992), co-occuring changes in social cognition and emotional regulation (Burnett, Sebastian, Cohen Kadosh, & Blakemore, 2011; Choudhury, Blakemore, & Charman, 2006; Kilford, Garrett, & Blakemore, 2016). Finally, and perhaps most importantly, both autistic and non-autistic adolescents and adults rate their friends as important to their quality of life (Van Heijst & Geurts, 2015; Helseth & Misvær, 2010; Mason et al., 2018). Therefore, understanding these friendships in autism is essential to understanding their social cognition and supporting good outcomes for autistic people.

1.5. Friendship in autism

The friendships of autistic adolescents without communication challenges or intellectual disability has been a large area of autism research. This has likely stemmed from earlier research investigating the friendships of autistic children (Bauminger et al., 2008; Bauminger & Shulman, 2003) and increasing recognition of the importance of friendships for reducing depression and anxiety in adolescence (Van Harmelen et al., 2017) and adulthood (Black et al., 2022; Mazurek, 2014). Autistic people do report a desire for friendships (Black et al., 2022; Daniel & Billingsley, 2010; Mazurek, 2014), however a study of 13 neurotypical and 7 autistic adolescents in a mainstream school found that the autistic adolescents reported lower friendship quality and significantly lower social network connectivity relative to their neurotypical peers (Locke, Ishijima, Kasari, & London, 2010). Similarly, a meta-analysis of 57

studies examining friendships for autistic children and adolescents found that autistic children and adolescents had generally fewer friends, were less likely to be reciprocally nominated as a friend, and scored lower on questionnaire measures of friendship quality (Bauminger et al., 2008; Petrina, Carter, & Stephenson, 2014). This suggests that overall, there does appear to be a difference in friendships for autistic people relative to neurotypicals.

However, two key caveats must be made regarding research in this area. First, some studies have highlighted that small, close-knit but enduring friendship groups amongst autistic and non-people can develop around a shared interest, for example gaming amongst boys (Black et al., 2022; Kuo, Orsmond, Cohn, & Coster, 2013). These close-knit friendship groups may appear as a profile of reduced social connectedness to peers overall relative to neurotypicals (Chamberlain, Kasari, & Rotheram-Fuller, 2007; Locke et al., 2010), despite potentially meeting the social needs of the individual. In this sense, some measures of social connectedness (e.g, peer nomination studies) may overlook that some autistic people may be happy within smaller friendship groups (Crompton, Hallett, et al., 2020). Second, autistic people may emphasise different aspects of their friendships relative to neurotypicals. A scoping review of 94 qualitative studies examining autistic people's experiences of their friendships highlighted the importance of autistic people feeling being able to 'be themselves' with their friends, particularly if their friend was also autistic, and feeling less pressure to 'act neurotypical' (Black et al., 2022). This unique aspect of friendship has been reported as highly important to autistic people (Crompton, Hallett, et al., 2020), yet is currently not captured in quantitative measures of friendships used for autistic people. This highlights the need to co-develop novel measures of friendship relevant to the autistic community, and also underscores the importance of gaining the perspectives of autistic people on their friendships.

The friendship experiences of autistic people have been explored in a range of qualitative studies (Black et al., 2022; Crompton, Hallett, et al., 2020; Daniel & Billingsley, 2010; Sedgewick, Hill, et al., 2019). One study explored 12 autistic adults' perspectives on their relationships with important autistic and neurotypical people in their lives (Crompton, Hallett, et al., 2020). Participants highlighted the ease of within-neurotype communication

relative to between-neurotype communication, with other autistic people often showing a greater flexibility in what constitutes a 'good' social interaction. For example, silences are felt as more acceptable with other autistic friends due to the shared understanding that these silent periods are acceptable. However, note that this wasn't an absolute rule, and a few autistic people did report some barriers with other autistic people, particularly those they were less familiar with (Crompton, Hallett, et al., 2020). Indeed, one critique of Double Empathy Theory is that may risk dichotomising autistic and neurotypical communication (see Double Empathy theory). This has led others to suggest a spectrum of understanding approach (Gillespie-Smith, Mair, Alabtullatif, Pain, & McConachie, 2024), wherein the barriers between neurotypes are instead conceptualised as a continuum of neuro-cultural learning. This is particularly relevant within friendships because friends are likely to share their perspectives and values with each other. In turn, this may lead to greater understanding and successful social communication, even across neurotypes. Therefore, greater understanding of cross-neurotype friendships can be used to understand equifinality in how a successful social interaction can be achieved and improve social outcomes for all. This will form the central aim of the current thesis.

1.6. Aims of the current thesis

Overarching thesis aim

Overall aim: To better understand cross-neurotype communication within the context of friendships for autistic people.

The thesis aims to adopt an analogous reasoning approach to understand cross-neurotype communication; understanding how successful cross-neurotype social interaction can be achieved through friendships, and using this as a potential example of successful cross-neurotype communication to inform our understanding of cross-neurotype communication more broadly. Friendships are a highly individual and subjective experiences, necessitating the use of a broad range of methods to provide a holistic picture of friendships and account for individual differences across autistic people. Therefore, the current thesis used a mixed-methods approach, including qualitative and quantitative methods to provide a holistic view of cross-neurotype friendships for autistic people.

Research Question 1

First, amongst autistic individuals without communication challenges or intellectual disabilities, no research to date has integrated autistic adolescent's perspectives on multiple levels of their social worlds. For example, studies generally examine their perspectives on friendship (Daniel & Billingsley, 2010; Rowley et al., 2012), eye contact (Trevisan et al., 2017) or general social interactions (Constantino et al., 2003) but no studies to date integrated all three. This integrated approach may enable adolescents to provide more nuanced responses, for example stating that eye contact is difficult but with the caveat that it may be much easier with friends. This is important on two levels. First, studying these behaviours in isolation can often overlook equifinality, therefore by providing an integrated approach this equifinality in social interactions could be explored. Second, this integrated approach allowed the perspectives of the autistic community on this area to guide the remainder of the thesis (see Discussion chapter). This ensured that the research followed the priorities of the autistic community.

Research Question 1: How do autistic adolescents conceptualise their own social interactions, friendships, and neurotype specific behaviours such as eye contact (Chapter 2)?

This question will be addressed by interviewing autistic adolescents directly on their experiences of their own social interactions, friendships, and eye contact. Themes will then be constructed based using reflexive thematic analysis to highlight the areas that appeared to be most important to the autistic adolescents.

Research Question 2

Second, the vast majority of current research has only examined friendships in autistic adolescents without communication challenges and without intellectual disability, and usually involves autistic people that feel comfortable taking part in an interview setting. However, some autistic people have communication challenges, 50% have an intellectual disability (Russell et al., 2019), and 30% have co-occuring social anxiety disorder (Simonoff

et al., 2008). These autistic people do have a valid perspective to share, but it is often not captured in existing research (Russell et al., 2019).

This is additionally important given that the developmental trajectory of friendships may differ substantially in this group due to either general developmental delays (e.g, due to co-occuring intellectual disability) or specific differences in social development as a result of differences in the language and social environment (e.g, not being able to take part in conversations with peers). There may also be specific differences in friendships for this group due to other domains, for example heightened anxiety or frustration as a result of being unable to express their needs (Tarver et al., 2021). Furthermore, there may be more practical barriers for these adolescents in terms of their own skills (e.g, being able to take part in games with others) or even being unable to express interest in meeting a friend outside school. Without language, these friendships may appear qualitatively different to what would be expected from neurotypical adolescent friendships but nonetheless may still be beneficial for the autistic adolescent.

Research Question 2: How do autistic adolescents with communication challenges and their parents conceptualise their own social interactions, friendships, and neurotype specific behaviours such as eye contact (Chapter 3)?

This question will be addressed by gaining the perspective of a more inclusive range of autistic participants on the issues outlined in Study 1. This will be done with an adapted interview with adolescents where possible and interviews with parents. Measures will be adapted to the abilities of the adolescents and, to guide future research, parental insights will be gathered on how to further adapt existing measures for their to meet their adolescents needs.

Research Question 3

Current research examining cross neurotype social interactions have only examined cross neurotype interactions with unfamiliar social partners (Crompton, Sharp, et al., 2020; Crompton, Ropar, et al., 2020; Rifai et al., 2022). Therefore, there is a gap in the literature for applying these experimental techniques for exploring cross neurotype communication to

friendship dyads. Understanding this is important because friendships are a context wherein high-quality cross-neurotype interactions are likely to be achieved. Therefore, this provides a useful context for understanding mutually rewarding cross-neurotype social interactions and their associated behaviours. In turn, this can inform broader thinking in how to facilitate cross-neurotype social interactions.

Research Question 3: How do communication styles and interaction quality differ in cross-neurotype friendship dyads relative to cross-neurotype stranger dyads for adults (Chapter 4)?

This question will be addressed through comparing autistic-neurotypical and neurotypical-neurotypical friendship and stranger dyads on self-reported interaction quality and social behaviours in adults.

Research Question 4

Finally, note that no studies to date have explored interaction quality in cross-neurotype dyads for adolescents. Adolescent autistic friendships are generally examined using questionnaires or peer nomination approaches (see Friendship section). Or, in a few cases, interviews with the adolescent or the parent (Sedgewick, Hill, et al., 2019; Sedgewick et al., 2016). However, there are no equivalent experimental procedures or measures for assessing interaction quality within cross-neurotype friendships for adolescents. Therefore, first, there is a need to extend exploration of general cross-neurotype interactions in adults to adolescents. This is important because these interactions can demonstrate whether stigma towards autistic people from neurotypicals is also present in adolescence and, if it is, training could be targeted within educational settings (Gillespie-Lynch et al., 2015; Ranson & Byrne, 2014). Second, there is a need to examine these effects in cross-neurotype friendships compared to cross-neurotype stranger dyads. This is important because, similar to Research Gap 3, friendships can provide a context for high-quality cross-neurotype social interactions. Therefore, understanding friendships enables exploration of how equifinality in social interactions can be achieved, and thus this can be used to support cross-neurotype interactions within the school setting.

Research Question 4: How do communication styles and interaction quality differ in cross-neurotype friend dyads compared to cross-neurotype stranger dyads for adolescents (Chapter 5)?

This question will be addressed through comparing autistic-neurotypical and neurotypical-neurotypical friendship and stranger dyads on self-reported interaction quality and social behaviours in adolescents within the school setting.

2 Chapter 2a: Friendships in autistic adolescents

2.1. Autism and social interactions

Social interactions for autistic people have been a key research area across the last few decades (Dawson, Meltzoff, Osterling, Rinaldi, & Brown, 1998; Sigman et al., 1999). Early research often focused on purportedly lower performance on social skills measures relative to neurotypicals; for example differences in performance on Theory of Mind tasks (Baron-Cohen, 1996) or in eye gaze recognition (Nation & Penny, 2008). However, these studies often only examined the autistic person's behaviour within cross-neurotype interactions, and hence missed the dyadic component of social communication (see Introduction for further discussion). For example, neurotypicals are also less likely to want to engage with autistic people (DeBrabander et al., 2019; Sasson et al., 2017) and in turn, this stigma from the neurotypical social partner may influence the social interaction beyond the behaviour of the autistic person alone. Therefore, to understand autistic social interactions it is essential to consider the dyadic nature of the interaction, and how this may be influenced by the societal context autistic people are interacting within.

Studies examining social behaviours and relating this to social outcomes (e.g, typically partner judgements of rapport) have often found that autistic-autistic social interactions have similar levels of efficacy relative to neurotypical-neurotypical social interactions. For example, there is no difference in the accuracy of information transferred during autistic-autistic dyadic interactions and neurotypical-neurotypical dyads (Crompton, Ropar, et al., 2020). However, information transfer difficulties do emerge when pairs differ in neurotype, e.g, autistic-neurotypical dyads (Crompton, Ropar, et al., 2020). Communicative differences for autistic people are also associated with neurotypicals rating them as less desirable to interact with (Rifai et al., 2022; Sasson et al., 2017), but this is not seen when autistic people rate other autistic people (DeBrabander et al., 2019). This effect of reduced desire for neurotypicals to engage with an autistic person persists even when only video or audio information is given, but not in written transcripts from autistic people (Sasson et al., 2017). This suggests that differences may not lie in information that is communicated, but rather in *how* information is presented across neurotypes (Sasson et al., 2017).

These findings are also supported by qualitative reports suggesting that autistic people find interacting with other autistic people considerably easier than interacting with a partner who is neurotypical (Crompton, Hallett, et al., 2020). Furthermore, autistic people report that it is easier to develop a sense of shared understanding and rapport with other autistic people, relative to someone who is neurotypical. Indeed they sometimes state that there is greater opportunity to 'be themselves' in these situations (Crompton, Hallett, et al., 2020). This research suggests that differences in interpersonal behaviour may stem from differences in communication styles across neurotypes (Crompton, Sharp, et al., 2020; Crompton, Hallett, et al., 2020; Rifai et al., 2022) and, in turn, barriers can emerge from different social expectations when interlocutors with different communication styles interact (see Social Behaviours section of the Introduction). This type of interpretation is supported by evidence that behaviours such as eye contact and backchannelling (e.g. the use of communicative prompts such as "yeah", "OK", "uh-huh", "hmm") are associated with higher rapport in neurotypical and cross-neurotype interactions, but not within autistic-autistic interactions (Crompton, Sharp, et al., 2020; Rifai et al., 2022).

Dyadic studies, whilst integral to better understanding the nature of social communication differences across neurotypes, have often used measures such as rapport or first impression ratings (Crompton, Sharp, et al., 2020; Rifai et al., 2022). First impressions can only be established in the early stages of social interactions (i.e, upon first contact), therefore findings are difficult to extend to longer term interactions such as friendships, wherein these first impressions may be changed by future interactions with an individual. This is key as repeated exposure to a specific group is known to reduce associated stigma (Herek & Capitanio, 1996) and increasing knowledge about autism is also known to reduce stigma towards autistic people (Gillespie-Lynch et al., 2015; Ranson & Byrne, 2014; Underhill et al., 2019). Therefore, repeated interactions with an autistic person may increase autism knowledge and reduce stigma. In turn, this may lead to increased shared neurocultural understanding within longer-term dyads (Gillespie-Smith et al., 2024) that enables successful cross-neurotype social interactions. It is possible that cross-neurotype barriers to social interactions may be strongest at the beginning of a social relationship; when neurocultural understanding and knowledge about the other person are at their lowest.

Therefore, it is essential to explore cross-neurotype social interactions within longer-term relationships.

Autism and friendships

One type of longer term relationship is friendships. Friendships can be defined as the affective bonds that exist between two persons intended to facilitate the accomplishment of socioemotional goals (Hartup & Stevens, 1999). Autistic people do report desire for friendships (Cresswell, Hinch, & Cage, 2019) and having close friends is associated with higher self-esteem and more positive wellbeing (Black et al., 2022; Mazurek, 2014). However, for autistic people, initiating and maintaining friendships with non-autistic peers can be challenging (Bauminger et al., 2008; Black et al., 2022; Cook, Ogden, & Winstone, 2018; Cresswell et al., 2019; Daniel & Billingsley, 2010; Mazurek & Kanne, 2010). Difficulties initiating friendships can be understood through the aforementioned mechanisms of stigma 'in the moment' and based on past experiences. For example, in terms of a specific interaction (e.g, the social partner assuming the autistic person is 'uninterested' based on behavioural differences) and in terms of previous experiences (e.g, previous experiences of rejection). Some autistic men have qualitatively reported lower motivation for attempting to initiate friendships with neurotypical peers due to past experiences of rejection (Acker et al., 2018). Alternatively, other autistic people report high motivation to attempt to initiate friendships, but report that it necessitates 'masking', or attempting to appear more neurotypical to avoid potential stigma (Cook et al., 2018; Miller, Rees, & Pearson, 2021). This strategy, whilst potentially making initiating friendships easier, is associated with exhaustion, loss of identity, and potential negative mental health effects (Miller et al., 2021). Taken together, these highlight the potential challenges of initiating friendships for autistic people, and the associated 'cost' of strategies to overcome these challenges.

There has been minimal research focused directly on the maintenance of cross-neurotype friendships for autistic people, however some findings can be gathered from existing qualitative studies on friendship more broadly (Daniel & Billingsley, 2010; Sedgewick, Hill, et al., 2019). Autistic people report the importance of trust and shared understanding interests in developing and maintaining friendships (Daniel & Billingsley, 2010; Sedgewick, Hill, et al., 2019), but also find navigating conflict within cross-neurotype friendships challenging

(Sedgewick, Hill, et al., 2019). Communication style difference may play a role here and could suggest that, whilst initial stigma may be overcome, difficulties still may remain in reaching a shared understanding across neurotypes even within friendship pairs. Furthermore, there is increasing acknowledgement that the emphasis placed on trust within friendships can be a potential risk factor for some autistic people. For example, 'mate crime', or victimisation of autistic people by their often non-autistic friends, has been reported by some autistic people (Forster & Pearson, 2020; Pearson, Rose, & Rees, 2022). This also underscores the importance of appreciating the dyadic nature of friendships; both individuals are responsible for the maintenance of a healthy friendship.

Autism and eye contact

One element of social interactions that often impacts communication of information is eye gaze, particularly eye contact with the social partner (see Eye contact section of the Introduction). Eye contact appears to be an important aspect of neurotypical social communication, for example the proportion and timing of eye contact has been associated with ratings of peer engagement (Wohltjen & Wheatley, 2021). However, eye contact has been reported as less important within autistic communication styles (Trevisan et al., 2017). Therefore, within cross-neurotype communication, eye contact can serve as a useful example for how different communication styles may converge on a successful outcome. For example, perhaps there is modulation in eye contact between social actors (e.g, perhaps a middle ground between autistic and non-autistic partners) or perhaps interactions are more successful when this behaviour is simply less emphasised (e.g, on a phone call). This represents a key avenue for future research.

A plethora of research has examined the role of eye contact during social interactions for autistic individuals (Cook et al., 2017; Falck-Ytter, Carlström, & Johansson, 2015; Jones et al., 2017; Senju & Johnson, 2009). Research has highlighted context-specific differences in eye contact, for example using eye tracking methodology (Chawarska et al., 2012; Kwon, Moore, Barnes, Cha, & Pierce, 2019). Such research has also suggested eye contact differences a potential model for understanding overall autistic social communication (Senju & Johnson, 2009a). However, no studies to date have used these eye tracking methods with friends in naturalistic interactions, instead focusing predominantly on stranger interactions (Auyeung

et al., 2015; Rifai et al., 2022). Therefore, it remains unclear whether these differences in eye contact are specific to stranger pairs. Autistic people have reported finding eye contact with friends considerably easier relative to strangers (Trevisan et al., 2017) and that eye contact with unfamiliar people in particular feels invasive and anxiety provoking. However evidence is limited to a content analysis of autistic people's discussions online. Therefore, there is a research gap in exploring eye contact within pre-existing cross-neurotype friendship dyads through direct questioning.

Autistic voice within friendships

Key insights into understanding cross-neurotype friendships can be gained from the direct perspectives of autistic people (Cook et al., 2018; Sedgewick, Hill, & Pellicano, 2019; Sedgewick, Hill, Yates, Pickering, & Pellicano, 2016). For example, most autistic people rate friendship as important to them (Black et al., 2022; Mazurek, 2014), with some gender differences in which aspects of friendship are considered most important (Sedgewick, Hill, et al., 2019). Furthermore, they highlight that friends can often serve to scaffold other aspects of social interaction, for example introducing additional mutual friends or providing a means to practice social behaviours such as eye contact (Trevisan et al., 2017). However, studies have not yet incorporated friendship perspectives within a broader framework of social interactions, including initiating and maintaining friendships.

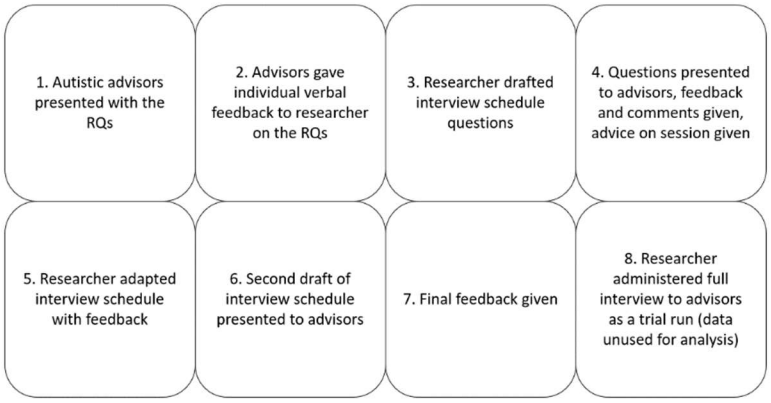
The current study aimed to increase understanding of the perspectives of autistic adolescents regarding their social interactions. This led to three main research questions. First, to understand how autistic adolescents conceptualise their own social interactions, further expanding upon previous research that examined conceptualisations of behaviours such as eye contact (Trevisan et al., 2017) or masking (Miller et al., 2021). Second, this focus on general social interactions will be specifically narrowed down to friendships, building on the known importance of friendships for autistic people (Cook et al., 2018; Mazurek, 2014). Finally, given the nature of eye contact as a potentially neurotype-specific and context-specific behaviour (Davis & Crompton, 2021; Rifai et al., 2022), this research aimed to understand how autistic adolescents experience and understand eye contact, particularly across friendships relative to strangers.

2.2. Method

Co-design

Interview schedules were created in collaboration with four autistic advisors known by the researcher; two adolescents and two adults. They were informed that the study sought to examine the perspectives of adolescents on their social interactions, friendships, and eye contact. This was intended to ensure the interview was relevant to autistic people (Pellicano, Dinsmore, & Charman, 2013), framed in a manner that was accessible to a broad range of autistic people, and avoid assumptions based on neurotypical communication styles (process outlined in Figure 1).

Figure 1: Stages of co-design of the interview schedule



Interview schedule and style

One-to-one semi-structured online interviews included a range of questions broadly separated into three sections: General social interactions, friendships, and eye contact experiences. Typical questions include “In your experience, are there any particularly difficult parts of social interactions?”, “How do you experience social interactions with your friends compared to people you know less well?” and “What does eye contact feel like to you?” (see Supplementary Materials).

Participants

Fifteen autistic adolescents aged 12-17 years (M=14.9; SD=1.3; gender 9 male, 4 female, 2 nonbinary) were recruited via advertising on social media outlets and via local links established by the research team. Opt-in consent was used with parents of all adolescents

providing informed consent for participation and the young person giving additional assent to be interviewed.

No exclusion criteria were set for co-occurring conditions and the core diagnosis needed to be autism. Three participants had co-occurring diagnoses of Generalised Anxiety Disorder, one had dyslexia, one Pathological Demand Avoidance, one Developmental Coordination Disorder, and one Sensory Processing Disorder. Participants were all attending fulltime mainstream education, had English as a first language, had a parent-confirmed autism diagnosis, and were currently UK residents. Participants were reimbursed £10 for their time.

Procedure

Interviews were conducted online via Microsoft Teams by the lead researcher, with participants told in advance they had the option of turning their camera off or keeping it on depending on preference. One participant kept their camera off during the interview. Interviews were audio recorded using Open Broadcaster Software (OBS), with initial automatic transcription via Microsoft Teams checked against OBS recordings and anonymised. Parents were asked to be present at the beginning and end of the interview for confirming consent and debriefing. Participants were given the choice of whether the parent should be present during the interview itself. Eleven parents left prior to, or during, the initial two questions of the interview and four participants requested having their parent present beside them during the whole interview. In the instances when parents remained present, they were asked to let the participant speak first and then they could add their thoughts during the debrief. Only adolescent contributions were analysed.

Analysis

Reflexive thematic analysis (Braun & Clarke, 2006, 2013, 2019) was carried out by the lead researcher using NVivo to analyse transcriptions and assist theme construction. It has been argued that qualitative research should aim to reach ‘saturation’. However, the concept of saturation may be a logical fallacy (Braun & Clarke, 2021; Low, 2019; Mason, 2010; Nelson, 2017); researchers cannot be certain that the next interview will not provide additional insights. This is particularly the case given the variability between autistic participants.

Therefore, conclusion of data collection and sample size was determined based on feasibility and pragmatic considerations (Braun & Clarke, 2021; Low, 2019).

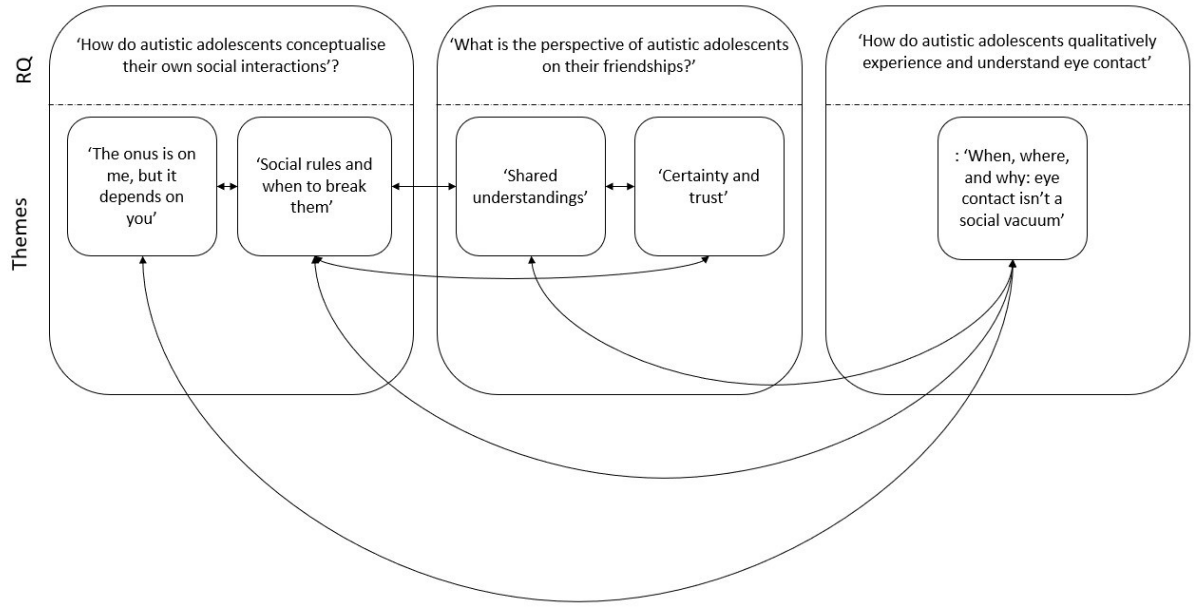
First, transcripts were read alongside interviewer notes to assist familiarisation with the dataset. Second, both semantic and latent codes were established which related to a specific meaning that related to a research question. For example, 'enjoyment of social interactions with friends', taken directly from participants, and 'I need to make the other person feel comfortable', a latent code implied by participants but not explicitly stated. Codes were initially developed separately within each section of the interview however codes were often shared across sections (e.g, participants would discuss friendships in the social interaction section). Therefore, on a second coding pass, codes were developed across the entire transcript. From this list of codes, themes were constructed through establishing conceptual links between codes using mindmaps and highlighting codes that may reflect a shared conceptual basis. Themes were not atheoretical, instead they were constructed with relation to both the research questions and with consideration of existing theory, such as double empathy (Milton, 2012) and autistic masking (Miller et al., 2021). Analysis sought to extend existing knowledge and challenge assumptions through giving voice to the constructed social reality of autistic participants. This abductive logic (Timmermans & Tavory, 2012) is consistent with a constructivist epistemology and placed the researcher in a role of developing a narrative from participant perspectives to increase understanding for both researchers and the general public regarding autistic peoples' experiences.

The researcher emphasised reflexivity, as they are constructing the narrative for a group they are not situated within. The lead researcher, whilst having multiple autistic siblings, is an NT male lacking lived experience of autism. Therefore, to aid reflexivity, themes were discussed and redeveloped with two autistic adults known by the researcher (same individuals as in the design phase) and two female undergraduate research assistants with experience caring for or teaching autistic adolescents. Discussions served to highlight assumptions made by the lead researcher, and identify novel means of constructing themes. Advisors generally agreed with the themes constructed and felt they related to their/others' experiences well, in particular discussions around friendship and anxieties around strangers.

2.3. Results

Results are structured around three main research questions with constructed themes within these (see thematic map; Figure 2). Frequency data will be reported in general terms. Phrases such as 'overwhelmingly' refer to greater than 13 participants, 'most' or 'many' refers to 10-13 participants, 'some' refers to between 5-10 participants, and 'a few' refers to less than 5 participants. All names are given as pseudonyms, and additional example quotes within each theme are given in Appendix 1a.

Figure 2: Chapter 2a themes



RQ1: 'How do autistic individuals conceptualise their own social interactions and potential difficulties'?

Most participants described enjoying social interactions with friends. However, social interactions with strangers were often described as difficult or anxiety-provoking. Two main themes were developed.

Theme 1: 'The onus is on me, but it depends on you'

Participants often spoke in terms of their own behaviour and needing to make others feel comfortable when socially interacting.

"I kind of adapt to the people I'm talking to. So if they look at me and make eye contact, that's fine. And if there's someone that doesn't make eye contact with me? Also fine.", Sarah

One older autistic adolescent did acknowledge the dyadic nature of social interactions, with particular note of how this masking may be anxiety provoking and unenjoyable:

"[as an autistic person] You tend to get quite anxious in social interactions. So I guess my advice is, have a breather. Just, try not to worry and focus on yourself as much. Just try to enjoy it, and then it can be enjoyable for you both… It can help if the other person is more… More accommodating I guess you could say? If you're struggling to get your words out, something like "No rush", or "No worries", stuff like that does help", John

This was the only participant to, unprompted, discuss the role of their social partner in social interactions, highlighting that most autistic adolescents felt the onus was predominantly on them. When prompted, most participants described how their enjoyment of a social interaction did also depend on the social partner, with interactions with friends or family being particularly enjoyable. In turn, this interacted with their own behaviour, with participants describing how they could behaviourally 'be themselves' with their friends, but were quiet or withdrawn with strangers.

"Like, with my mates it's alright, I trust them. With strangers… Normally I'm like the most quiet person you'll ever meet when I first meet someone…" , Sarah

Theme 2: 'Social rules and when to break them'

During interactions with neurotypical partners many social norms can be understood in terms of implicit 'social rules'. Participants often described finding some of these social rules challenging to navigate.

"The more I know someone, the more topics I can cover with them. Discuss with them. But if I don't know anyone at all, everything I say is a risk, and I prefer playing it safe.", Anna

This quote suggests a potential interaction of unfamiliar/familiar conversation topics and unfamiliar/familiar person. First, a familiar conversation, such as a scripted response, appears to be less challenging for the autistic person relative to an uncertain conversation. This reduced uncertainty from a familiar topic then reduces the risk of breaking a social rule. Second, a familiar interlocutor appears to reduce the potential social cost of breaking these rules.

"I know when I'm around my friends I feel like I have leeway to be slightly rude because they'll just laugh. If I'm around a stranger I'll be more polite, because I don't know how they will take it. If they'll find it offensive or what?", Alex

This highlights that these implicit social rules are only as powerful as their enforcement, with participants feeling the potential 'social cost' of breaking social rules to be considerably lower with friends.

RQ2: 'What is the perspective of autistic individuals on friendship and their friends?'

All participants were able to name at least one friend, typically a classmate or, in two cases, a cousin. This is consistent with other studies (Crompton, Hallett, et al., 2020; Sedgewick, Hill, et al., 2019; Sedgewick et al., 2016). Participants often described small, close-knit friendship groups that were highly important to them emotionally and in terms of shared

interests, consistent with previous research (Baron-Cohen & Wheelwright, 2003; Daniel & Billingsley, 2010; Kuo et al., 2013; Mazurek, 2014; Petrina, Carter, & Stephenson, 2014).

“I remember in primary school I didn’t have many friends. I got really lonely and sad. So then I moved to secondary and I’ve got all these new friends and they appreciate me as a person. If I didn’t have that… I’d still be really lonely and I’d be sad!”, Sarah

Two themes were constructed in terms of friendships. First, a shared understanding amongst social partners and, second, a sense of certainty and trust.

Theme 1: ‘Shared understandings’

Most participants described social interactions with their friends as easier than interacting with strangers, often stating that their friends ‘understand them’. The nature of this shared understanding was seen in multiple areas. First, in terms of neurotype, some autistic adolescents (n=6) stated a preference for initiating friendships with other autistic adolescents, consistent with Double Empathy models and existing research on autistic friendships (Crompton, Sharp, et al., 2020; Crompton, Hallett, et al., 2020; Crompton, Ropar, et al., 2020). However, others highlighted that shared neurotypes were not sufficient for friendships and some variation was identified even within neurotypes.

“Two of my friends are autistic. One of them I really get along with. Obviously autism is different in lads and lasses, and like me and her kind of understand each other. But the other… Like, for boys it’s different isn’t it? His autism just doesn’t like my autism! So it varies a bit.”, Alex

Some autistic participants highlighted that they were indifferent to shared neurotype as a preference for their friends, instead highlighting other factors such as kindness.

“It matters more about their personality. So autistic or not, doesn’t really make a difference. Matters more if they’re kind.”, Sarah

In addition, shared interests were overwhelmingly identified as the most common pathway to developing friendships, consistent with homophily preferences being shared across autistic and neurotypical adolescents (Berndt, 1982; Black et al., 2022; Youniss & Haynie, 1992).

“We all like the same board games and stuff, and then we all like talking about the same things. All my friends like dark humour, which I’m really into. And we’re often sarcastic with each other. So we have like, similar interests as well as being a diverse group.”, Emma

This importance of shared interests was also discussed when asked about previous interventions. For example, some participants stated how interventions centred around an identified shared interest, such as drawing, could be highly effective. However, in other cases participants described being simply placed in groups with other neurodivergent students.

“The tasks were really weird. Like a cooperative teamwork game which I found to be pointless and… Condescending? Blockbuilding to make a tower? I just didn’t engage well with the other students.”, Paul

These settings were described as unhelpful as participants felt the tasks did not focus on a shared interest or understanding, and in some cases felt age-inappropriate. Furthermore, a few participants mentioned how these kinds of interventions can also be counter-productive, as they were taken out of a setting with their existing friendship group (e.g, seated with friends in a classroom) and sent to a new room to learn to ‘make friends’.

Theme 2: ‘Certainty and trust’

The majority of participants described friendship as important to them, mapping to research across neurotypes (Berndt, 1982; Black et al., 2022; Youniss & Haynie, 1992). In particular, they emphasised the importance of trust, reliability, and dependability of their friends.

“Trust, knowing that someone’s not going to lie to me… Is the most important thing in a friendship for me? If that’s mutual, I would call them a true friend.”, Gary

This strong emphasis on trust and honesty is potentially a response to previous negative friendships, by insisting on honesty to accommodate for difficulties in identifying risk factors. A few participants did discuss this trust as a potential risk factor and led to potentially toxic friendships (Forster & Pearson, 2020). However, the vast majority of described friendships were positive. The trust and certainty stemming from healthy friendships often also scaffolded interactions in anxiety-provoking settings.

“When I finally got diagnosed with autism. I cried. I didn’t tell anyone. I didn’t tell my classmates. But I told him. I don’t know why, it’s just that I trusted him.”, Peter

RQ3: ‘How do autistic adolescents qualitatively experience and understand eye contact’

When speaking about eye contact, participants tended to be more brief with their answers relative to discussing social interactions or friendships. For example, one sentence or one word answers were considerably more common. One participant reflected on this fact.

“It’s kinda difficult for me to talk about eye contact because I don’t really think about it. It’s not that important for me, so I don’t have much to say about it? How can you talk about something you don’t think about?”, James

Theme 1: ‘When, where, and why: eye contact isn’t a social vacuum’

When discussing their experiences of eye contact participants often qualified their statements with specific contexts where they would be more or less likely to make eye contact. One of the main contributors was the identity of the social partner, with participants describing eye contact with their friends as considerably easier.

“My eye contact… It did begin with friendships. When I was talking with my friends, I could always look them in the eyes. But when I talked to adults or strangers I never could. But over time practicing with friends has helped a lot. Nowadays I can talk to strangers and look them in the eyes. And if I do get a little anxious I will look at their forehead instead, so I don’t seem rude.”, Ben

The reported usefulness of eye contact in social interactions varied substantially across participants. Whilst most participants identified that eye contact is important for NTs, responses regarding how they used their own eye contact was considerably more mixed. Most participants described the importance of demonstrating attention and not appearing rude to NTs, with discussions of emotional valence or intimacy considerably rarer.

“Even though in reality I might not be listening… Eye contact looks like I’m giving them attention. Giving them attention so you can have a conversation.”, Alex

Note that many social interactions do not involve eye contact, such as online communication which was reported as easier by a few autistic participants in this study and elsewhere (Davidson, 2008). This emphasises the diverse pathways to achieving a social interaction, and may have implications for facilitating social interactions overall. For example, it is known that online communities can be useful for developing friendships and a sense of belonging for some autistic people (Stone et al., 2019). Finally, costs of using eye contact were discussed by some participants, highlighting that the use of eye contact may not be always beneficial for autistic people.

“I can’t really talk when I am making eye contact usually, unless I really need to. It’s hard to like, think straight, when I’m making eye contact. Whereas if I look away then I can actually tell what they’re saying.”, Sarah

2.4. Discussion

It is essential to appreciate that autistic adolescents are socially interacting within a predominantly NT society, so it may be socially adaptive to attempt to adapt to neurotypical peers (Fombonne, 2020; Lai et al., 2017; Tubío-Fungueiriño et al., 2021). This supports

existing research highlighting that masking occurs at least as early as adolescence (Sedgewick, Hill, et al., 2019; Sedgewick et al., 2016) and that it may represent an internalised adaptive mechanism for socially interacting with neurotypical society (Lawson, 2020; Miller et al., 2021). Furthermore, the notion of masking as a potential stigma reduction strategy (Miller et al., 2021) also received some support from participants, with particular emphasis that they struggled to 'be themselves' with strangers and were particularly concerned by how others may react. However, the current study also expands upon this in the context of friendships, with participants highlighting that with their friends they felt both more confident behaving as themselves and that anxieties around the uncertainty of the interlocutors responses were greatly reduced. One means to conceptualise this may be that the trust towards friends constrains the potential responses that the autistic person may predict by their social partner in response to their own behaviour – for example, the autistic people felt it unlikely their friends would reject them for breaking social rules. Indeed, this would additionally be consistent with the emphasis on trust from both the participants in this study and in earlier research (Black et al., 2022; Daniel & Billingsley, 2010; Sedgewick, Hill, et al., 2019). Hence, this trust may constrain the possibility of potential reactions and reduce this feeling of uncertainty, perhaps analogous to similar frameworks applied within Bayesian approaches to understanding prediction in autism (Palmer et al., 2017).

This is of particular importance given that most studies use strangers as interlocutors when attempting to understand autistic social interaction (Crompton, Sharp, et al., 2020; Crompton, Ropar, et al., 2020; Kwon et al., 2019; Oberwelland et al., 2016). It is possible that anxiety and uncertainty leads to greater challenges in social interactions with unfamiliar people in autistic adolescents relative to neurotypical adolecents (albeit with the caveat that neurotypical experiences were not explored in the current study). Multiple participants stated that with strangers they would remain quiet and attempt to strictly adhere to what is 'expected' of them. Therefore, this strategy of acting more reserved is likely intended to avoid rejection, which is consistent with previous research (Acker et al., 2018). However, amongst friends, they would feel more confident sharing more about themselves and feel less need to 'play it safe' within a social interaction. Nonetheless, this finding mirrors similar qualitative findings examining autistic-autistic social interactions

(Crompton, Hallett, et al., 2020), however the participants in our study described how this feeling was neither exclusive to, or inevitable within, same-neurotype pairs. Instead, they characterised it more as a feature of friendship, with friendship in turn based on a shared understanding and trust. Shared neurotype can then potentially facilitate this shared understanding, but was not necessary as they reported their neurotypical friends could understand them well. This finding is consistent with reduction of stigma in neurotypicals with increasing knowledge and understanding of autistic people (Jones, Morrison, et al., 2021; Jones, DeBrabander, & Sasson, 2021), suggesting that this stigma can be overcome to achieve rewarding friendships and emphasising potential equifinality in how social interactions and friendships can be achieved. Secondly, shared neurotype was not seen as sufficient as two autistic people may still have different experiences and perspectives. Indeed, one limitation of the Double-Empathy framework (Milton, 2012) is that it may potentially overstate the homogeneity within both autistic and non-autistic populations. A range of other characteristics may shape perspectives and communication styles independently of, or in conjunction with, autism. For example, gender (Sedgewick, Hill, et al., 2019), school background (Cook et al., 2018), intellectual disability, family background, or other co-occuring conditions.

In terms of friendships, this research highlights the role friendships can play in supporting other domains. This influence on other domains is often overlooked, with 'social-domains' often examined in isolation (Barak & Feng, 2016; Chevallier, Kohls, Troiani, Brodkin, & Schultz, 2012; Elsabbagh & Johnson, 2010; Senju & Johnson, 2009a) despite likely developmental cascades between domains over time (Hahn, 2016; Masten & Cicchetti, 2010). Participants provided multiple examples of this, with trusted friends creating a potential source of certainty and stability during uncertain events such as receiving an autism diagnosis or even taking a bus. In turn, this has implications for emotional regulation (Mazefsky et al., 2013), daily living skills, mental health (Hedley, Uljarević, Bury, & Dissanayake, 2019), and quality of life (Mason et al., 2018). Previous research has highlighted the role having at least a few good friends for mental health for autistic people (Black et al., 2022; Hedley et al., 2019; Mazurek, 2014), however the current study provides examples for future exploration on how existing friends can be used to improve quality of life for autistic people (e.g, in supporting developing life skills). Likewise, participants

highlighted the need to identify shared interests when practitioners seek to facilitate initial friendships and the potential value of 'friends of friends' in broadening social connectedness. These insights have direct relevance within school settings, wherein existing friendship support was sometimes described by participants as counter-intuitive or not helpful.

Finally, in terms of eye contact within social interactions and friendships, understanding the role of the social partner in eye contact is essential given the use of eye contact as a 'social model' for understanding autistic social communication (Cook et al., 2017; Fonger & Malott, 2019; RajKumar, Arora, Katz, & Kapila, 2019; Senju & Johnson, 2009a; Ye et al., 2012). But these reports suggest that autistic eye contact may be more complex, context specific, partner-dependent, and idiosyncratic feature of overall social communication. For example, many participants highlighted eye contact with friends as easier, consistent with previous research (Trevisan et al., 2017), but nonetheless some friends would simply accommodate lower levels of eye contact.

These findings also suggest the NT purpose of using eye contact to gain social information may also differ from autistic peoples purpose of using it predominantly to demonstrate attention or accommodate peers (ie, to not appear rude). This variation in how eye contact is being used across neurotypes may explain known differences in the proportion of neurotypical eye contact between studies despite relative consistency in the proportions of autistic eye contact across studies (Hanley et al., 2015; Nadig et al., 2010). That is, it may be that neurotypical individuals are more likely to modulate their eye contact across contexts based on the social information required, whereas the purpose of autistic eye contact is to demonstrate attention and accommodate peers, so may be less modulated based on their own social information requirements. An eye contact 'cost' was also seen at the emotional level by some autistic adolescents, often reporting feelings of anxiety or uncertainty regarding eye contact. This may link to hyperarousal accounts (Pellicano & Burr, 2012; Senju & Johnson, 2009a), and is consistent with eye contact being described as invasive or intimate in previous research (Trevisan et al., 2017). This additional emotional labour required may explain some of the reports of exhaustion associated with social interactions both in the current study and elsewhere (Pellicano et al., 2021; Trevisan et al., 2017).

However, a lack of emphasis placed on eye contact despite the majority of autistic people emphasising the importance of friendships and social interactions, suggests that the assumed link between social interaction skills and eye contact in autism may be tenuous, mirroring both studies highlighting the neurotype-specificity of eye contact (Crompton, Sharp, et al., 2020; Davis & Crompton, 2021) and studies highlighting the difficulties in demonstrating links between 'social skills' and naturalistic social performance (Morrison, DeBrabander, Jones, Ackerman, et al., 2020). This perhaps suggests a need to move beyond simple comparisons of autistic/non-autistic eye contact (and broader communication styles) and towards understanding how equifinality in successful social interactions can be achieved. Indeed, participants gave many examples of this, such as walking side-by-side, shared understanding, and different formats such as online communications. Future research exploring successful cross-neurotype interactions such as within friendships may provide into facilitating successful social interactions for all.

Limitations

First, it was impossible in the current study to distinguish the extent to which some of the perspectives are influenced by general social anxiety, co-occurring conditions, or being autistic; for example, non-autistic socially anxious people also often find eye contact challenging (Hessels, Holleman, Cornelissen, Hooge, & Kemner, 2018; Schneier et al., 2011; White et al., 2014; Wieser et al., 2009). However, note that it is challenging to determine the extent to which constructs such as social anxiety, autism, and other neurotypes can be separated in a meaningful manner. First, note that 70% of autistic people have at least one other co-occurring condition (Simonoff et al., 2008), and therefore it is the norm for autistic adolescents to have at least one other diagnosis. Indeed, the current study took the stance that social anxiety, both clinical and subclinical, and other co-occurring conditions are part of the lived experience of many autistic people and therefore excluding on this basis would be removing valid perspectives within the autistic community.

It also remains unclear the extent to which these interviews may relate to 'real' social behaviour. This was not wholly problematic for the current study given that the purpose was to collect the constructed reality of the participants and is indifferent to whether this

may relate to an ‘objective’ social reality. However, there is a need to complement these perspectives with analysis with measurement of social interactions directly in the future. Equally, in terms of reflexivity, it would have been beneficial to have interviews carried out by autistic people (Pellicano et al., 2021) and for autistic people to be more heavily involved in analysis; particularly in using their own experience to construct themes within the analysis.

The current study also comes with the caveat that all participants responded to a recruitment post advertising a study on friendships and social interactions. Therefore, it is likely there was some self-selection bias with autistic adolescents, with more interested in friendships more likely to take part. Furthermore, given the interview setting, autistic adolescents with social anxiety or few or no words would be unable to take part. In this sense, the perspectives given do not include these members of the autism community. The perspective of the members of the autistic community that find interview settings challenging is underrepresented across autism research (Russell et al., 2019). Therefore, Chapter 2b will expand upon the current study with a sample of autistic participants that would not typically be able to take part in an interview setting.

Chapter 2b: Friendships in autistic adolescents with communication difficulties and/or social anxiety

2.5. Introduction

Research has emphasised the need to incorporate the autistic voice into current research (Sue Fletcher-Watson et al., 2019; Poulsen et al., 2022), including the current thesis (see Chapter 2a). However, it is essential to consider that the interview-style approach adopted in the current thesis, whilst effective in gaining the perspective of a subgroup of autistic people that are able to report their experiences, is not feasible for collecting the perspectives of all autistic people. In particular, these interviews are ordinarily not able to collect the perspectives of autistic people with co-occuring intellectual disability (ID), anxiety, or language difficulties. This is particularly key as an estimated up to 50% of autistic people have some form of ID (Charman et al., 2011; Fombonne, 2003; Matson & Shoemaker, 2009) despite a recent meta-analysis highlighting that only 6% of autistic people involved in research have ID (Russell et al., 2019). Likewise, 30% of autistic people have a diagnosed social anxiety disorder (Simonoff et al., 2008), with anxiety on average higher across autistic people even without co-occuring diagnoses (White, Oswald, Ollendick, & Scahill, 2009). In turn this anxiety may raise additional challenges when co-occuring with language difficulties (Tarver et al., 2021). Finally, 25% of autistic people have some form of language difficulties, often described as 'minimally verbal' or 'few or no words' (Brignell et al., 2018). Therefore, current autism research currently vastly underrepresents a large subgroup of the autistic population (Jack & Pelphrey, 2017; Russell et al., 2019; Tager-Flusberg et al., 2017), with this being further compounded in studies aiming to gain the perspectives of autistic people such as via interviews.

Gaining the perspectives of autistic people is integral in refining existing theories (Trevisan et al., 2017), ensuring that research is guided by the autistic community (Sue Fletcher-Watson et al., 2019), and improving relations between the research community and autistic community (Botha et al., 2022; Bottema-Beutel et al., 2020; Sue Fletcher-Watson et al., 2019; Gernsbacher, 2017). Therefore, there is a need to broaden research to involve a variety of abilities and perspectives to ensure that research is inclusive.

Ensuring that existing research is inclusive to a range of autistic perspectives is important because insights may differ between autistic with and without these additional needs. For example, it is known that ID alone is associated with less warm, close, and reciprocal friendships than peers without ID (Tipton, Christensen, & Blacher, 2013), and two studies have attempted to gain the perspectives of people with ID on their friendships (Fulford & Cobigo, 2018; Knox & Hickson, 2001). Adults with ID have highlighted the importance of friendships in providing support, building upon shared interests, and reflecting on their shared history (Fulford & Cobigo, 2018), but equally describe barriers in their friendships, such as limitations on their autonomy restricting the kinds of activities that could be carried out together (Knox & Hickson, 2001). Therefore, it is imperative to both increase overall representation of autistic people with these additional needs in research, and to better understand their perspectives on their social worlds.

To improve representation of autistic people with additional needs in research, it is essential to consider the reasons for this underrepresentation so that specific barriers can be targeted. Three key reasons can be suggested for this gap from a researchers perspective. First, there is little guidance on how to carry out research on these populations, particularly in terms of which adaptations to interviews or research methods may be most effective. Some guidance has been published regarding adapting neuroimaging and behavioural research (Jack & Pelphrey, 2017; Tager-Flusberg et al., 2017), some alternative communication tools have been developed (Bradshaw, Gore, & Darvell, 2018), and methods such as Photovoice has been used to try and minimise constraints (Ha & Whittaker, 2016; Lam, Holden, Fitzpatrick, Raffaele Mendez, & Berkman, 2020; Sutton-Brown, 2014). But nonetheless, problems remain in how to combine results at the analysis stage (e.g, comparing between participants with these co-occuring conditions is difficult to interpret), and then how to standardise and sensitise measures across a wide range of abilities.

Secondly, research including these populations is highly time consuming and requires some specialist knowledge – in researcher training on specific tools and methods (Bradshaw et al., 2018; Do, Frawley, Goldingay, & O'Shea, 2021; Ha & Whittaker, 2016), recruitment beyond university settings and avoiding selection bias (Russell et al., 2019), and designing or adjusting data collection methods (see Methods). Overcoming these barriers is difficult but

could be done through collaboration with professionals in other fields. For example Speech and Language Therapists are often already trained on a range of communication tools and likely already have relationships developed with specific clients, hence they can provide recommendations to adapt to their idiosyncratic needs.

Third, it is essential to acknowledge that autism research is often driven around testing, refining, and falsifying specific theories (Popper, 1963). This necessitates holding potential extraneous variables such as co-occuring conditions constant to test a main hypothesis. In turn, this has two potential implications for involving autistic people with additional needs. First, it could be assumed that these additional needs are a potential extraneous variable, and therefore must be controlled for, often leading to direct exclusion criteria based on these co-occuring conditions (Baron-Cohen et al., 2001; Bauminger et al., 2008; Bauminger & Shulman, 2003; Kamio, Inada, & Koyama, 2013; Lai et al., 2017; Nadig et al., 2010; Rao, Beidel, & Murray, 2008). However, this approach does open the possibility of studies investigating specifically these co-occurences (Brignell et al., 2018) if the previous barriers could be overcome. Nonetheless, this approach necessitates a separation of studies along these co-occuring conditions. Second, it could be assumed that viewing these additional needs as extraneous variables is imposing arbitrary homogeneity on the autistic population. That is, it could be that these co-occurences themselves represent typical variation across the autistic population. Indeed, co-occuring conditions in autism such as ID, social anxiety, and language difficulties are very common (Fombonne, 2003; Simonoff et al., 2008). This approach involves integrating autistic people with and without additional needs into the same studies, and would potentially improve generalisability of findings, but would increase potential 'noise' from variability in autism research and make selection of appropriate measures difficult (see previous challenges).

These challenges highlight the barriers to participation in research for autistic people with additional needs from a researcher perspective. However, it is also essential to consider these barriers from the perspectives of autistic people themselves to identify additional challenges to participation that may not be obvious to researchers and better adapt future studies. Therefore, this chapter has two main aims. First, to replicate Study 1 with autistic adolescents with these additional needs, in turn highlighting the extent to which some key

themes may be shared and how some perspectives may unique to this subgroup of autistic adolescents. In this sense, the research questions were shared with Study 1. Specifically, to understand the perspectives of autistic adolescents with social anxiety, ID, and communication challenges that means a standard interview would not be appropriate on their social interactions, friendships, and eye contact. Second, to explore some of the barriers to gaining the perspectives of autistic adolescents who would generally not be able to take part in an interview approach.

2.6. Method

Participants

10 autistic adolescents aged 12-17 years (mean age: 14.3 years, SD=1.7, 4M, 5F, 1NB, mean age of diagnosis: 6.64 years, SD = 4.38) and their parents were recruited via the same sources as Study 1. As with Study 1, sample size did not aim for saturation but rather was based upon feasibility within the time constraints of the project and pragmatic considerations (Braun & Clarke, 2021; Morse, 2015). All adolescent participants had a clinical autism diagnosis and communication difficulties and/or social anxiety confirmed by parents. These additional needs were such that parents and, where possible, the adolescents themselves felt a typical interview would not be appropriate for gaining their perspective. No restrictions were placed on co-occuring conditions. All adolescent participants were raised in predominantly English speaking households, resident in the UK. Direct IQ measures were not collected to determine the degree of ID, however all participants were in full-time specialist autism schools. Adolescent participants were reimbursed with a £10 voucher for their time.

Co-occuring conditions were overwhelmingly common, with only one participant not having at least one diagnosed co-occuring condition. Note that having few or no words is not typically considered a condition, however this information is relevant for the interviews and was often specified by the parents so it will also be included. Diagnoses were not mutually exclusive, therefore proportions do not sum to 100% (Table 1).

Table 1: Chapter 2b participant co-occuring conditions

Co-occuring condition	Frequency (% of sample)
Social anxiety disorder	60%
Few or no words	50%
ADHD	30%
OCD	20%
Sensory processing disorder	20%
Generalised anxiety disorder	10%
Borderline personality disorder	10%
Developmental coordination disorder	10%

Data collection approach

The approach taken involved designing several distinct data collection methods, interviewing parents, and then selecting the most appropriate for the needs and abilities of each autistic adolescent. The study began with an online interview with the parent using the same interview schedule and process as Study 1. This ensured that some data could be collected for all participants even in circumstances where no data collection with the adolescent was possible. The author appreciates that the perspectives of parents are not ideal considering that many adolescent friendships occur within a school setting outside of the view of parents (Jones & Frederickson, 2010; Locke et al., 2010; Mruzek, Cohen, & Smith, 2007) and friendship itself is a personal experience for each individual (Knox & Hickson, 2001). There is an influence of the informant chosen in other research areas, such as school adjustment and social inclusion (Jones & Frederickson, 2010; Makin, Hill, & Pellicano, 2017). But nonetheless, parents also have the benefit of knowing their child well, and hence can give idiosyncratic feedback in terms of what would work for their child specifically (Glascoe, 1999, 2000; Johnson & Katz, 1973). This approach has been highly influential, for example the community sample outlining the autism research priorities created by Autistica was comprised of 23% autistic people and 52% caregivers of autistic people (Autistica, 2016). Nonetheless, parental perspectives alone are not sufficient to capture the direct experiences of autistic people. Therefore, at the end of the interview parents were consulted on what data collection strategies may be best for gaining the perspective of the adolescent directly. Then a data collection strategy that was most accommodating for the specific needs of the autistic adolescent was used to collect their

perspective directly. This provided a multi-informant approach intended to explore the social worlds of these adolescents.

The perspective of the adolescent was collected directly in 5 out of 10 interviews (see Limitations). These direct responses involved three written questionnaire responses and two verbal interview responses. However, the parents perspective was collected through interviews with all 10 parents. This gives a total dataset of 10 parental interview transcripts, 3 adolescent questionnaire responses, and 2 adolescent transcripts. Participants were also given the option of using art methods, multiple choice responses, or typing responses in the chat but given that no participants selected these options these will not be discussed further (See Appendix 2).

Parental Interviews

A parental interview was administered using an adapted version of the interview schedule in Study 1 (see Appendix 3). As previously, this interview was attempting to examine the experiences of social interactions, friendships, and eye contact for autistic adolescents, however questions were adapted to apply to parents. Parents were told that some questions they may not know directly (e.g, whether their adolescent finds eye contact challenging), but that the researcher will take this into account when considering the findings. In some cases clarification could be received from the adolescent directly when a parent was unsure (e.g, the adolescent was often present during the entire interview and where appropriate parents would consult with the adolescent). In this sense, the familiarity of the parent with the adolescent and vice versa allowed them to act as a 'bridge' in some instances.

Data collection with the autistic adolescent

Data collection began with the parental intervention. At the end of the parent interview, parents were asked which data collection method they felt would be most appropriate for their son/daughter. Several potential methods were offered to parents to best accommodate the needs of each autistic adolescent. These are outlined below.

Adapted interviews

Interview schedules used in Chapter 2 (see Appendix 3) were adapted following guidelines specified in previous studies working with autistic adolescents with communication difficulties (Courchesne et al., 2021). This included the use of pictures, reformulating questions, offering various options for the adolescent to respond with, providing adolescents with a video clearly explaining the research, providing participants with a video including the face of the researcher, providing sufficient time for participants to answer, and highlighting non-responses as a valid form of response. Two adolescents were seated or pacing in the room with the parent during the parental interview (enabling them to build familiarity and know what is likely to happen during their own interview). Then, following the parental interview, they expressed that they were comfortable and able to go through the same process themselves with the parent still present (one of these participants also would occasionally interject during the parental interview and some of the dialogues stemming from this were analysed). These two participants reported experiencing selective mutism and would typically not be able to speak during the anxiety-provoking context of an interview. However, adjustments eased this anxiety sufficiently and removed the barrier to enable them to take part.

Written questionnaire

Participants could fill in a questionnaire with the same questions provided in the adapted interview (Appendix 3). This removed the time, verbal, social interactional, and anxiety demands of the interview. All questions were based on the interview given in Study 1. Three adolescents were happy to fill in these questionnaires as a data collection strategy. This included two participants with few or no words, enabling representation of this underrepresented group of autistic people (Jack & Pelphrey, 2017; Russell et al., 2019; Tager-Flusberg et al., 2017) with this somewhat minor adjustment to data collection. Parents reported often supporting the adolescent during this form of data collection (e.g, keeping them on task). Given the online nature of this research it was difficult to assess this level of support. Indeed, whilst it could be argued that it would be more valid for them to fill in the questionnaire during the call, this would not reflect the flexible nature of how the parents described supporting this data collection (e.g, spreading the questions out over time).

Transcription

As with Study 1, interviews were transcribed using Microsoft Teams automatically and then compared to audio recordings made via a dictaphone and OBS to correct any mistranscriptions and remove identifying information. Questionnaires were available in a written format directly so simply required anonymising. As in Study 1, overt behaviours relevant for communication were labelled on the transcript, and in addition instances where multiple social actors spoke (e.g, the parent talking to the adolescent) were labelled in the transcripts.

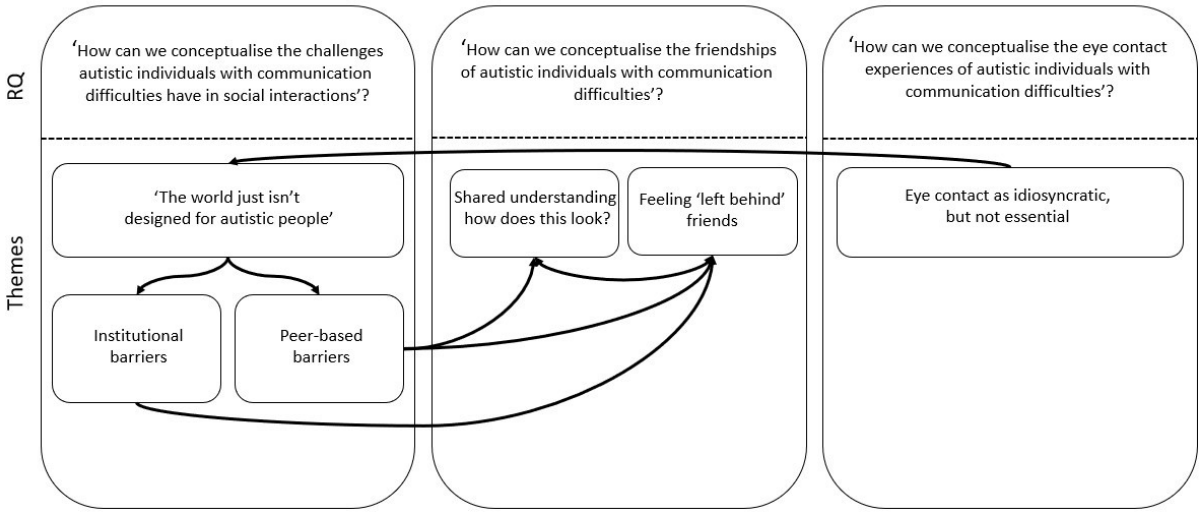
Analysis

Data were analysed using Reflexive Thematic Analysis (Braun & Clarke, 2006, 2019, 2020) following the same procedure as Study 1. This analysis method enabled both questionnaires and written transcripts to be analysed together as codes could be developed across data collection formats. Speakers and format information (e.g, written directly or spoken and then transcribed) were available when coding. The same constructivist epistemology, procedure, and discussion of themes with research assistants was used as previously (see Chapter 2). The main difference was that the respondent was labelled (ie, whether it was said by a parent or the adolescent) and the formats of the data varied (ie, questionnaires and interview transcripts).

2.7. Results

Four themes centred around three research questions were constructed from the interviews with parents and autistic adolescents that were able to communicate their views, similar to Study 1 (Figure 3). Themes are not atheoretical and will be discussed with reference to existing theory (see Study 1).

Figure 3: Chapter 2b themes



Responses will be presented together as adolescents often worked with the parent or had them present to provide scaffolding when giving answers (e.g, support writing the response or being present during the interview and offering their own contributions). Responses were similar between parents and adolescents, although parents were more likely to elaborate on aspects such as institutional barriers to receiving support whereas adolescents tended to focus on specific events (e.g, whilst parents often discussed the challenges of accessing support and groups for their child to make friends, the adolescents themselves often mentioned more direct experiences of peer or teacher stigma). In this sense, the perspectives provided by both parents and the adolescents themselves were generally complementary. Themes were constructed based on relevance for the research question rather than frequencies (see Study 1). This is particularly relevant in this study given that specific abilities and challenges for each adolescent varied substantially, therefore frequencies are likely to overrepresent those that were able to communicate in this instance. As in Study 1, additional quotes are given in Appendix 1b and pseudonyms will be used throughout.

RQ1: 'How can we conceptualise the challenges autistic individuals with communication difficulties have in social interactions'?

Theme 1: 'The world just isn't designed for autistic people'

The autistic adolescents and their parents often discussed how the social and societal environment wasn't appropriately supportive or set-up for autistic people and their social interactions. These barriers were then particularly prevalent for autistic children with more complex needs, including communication challenges or social anxiety. These difficulties can be divided into two subthemes: institutional barriers to social interactions and peer-based barriers to social interactions.

Subtheme 1: Institutional barriers

Insitutional barriers took several forms, and were often described in terms of bureaucratic barriers to getting support in social interactions and with making friends, analogous to other studies that have examined healthcare barriers (Malik-Soni et al., 2022). As with Study 1, adolescents often described friendships as important to them however parents discussed how communication challenges can make this additionally challenging. For example, one parent described frustration at being unable to know who their adolescent wanted as a friend because the adolescent had few or no words.

'In school apparently they're quite friendly with another boy. But… Because of GDPR… They won't tell me the boys name. So they don't see this kid outside of school…'
Jared, parent of autistic teenager

These institutional barriers were also seen in schools, wherein the adolescents were often in smaller classes with fewer opportunities for interactions with peers relative to neurotypical pupils.

"And with them being like in an autism specialist unit it is very closed and he didn't get a lot of opportunities outside of that. You know friendship groups or freedom to make it. So, their world is, sort of. Quite small in that way really, so I just don't think he really…Probably

gets the opportunity… Even though I think now he's starting to be capable of being in a group…",
Kim, parent of autistic teenager

As with Study 1, social interactions tended to predominantly be within small, close-knit friendship groups, mirroring findings in autistic adolescents without these additional needs (Chamberlain et al., 2007; Locke et al., 2010).

"She has two friends and… My child hasn't really associated with others to be able to make more friends…",
Dominic, parent of autistic teenager

Participants also discussed how parents or existing friends can act as 'bridges' or scaffolds to support social interactions. This may take the form of organising social events (depending on the abilities of the adolescent) or simply attending a social event with them to act as a comforting figure if they get overwhelmed.

"I don't think it's easy for kids with ASD which largely comes with a big anxiety component to have that social interaction… Without someone there who is able to be a bridge like me or a trusted carer. You know, maybe certainly I try and go with them to these groups and sit in the groups and gradually, it's almost like, that I like, step back. It's one of the strategies we were given as parents. ", Mark, parent of autistic teenager, adolescent then nodded and vocalised in agreement.

This is perhaps analogous to the suggestion in Study 1 that friends of friends may be a particularly useful target for further developing the social networks of autistic adolescents. However, parents being able to provide this level of support is dependent on them knowing who their friends are, which may not always be possible.

Institutional barriers were also seen at the level of diagnosis and necessary support, such that it was challenging to ensure that other needs could be met so that the child could feel supported to engage in social interactions. This was particularly difficult when the abilities

of the adolescents varied across time. For example, a few adolescents had communication challenges specifically during times of stress or when being overwhelmed. In this sense, adolescents and the parents felt they were often overlooked when providing social support because assessments took place with the parent present and strategies were implemented to make sure the adolescent felt comfortable during the session (e.g, knowing the assessor beforehand). Participants felt that these assessments, whilst essential to demonstrate what the adolescent is capable of with appropriate support in place, often overlooked challenges that would exist in more naturalistic settings without this support. In turn, perhaps paradoxically, support became more difficult to access. One parent described particular frustration when attempting to get support in place in school settings.

“It literally is a really good day or a bad day and his behavior literally goes like a switch. There's no- this is what's CAHMs are struggling with to offer any advice because they'll ask me for the trigger and I'll go… *shrugs*. There isn’t a clear trigger.” Jane, parent of autistic adolescent

Likewise, potential aggression, often stemming from unmet needs in other areas, was often a barrier for social interactions, particularly in school settings.

“He can be very, in your face and he sort of nips a little bit… And and and I think other kids… Other kids can be quite wary. That can be a barrier because people are like- when he was little it was kind of cute. But now he's 6 foot.”
Dominic, parent of autistic adolescent

Likewise, the importance of understanding and meeting the needs of the adolescent is emphasised by a quote written by one participant with few or no words:

“I believe people working with autistic people should know that we are good people and that we are most comfortable when our choices and decisions are being met. People with autism should not be discriminated against.” Archie, autistic adolescent

Subtheme 2: Peer-based barriers

Barriers to friendship were also identified at the level of peers. Indeed, social interactions and friendships depend on the behaviours of both social actors (see Study 1), and therefore barriers such as stigma from neurotypical peers can make social interactions more challenging (Botha et al., 2022; Deguchi, Asakura, & Omiya, 2021; Gillespie-Lynch et al., 2015; Mitter et al., 2019; Ranson & Byrne, 2014; Underhill et al., 2019).

“I think sometimes people are a little bit fearful because he is clearly disabled, you know, clearly has, although physically…He can walk and talk, well not talk, but he can walk and use his limbs. But physically, there's flapping, squawking, you know, he's physically autistic and visually autistic. So, I think it's important for people to not ignore him, but I think people well… It's like a fear anyway, because they’re like, “what do I say to somebody like that?””, Jared, parent of autistic adolescent

In turn, this may lead to some adolescents being more hesitant to interact with peers due to this fear of stigma or rejection (Acker et al., 2018; C.Masten et al., 2011). This is exemplified by an exchange between one of the adolescents in the study and their autistic parent:

“Fun fact, everyone in my year hated me.”
“Do you think everyone hated you?”
“Yes. Bullied me directly.”
“Right. So, I think sometimes there’s a bit of a barrier put up. But actually, maybe rightly so.”
“Yeah.” Max and Alyx, parent and autistic adolescent

Finally, it is important to note that this peer stigma was also internalised in some instances by both parents and the adolescents (Deguchi et al., 2021; Mitter et al., 2019).

“She tends to look down on herself, not being ‘normal’, or able to understand others or not acting ‘normal’ like every other child does. But right now she's coping. She's getting used to it. She is starting to accept herself for who she is.” Dominic, parent of autistic adolescent

These stigma experiences are similar to reports in Study 1, however these experiences of stigma in this study appeared generally more severe (e.g, in Study 1 one participant discussed the difficulty of disclosure to prevent stigma, whereas in this study participants seemed to display a greater desire to simply 'be neurotypical').

RQ2: 'How can we understand the perspectives of autistic individuals with communication difficulties on their friendships and their friends'

Theme 2: Shared understandings- but how does this look?

Similar to autistic adolescents without additional communication needs, friendships were often centred around shared understanding. Again, this mirrors the homophily preferences seen amongst neurotypical adolescents and autistic adolescents in other studies (Berndt, 1982; Kuo et al., 2013). Equally, whilst some participants expressed a preference for other autistic people, there was considerable variation in this. In this sense, reports were similar to the previous interviews in that shared diagnosis could facilitate this shared understanding, but was neither necessary nor sufficient.

"If I'm showing autistic traits, as long as they're just like, 'ohh, that's chill then'. I think my friends don't even know anything about autism. But they understand me.", Alyx, participant verbal report

However, it is also important to note that identifying this shared understanding may be a challenge when the adolescent cannot verbally report their experiences. Indeed, some parents stated that weren't sure what friendship means to their adolescent.

"She thinks every… She'll tell the lady on the checkout in the supermarket your wildest secret she has no…No, she's friends with everybody... She'll talk to anybody. But it's… No, it's, but it's not a conversation. It's just a… Like a 'safe' sentence.", Jane, parent of autistic adolescent

However, some parents did discuss what appeared to be some form of shared understanding between their adolescent and other autistic friends with additional needs.

“So, he did have one friend at school. And it's really weird because they would sort of talk the same language to each other. But I think it was more, you know like… I don't. I wouldn't say it's like [neurotypical] boys and banter… It was definitely some sort of…. Like, if you stuck two babies together in a pen, then they would try and communicate…?”, Jared, parent of autistic adolescent

Theme 3: Feeling ‘left behind’ friends

The autistic adolescents and their parents often discussed developmental changes in friendships around adolescence (Lodder et al., 2017; Poulin & Chan, 2010), particularly when peers started to gain more autonomy or meet outside school settings. In this sense, there was often a feeling of being ‘left behind’ their neurotypical peers for a variety of reasons. Adolescents often are given the freedom to meet with their friends outside of school, however for the autistic adolescents this was not always possible or came with specific costs. Extending friendships outside school was identified as one particular challenge by the autistic adolescents in this study. First, it was sometimes not safe for the autistic adolescents to receive the same level of freedom as their neurotypical peers.

“So she's over friendly with everybody and and she doesn't understand that that's not a good thing… All the time… And if someone is nasty to her, she doesn't come out of that situation, she doesn't know to leave that situation, cause it's not a healthy situation. So, she's there then argues, and then she ends up getting upset. So yeah, she's she's not good with with that either.” Jane, parent

This need for safety in turn may provide a barrier to developing friendships outside of the school setting and place a greater onus on parents/carers to facilitate interactions outside school. Parents did describe structured social groups organised around a specific interest outside a school setting as a particularly useful context for their adolescent to develop friendships. Similarly, extending friendships outside of school often came with costs. Some adolescents described being anxious or overwhelmed depending on the specific contexts of

the social interaction, particularly when expectations were placed on how the adolescent should behave. For example, sitting down for a meal was described as particularly difficult for one adolescent.

“I think it as soon as there is sort of pressure on him- as in as in, say if you had a goal and you know you've gotta be structured and waiting and and, you know, those sorts of things. Or eating, you know trying to start eating out with his friends. Yeah, he really struggles. I guess it's expectancy, lowering the expectancy levels.” Mark, parent

The expectations of non-familiar social interactions in turn may generate anxiety for the child and make it a greater challenge to meet their peers outside of a school setting. This mirrors some of the findings around the fear of breaking social norms in Study 1. Some parents or friends suggested acting as a ‘bridge’ for the adolescent. However, note that having an adult present during the interaction may also change the dynamic (Silva, Chein, & Steinberg, 2016), which may also lead to differences in the interaction overall. Nonetheless, it was described as beneficial to some autistic adolescents.

RQ3: ‘How can we understand how autistic individuals with communication difficulties qualitatively experience and understand eye contact’

Theme 4: Eye contact as idiosyncratic, but not essential

Reports on eye contact varied substantially between individuals as in Study 1, however, most described it as difficult but not essential. Parents often highlighted that their child had challenges in other domains that were far more relevant to their friendships (e.g, social vulnerability). One participant discussed with their parent their own interactions without eye contact as such:

“The video calls that we do, we usually just do our own thing anyway? I've had video calls where I’ve been doing something and they've been playing Splatoon.”
“And I’ve been like, ‘you’re not even looking at each other on this.’”

“Yeah. I mean like looking at... Yeah. So, we don’t even have to be like talking or anything we can just be… Vibin’.” Max and Alyx, parent and autistic adolescent

Parents also described their journey in realising their adolescents eye contact wasn’t important:

“The other thing used to, that used to upset her mental health when she was younger, because of course she would never look at the teachers when they were telling her off and they would make her look at them and she couldn't. As parents we did it, when she was younger, we would be like ‘don't you dare look away from me’ because of course we didn't understand it when she was three or four. And then as soon as we understood it… We will allow her to look away because it's not a comfortable position to be in, but we'll say to her sometimes… You just have to look back at that person just to make sure that they know you're listening. So, we understand that you are listening, but other people might not.” Tim, parent

This mirrors a quote directly from one participant regarding being forced to make eye contact:

“And also have, when people are telling you off and they tell you to look at them and I don't know what they’re saying because I'm over here literally 3 seconds into the eye contact, I'll be crying already.” Georgie, autistic adolescent

Nonetheless, there was individual variation in the use of eye contact. As in the previous study, some adolescents described no difficulties with eye contact:

“I do find that… Again, smashing the stereotypes of autism. He really gives good eye contact.” Jared, parent

Indeed, this makes it somewhat difficult to interpret the responses where parents and their adolescent did emphasise eye contact.

“Yeah, eye contact is very important. Our school and us do try to support her eye contact. So she needs to be able to make eye contact to be able to interact with people outside… Outside those who have the same thing as her [autism]… But it is not really easy for her. ” Dominic, Parent of autistic adolescent

“Eye contact is very good and necessary for an Autistic person like me. Because this is what aids me to cope and maintain long conversation with friends and people. It’s good because it makes the conversation more lively.” Karen, autistic adolescent (see also parent quote above).

It is possible that this adolescent has internalised the neurotypical norm, and therefore realises that eye contact is a useful tool for maintaining interactions with neurotypicals and feels it is therefore important for them. However, the parent did mention that this adolescent appeared to mostly interact and befriend other autistic people, which may reduce the emphasis on eye contact due to a shared communication style (Crompton, Sharp, et al., 2020; Crompton, Ropar, et al., 2020). Indeed, it is possible that eye contact is important for them due to the predominantly neurotypical societal context they are within, but there is less pressure for this within same-neurotype interactions. However, given the variability across autism, it is important to be cautious of this appearing as dismissive of their perspective. Instead, this should be used as a basis for further exploration of the perspectives of autistic adolescents with communication challenges on their eye contact and in turn support should be structured based upon the desires of the specific adolescent.

Equally, some parents described their adolescents eye contact as a useful cue to determine if they are becoming overwhelmed with the current situation.

“I just link the eye contact... If he doesn’t have eye contact, that means he is struggling in that situation. So it's like more of an indicator or trigger for me.” Keith, parent

This represented a solution to the challenge of understanding their adolescents’ needs when they are unable to verbally report this to their parents. Perhaps one means to assist this may be to use insights developed from autistic people to inform and support parents of

experiences and strategies that may work for their adolescents based on their lived experiences. This would mirror existing co-produced work in this area (Holloway et al., 2022).

2.8. Discussion

In terms of general social interactions, the overarching theme was that 'the world was not set up for autistic people', particularly those with additional needs. Study 1 previously emphasised that autistic people felt the onus was often on them in social interactions, therefore it may be that the additional needs of the autistic people in this study made adapting to this perceived societal 'onus' particularly difficult, as reported by the parents and some of the adolescents. Indeed, some behaviours such as being unable to speak when overwhelmed, or stimming behaviours may be particularly difficult to mask for this population. Masking has been explored heavily in autistic people without additional needs as a stigma prevention strategy when interacting with peers (Botha et al., 2022; Miller et al., 2021; Ranson & Byrne, 2014; Underhill et al., 2019), however this has been emphasised as additionally challenging (Mitter et al., 2019) for autistic people with co-occuring intellectual disabilities and their families. This could be seen at two main levels. First, in terms of institutional barriers, parents often discussed the barriers to getting support from providers and the subsequent effects this can have on their own quality of life and self-esteem. This mirrors findings in caregivers of adults with ID (Chou, Pu, Lee, Lin, & Kröger, 2009) and can be characterised as 'associative stigma', or stigma that carries across to individuals close to the stigmatised person (Chou et al., 2009) and can then be internalised by family members (Ali, Hassiotis, Strydom, & King, 2012). In turn, this increased familial stress and isolation of the family unit (Ali et al., 2012; Chou et al., 2009) and may lead to fewer opportunities for these autistic people to interact with others, however future research is needed to explore this specifically within autistic adolescents with these additional needs.

Second, in terms of peer barriers, parents often discussed peers being uncertain how to interact with their adolescent, particularly given these additional needs. This has parallels with findings in other visible disabilities, for example physical disabilities, wherein able-bodied individuals behave in a more inhibited manner and tend to seek to end the interaction sooner when interacting with people with visible disabilities compared to when

interacting with visibly abled individuals (Fichten, 1986). Taken together, these findings highlight the need to extend research examining stigma to these autistic people with additional needs, particularly in instances where 'masking' (Cook et al., 2018; Miller et al., 2021) may not be a feasible strategy (and may have its own costs, see Chapter 2). An approach highlighting the dyadic nature of these interactions, including NT behaviour, may be beneficial in this regard (see Introduction chapter).

These findings in terms of general social interaction do not rule out the possibly of friendships potentially overcoming this stigma, however (see also Chapter 3 and 4). The autistic adolescents and their parents described friendships as generally important, but parents were sometimes unclear on how friendship may appear and be experienced by their child given they may not be able to report this directly. No research to date has examined friendships without language, and how this may appear, however some evidence can be drawn on from adults with ID (Fulford & Cobigo, 2018; Jobling, Moni, Nolan, & Andrew, 2000; Knox & Hickson, 2001). These individuals have highlighted friendships as important to them, often describing the importance of doing a range of activities together and a sense of shared history and understanding with each other (Knox & Hickson, 2001). However, as with the current study, these friendships often occurred within a context of their own lack of autonomy (Knox & Hickson, 2001). Therefore, there is a qualitative difference in how friendship can be enacted for people ID.

Participants within the current study, first, were all in specialist autism schools, characterised by smaller class sizes and greater structuring from teachers being present. Adolescents with ID in specialist schools do report fewer friends overall and greater loneliness compared to those in mainstream schools (Heiman, 2000), and this may extend to the autistic adolescents in the current study, however none reported loneliness directly. Furthermore, this lack of autonomy represents a barrier to extending friendships outside of school settings (D'Haem, 2008; Heiman, 2000) and may place greater emphasis on parents to structure these friendships whilst minimising the risk due to the adolescents potential social vulnerability. This social vulnerability may not be specific to autistic adolescents with ID, and has also been described in people with Williams syndrome, Down syndrome, ID, and autism without ID (Fisher, Baird, Currey, & Hodapp, 2016; Fisher et al., 2013; Forster &

Pearson, 2020; Jawaid et al., 2012; Riby, Ridley, Lough, & Hanley, 2017; Ridley, Riby, & Leekam, 2020; Rowley et al., 2012). The pervasive nature of this vulnerability across different neurodevelopmental conditions and the potential influence it may have on social interactions and quality of life highlights it as a key area for future research.

Finally, discussions around eye contact somewhat mirrored Study 1, particularly in terms of both heterogeneity and complementary perspectives from parents highlighting that their adolescents have other needs that were more important for their wellbeing and social interactions compared to eye contact. Findings also underpinned the dual function of eye contact as both receiving and providing information for neurotypicals (Cañigueral & Hamilton, 2019), particularly in parents using their adolescents' eye contact as a useful cue to determine whether they were becoming overwhelmed in the current situation. One study did find that lower eye contact and greater levels of support needs are associated with lower quality of life for autistic people with ID, however this was through a mediation effect of community participation (Williams et al., 2021). Therefore, it is somewhat difficult to determine whether this is a result of eye contact directly or whether the mechanism of influence on quality of life is via reduced autonomy from additional needs and increased stigma from being more 'visibly disabled' as would be consistent with the current study.

Limitations, future recommendations, and reflections

One aim of this small-scale, predominantly exploratory study was to create recommendations for collecting the perspectives of autistic adolescents with communication challenges. In this sense, the purpose was to develop rich, multi-informant insights from a small group of an underresearched population (Jack & Pelphrey, 2017; Russell et al., 2019). Likewise, given that guidance for research within this population is limited (Jack & Pelphrey, 2017; Tager-Flusberg et al., 2017), potential limitations in this research could serve as future recommendations for future studies. First, note that whilst no participants would have felt comfortable providing responses in a 'standard' interview setting, only half the autistic adolescents were able to provide responses directly. Therefore, whilst diverse data collection strategies were useful for collecting the perspectives of adolescents that would otherwise not have been included in research, they were not sufficient for the needs of all participants. Equally, of participants that did give responses,

this did at times lack the ‘depth’ and ‘richness’ that would be associated with data quality in qualitative methods (Tracy, 2010). Indeed, there is a tendency in all qualitative methods to overemphasise more ‘verbally gifted’ participants (Christians, 2005; Pickering & Kara, 2017). Therefore, analytic methods must be chosen appropriately and thought given to data representation. One solution to go beyond this may be to incorporate behaviours beyond the spoken words of the individual at a single point in time, for example using ethnographic approaches (Simplican, 2015), naturalistic auditory recordings (Ganek & Eriks-Brophy, 2018), or naturalistic visual recordings (Yurkovic et al., 2021). Or, alternatively, diverse response methods such as Photovoice (Do et al., 2021; Lam et al., 2020).

Likewise, a lack of familiarity with the researcher limited data collection. Whilst this was overcome by some participants (e.g, they were present during the parent interview and were then given the option if they felt comfortable contributing after this interview) others were still uncomfortable or unable to provide responses. It may be useful in this sense to train individuals who already understand the adolescent to conduct interviews, for example parents or speech and language therapists. This approach has been successfully used to train autistic people as interviewers for autistic participants (Pellicano et al., 2021), and could be expanded within the current population. Training may also be beneficial in designing additional data collection methods. Since beginning data collection methods such as Photovoice (Do et al., 2021; Ha & Whittaker, 2016; Lam et al., 2020) or Talking Mats (Bradshaw et al., 2018) have been used successfully in this group. In turn, future studies may adopt these additional methods to collect data from adolescents. Finally, in terms of data collection, future researchers must be aware of the additional time commitment in collecting data from this group. In particular, interviews were often rearranged to be on a ‘good day’ for adolescent participants, and variability in abilities across time was substantial even during the short duration of data collection. This was feasible due to data collection taking place online; however, would likely not be feasible for in-person settings wherein families may need to travel into a lab. Parents also highlighted that a future recommendation for researchers is to see the child over multiple days where possible, with the adolescent in full control of initial meetings and the use of rapport-building none-research-centred activities to facilitate data collection (e.g, ask questions whilst conducted an activity that is the adolescents interest).

One final limitation is related to the challenges of working with this group within an academic framework, which represents a barrier that must be considered when including this group in future research. PhDs (and all research projects) are time limited, with strong emphasis on collecting and being able to efficiently analyse data. However, to include autistic adolescents with communication challenges requires substantially greater time investment, flexibility in data collection and analysis, and the possibility that limited or even no data will be collected. Studies working with autistic people are essential and do have impact for autistic people (Mitter et al., 2019; Russell et al., 2019; Walton & Ingersoll, 2013), but may not be feasible within the constraints of a PhD or represent a risk to completion. Furthermore, in terms of research priorities, this study highlighted research priorities for autistic adolescents with additional needs that may be particularly urgent within this group but less of a problem for groups without these additional needs. For example, exploring the influence of friendship on social interactions cannot be conducted without understanding what friendship means and appears like to the group in question.

This is particularly challenging in autistic adolescents that find it difficult to report on their friendships and where friendship is occurring within a very different context (e.g, autonomy limitations). In other words, before exploring autistic social interactions within friendships for those with additional needs, researchers must first step back and examine the assumption of what friendship is for this population. Therefore, the author would follow up this current study with an ethnographic approach in an autism specialist school, particularly focused on the direct friendship experiences of these adolescents and how this can interact with familial stigma and overcoming friendship barriers outside of school. In doing so, the research findings will be more directly impactful based on reports from the community in this study and the methods would be more appropriate for the population being studied. However, such a study would be beyond the time constraint of the current PhD. Therefore, for the purpose of the thesis, this approach shall be left to future research. Instead, Chapter 3 and 4 will continue the thread outlined in Chapter 2a to behaviourally explore cross-neurotype social interactions in autistic adolescents and adults without these communication challenges.

2.9. Overall conclusion

Chapter 2 explored social interactions, friendships, and eye contact for autistic adolescents with and without communication challenges (ie, ID, social anxiety, and few or no words). Autistic teenagers without communication challenges felt that the onus was on them to adapt to others during social interactions, despite social interactions being inherently dyadic. This is relevant for where potential interventions aimed at helping autistic people may be targeted; given that autistic teenagers appear to feel the onus is already strongly on them to adapt in social interactions. Second, they highlighted how social rules may provide a barrier to social interaction but this can be overcome within the context of friendships, building on the literature on implicit social rules by demonstrating that in naturalistic social interactions the importance of these rules may interact with the nature of the social partner, and in turn this has implications for reducing uncertainty and anxiety in social situations for autistic people. They also highlighted the importance of shared understanding, but not necessarily shared neurotype, thus expanding the Double Empathy Theory to encompass potential variation across autistic people. Finally, autistic adolescents predominantly considered eye contact in terms of attention and accommodating NT peers, but felt this wasn't essential for their own social purposes, building upon the naturalistic relevance of eye contact interventions and the use of this behaviour as a purported 'social model'. In sum, these findings suggest a need to understand the dyadic processes underlying potential equifinality in friendships both within and across neurotypes, alongside understanding potential variation within these categories.

In terms of autistic adolescents with communication challenges and their parents, they characterised the world as being not set-up for these autistic adolescents, partly due to institutional barriers in accessing support, increased peer stigma, and increased stigma experienced by the family unit. This mirrors and extends findings from people with ID, and extends Chapter 2a to highlight how barriers faced by autistic adolescents more broadly can be exacerbated within this subgroup. Participants highlighted the importance of their friendships, but challenges remain in understanding how friendship may appear and be experienced for autistic adolescents with communication challenges. Some parallels could be drawn with autistic adolescents with ID, in terms of both social vulnerability and limitations of specialist school settings, however more research is needed to examine

additional challenges specifically within autistic people with ID, particularly given specific communication difficulties. Expanding our understanding of friendships within this group may also have implications for understanding cross-neurotype communication and the equifinality in how friendships can be achieved. For example, participants in this study emphasised the role of shared interests and understanding, as was seen in Chapter 2a. Finally, eye contact findings mirrored Chapter 2a in that participants showed a high degree of heterogeneity, but most did report other aspects of their social interactions were more important for overall wellbeing compared to eye contact.

Chapter 2 has focused on the qualitative perspectives of autistic people on their social worlds, friendships, and eye contact. In particular, participants highlighted friendship as important to them, but were somewhat indifferent to their friends neurotype specifically. This is important because existing research on cross-neurotype communication in the context of strangers. Therefore, Chapter 3 will extend these findings to understanding cross-neurotype communication within friendship dyads for adults, and Chapter will examine these dyads in adolescents.

3 Chapter 3: Cross neurotype social interactions between friends compared to strangers in autistic-neurotypical adult dyads

As emphasised in previous chapters, existing research has often focused on the role of the autistic person in influencing the quality of the social interaction (Gates, Kang, & Lerner, 2017; Kasari, Gulsrud, Wong, Kwon, & Locke, 2010; Rao et al., 2008; Senju & Johnson, 2009a, 2009b; Wang & Spillane, 2009; Williams White, Keonig, & Scahill, 2007; Wong & Kwan, 2010). However, social interactions require involvement from both interlocutors in the interaction, with both social actors involved in the progression and success of the interaction in a dyadic manner. In turn, feedback from these social interactions (e.g, how social partners respond to us) is learnt and influences our future interactions. For example, some differences in communication style between neurotypes may act as a barrier for engagement with neurotypical peers (see Introduction chapter and Chapter 3), such as autistic people being perceived as less trustworthy by neurotypicals (Gurbuz et al., 2024). In addition, societal stigma towards autistic people may reduce the likelihood of neurotypicals wanting to engage with autistic people (Sasson et al., 2017; Underhill et al., 2019). This may feedback into the willingness of the autistic person to interact with peers in the future, for example due to fears of rejection (Acker et al., 2018; Gurbuz et al., 2024). Therefore, these dyadic factors of differences in communication style and the broader societal context may make it more difficult for autistic people to develop longer-term relationships such as friendships.

However, despite these findings, autistic people do form longer-term relationships such as friendships with neurotypicals. Study 1 and 2 highlighted the importance of understanding the role that peers can play in this from the perspectives of autistic adolescents themselves. However, no studies to date have quantitatively examined how these communication styles are adapted within friendship pairs. Therefore, this chapter will expand on a key characteristic of the social partner that can influence the quality and nature of social interactions for autistic people: pre-existing friendship with the social partner.

Friendships

Friendships have been highlighted as important for autistic people (Black et al., 2022) and self-reported friendship satisfaction is correlated with both well-being and quality of life

(Black et al., 2022; Van Heijst & Geurts, 2015; Mason et al., 2018; Mazurek, 2014). General findings on friendships for autistic people have been outlined previously (see the Friendship section of the Introduction chapter). Nonetheless, one factor that is essential to recall is that the vast majority of autistic friendship research has examined autistic people's interactions with strangers. This is an important caveat, because there may be aspects of interactions with friends that make overall social interactions easier relative to strangers. For example, participants in Chapter 2 highlighted that social rejection due to breaking a social rule was less likely with their friends compared to strangers. This could stem from their friends understanding them better relative to neurotypicals, consistent with the idea of reaching potential neuro-cultural understanding within autistic-neurotypical friendships (Gillespie-Smith et al., 2024). This is perhaps analogous to the finding that greater autism knowledge does increase neurotypicals willingness to engage with autistic peers (Gillespie-Lynch et al., 2015; Sasson & Morrison, 2019). The key difference is that a friendship can involve more individual, idiosyncratic knowledge about the social partner rather than general autism knowledge. This may be particularly beneficial given the vast variation across autistic people. In turn, within friendships it may be possible to develop a highly individualised neuro-cultural shared understanding (Gillespie-Smith et al., 2024).

Neurotype

Autism research has often placed the onus on successful social interactions on the autistic person (Gates, McNair, Richards, & Lerner, 2023; Mundy, 2018; Rao et al., 2008; Sigman et al., 1999; Usher et al., 2015). For example, differences in engaging with neurotypical peers has often been understood based on the individual characteristics of the autistic individual, such as through differences in Theory of Mind, social motivation, or difficulties with specific social behaviours such as eye contact (see the Introduction chapter for overviews of all of these concepts). However, these individual based approaches have all been somewhat limited in terms of their relationship to naturalistic social performance (Gates et al., 2023; Morrison, DeBrabander, Jones, Ackerman, et al., 2020) and this is likely in part due to focusing on a single individual in a dyadic interaction. Therefore, dyadic exploration of interactions and relating behaviours within these contexts has led to development of novel frameworks.

One alternate framework is Double Empathy theory outlined in the Introduction (Crompton, Hallett, et al., 2020; Davis & Crompton, 2021; Rifai et al., 2022). Behaviours that are associated with greater interaction quality appear specific to neurotypes; for example, eye contact and backchanneling are key predictors of interaction quality judgements in neurotypicals but not autistic people (Rifai et al., 2022). Similarly, autistic people are less likely than neurotypical individuals to judge other autistic people negatively for behaving differently to neurotypicals (Morrison, DeBrabander, Jones, Faso, et al., 2020). However, there is evidence that some aspects of cross-neurotype communication may be malleable to change, which could facilitate successful interactions. For example, autism acceptance training and improving knowledge about autism for neurotypicals does reduce biases towards autistic people in social interactions (Jones, Morrison, et al., 2021; Jones, DeBrabander, et al., 2021). This suggests biases may be open to change at the group level, and thus more experience with autistic people (e.g, speaking more frequently with autistic people) could have a similar effect in increasing knowledge and acceptance, which in turn may then facilitate cross-neurotype social interactions. This is also consistent with stigma research, wherein inter-group contact is known to reduce stigma towards that group, for example in contexts of racial or sexuality-based stigma (Herek & Capitanio, 1996). However, whilst this anti-stigma approach is essential, note that it remains somewhat individual focused.

Within a more dyadic framework, it could be suggested that a key strategy for facilitating cross-neurotype social interactions may be to either achieve convergence in these dyadic communication styles (e.g, through greater adaptation by both neurotypes) or, alternatively, to achieve a shared understanding irrespective of differences in communication styles (ie, an equifinality in how a successful social interaction can be converged upon regardless of communication style differences). No study to date has examined these possibilities as current research has been limited to comparing either same-neurotype dyads with purportedly shared communication styles and cross-neurotype stranger dyads wherein achieving shared understanding is known to be challenging (Crompton, Sharp, et al., 2020; DeBrabander et al., 2019; Sasson et al., 2017). Therefore, there is a research gap in examining cross-neurotype dyads wherein mutually satisfying social interactions are known to be achieved.

Why study cross-neurotype friendships?

Two main insights can be gained from comparing autistic-neurotypical and neurotypical-neurotypical social interactions within friendships. First, if social difficulties (measured by lower self- and partner-reported interaction quality ratings) for autistic people appear in interactions with neurotypical strangers, but are not seen amongst neurotypical friends, then this suggests some aspects of overall social functioning for autistic people may be specific to the social partner. Demonstrating a difference in self- and partner- reported interaction quality for autistic people with friends compared to strangers would be essential as it would suggest that barriers to social communication between autistic and neurotypical people can be overcome. In turn, this provides a potential context for exploring high-quality autistic-neurotypical social interactions.

Second, and building upon this first insight, it may be possible to identify features of dyadic interactions with friends that relate to higher interaction quality for both social partners. In turn, these features may serve as a useful target for facilitating more successful cross-neurotype interactions for both partners and increased understanding. In this sense, this research adopts an analogous logic; explore what appears to work in already successful social interactions and then consider how this can be applied to social interactions more broadly.

Methodological approaches to studying social interactions

Alongside these theoretical research aims, it is also essential to note that key methodological challenges exist in understanding cross-neurotype friendships. For example, many studies examining cross-neurotype communication have used First Impression Ratings (Cage & Burton, 2019; DeBrabander et al., 2019; Sasson et al., 2017), which are not applicable to established relationships. Therefore, this study aimed to served as a proof of concept for developing methods to examine how cross-neurotype communication occurs within cross-neurotype social interactions between friends in adults (see Study 4 for further exploration in adolescents). Particular attention was paid to two main aspects of the study – first, the measures intended for interaction quality, given that these have predominantly been used in the context of stranger dyads. Second, to examine behavioural coding of

features of these interactions online, given previous research examining communication style differences has focused on in-person interactions (Rifai et al., 2022).

Expanding our understanding to online interactions is timely, given the increased prevalence of online interaction following the COVID-19 pandemic, and the key role that online interactions have in autistic communities (Davidson, 2008; Parsloe, 2015; Stone, Mills, & Saggers, 2019). For example, they can often provide a safe space with greater individual control of how and when to engage with others and can be structured around a pre-existing shared interest. Furthermore, at the behavioural level, the role of social behaviours may vary in an online setting, for example eye contact no longer is able to serve the 'dual purpose' of receiving and providing information (Cañigueral & Hamilton, 2019; Jarick & Kingstone, 2015) because looking towards the eyes of the interlocutor necessitates looking away from the camera and vice versa. Despite these differences in potential demands, autistic people are still judged more negatively from video recordings (Sasson et al., 2017), suggesting a need to understand the predictors of judgements in this context.

Therefore, the purpose of the current study is twofold. First, to serve as a proof of concept for understanding methods of data collection and analysis to explore interaction quality and potential interactions between neurotypes within friendship dyads. In turn, this research can identify challenges when studying autistic-neurotypical and neurotypical-neurotypical interactions within friendship dyads. Second, to explore what behaviours may be related to interaction quality in these dyads in an online interaction. This will then serve as the basis of further exploration in Chapter 4 with adolescents.

This led to 2 main research questions that were broken down into 4 hypotheses. Due to the nature of the data, non-parametric tests were chosen for analysis.

> RQ1) What is the difference between friends and stranger interactions on self-reported interaction quality ratings for autistic and neurotypical adults?
>
> RQ2) What is the difference between friends and stranger interactions on neurotypical-based behavioural measures in autistic and neurotypical adults?

These research questions then led to four main operationalised hypotheses. First, it was hypothesised that in online interactions participants will rate their friend higher on the Social Interaction Evaluation measure relative to rating a stranger (H1a). Likewise, it was hypothesised that neurotypicals will rate other neurotypicals higher on the Social Interaction Evaluation measure relative to ratings of autistic people (H1b). Second, it was hypothesised that the frequencies of social behaviour and language use will be higher in online interactions for neurotypical-neurotypical pairings relative to cross neurotype pairings (H2a). Furthermore, it was hypothesised that frequencies of social behaviour/language will be higher in friendship dyads relative to stranger dyads (H2b).

In addition, the study originally intended to both examine interaction effects between neurotype on friendship and interaction quality, and to correlate some behaviours with interaction quality. However, due to methodological challenges this was deemed inappropriate for the data collected.

3.1. Methods

Participants

36 university students from Durham University (age M = 22.9, SD = 2.32, 22 female, 11 male, 3 non-binary) took part in the research, with 9 of these self-reporting an autism diagnosis (Table 1). Participants signed up in pairs with their nominated friend to take part and were then matched with another pair based on several characteristics (see Participant Matching section). No exclusion criteria were set for co-occuring developmental conditions (4 Attention Deficit Disorder, 1 Eating disorder[2], 7 anxiety, 4 depression) however this was considered in matching pairs. Inclusion criteria included the ability to speak with a stranger, access to Microsoft Teams and a computer, being resident in the UK, having native or native-English ability, both individuals in the pair needed to be aged 18-30 years, and that

[2] Note that for the group with a participant with an eating disorder, the food task was omitted; see procedure. All other tasks remained the same.

those in the autistic group either had a confirmed diagnosis (5 people) or were self-diagnosed (4 people). All participants received a £5 Amazon voucher for taking part. The study was approved by Durham University Psychology Department Ethics committee. Informed consent was received from all participants for video recording and storage of the data for the purposes of the study in line with the Data Management Plan.

Recruitment took place online via Facebook, Twitter, and via emails through colleges and departments. The sample size was limited to some degree by the nature of the coding, with each video taking a substantial amount of time to code (see Video Coding; each video taking around 2-3 hours to code) and with logistical challenges in arranging 4 young adults together for a single testing session. Indeed, 16 participants were unable to be tested due to scheduling conflicts or due to a single participant not attending the testing session (this difficulty was then compounded by the need to re-match participants prior to rescheduling). Likewise, the sign-up form had difficulties with bots, an issue recently highlighted in the literature (Pellicano et al., 2023). This did not influence data integrity in this specific study due to the need to be visible on camera and sign-up with a friend, however it did lead to additional logistical challenges when attempting to match participants (e.g, one pair having to wait for matching due to their initial match being either a bot or not responding). The advertising, drop-out, and final participant numbers are given in Figure 4 below.

Figure 4: Chapter 3 recruitment process

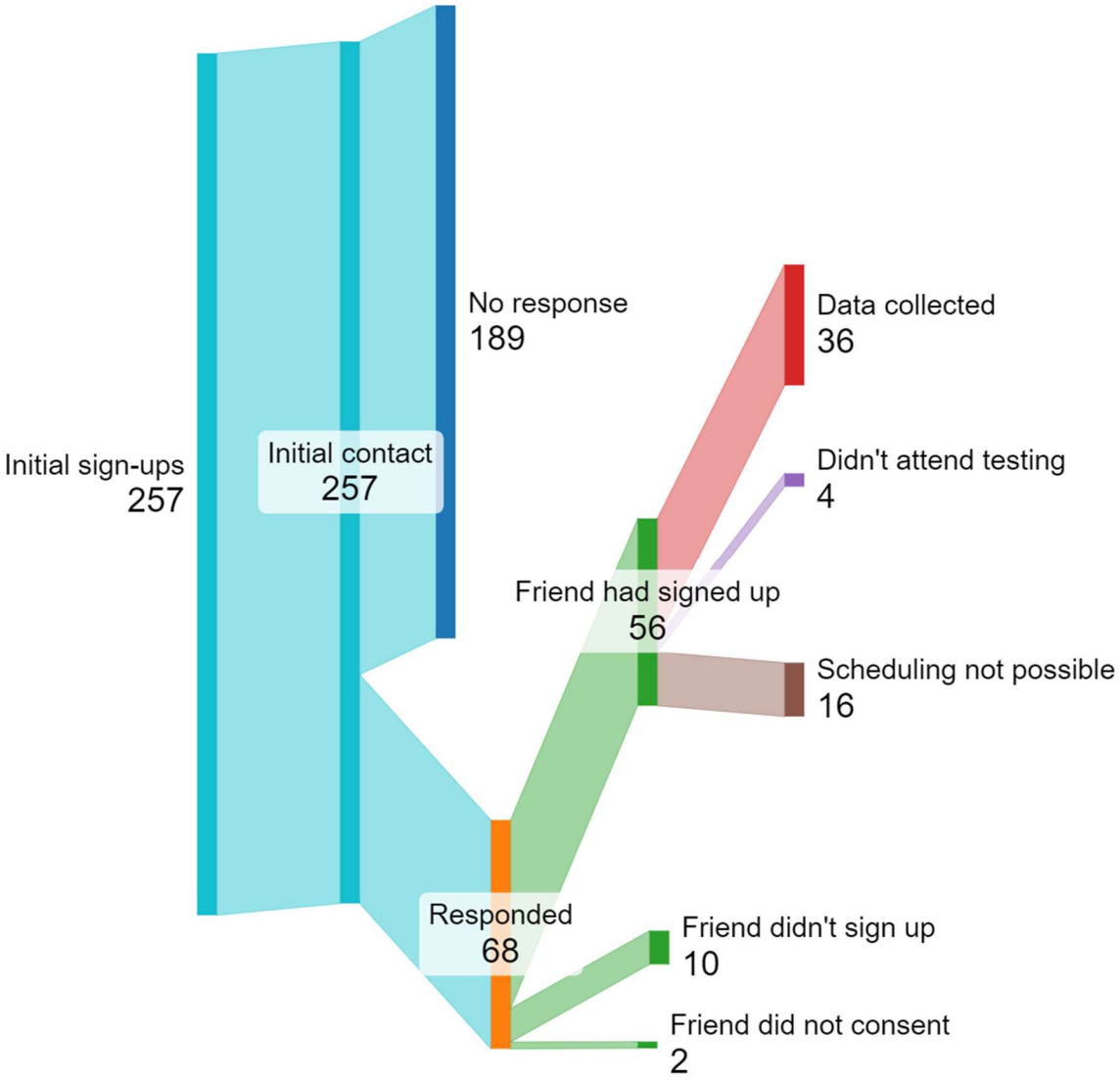


Figure made using https://sankeymatic.com/build/

Measures

All questionnaires were administered online via Qualtrics (https://www.qualtrics.com/uk/), with one set of questionnaires completed prior to the session (and used in the matching process) and the final questionnaire completed after all tasks had been completed with a specific social partner to evaluate the social interaction (see Procedure). All questionnaires are given below with a description of their purpose and limitations. There is little guidance in the literature for whether the criterion for emotional closeness differs across neurotypes,

and hence multiple questionnaires were used. Likewise, participants were asked following the questionnaire whether there was anything these questionnaires may have missed when discussing their friendships and interactions (ie, as a manipulation check) and this was followed up with a discussion with individual participants where discrepancies arose. Discrepancies were found in 3 participants between the scores on the Unidimensional relationship questionnaire and the Inclusion of the Self in the Other scale (see Discussion).

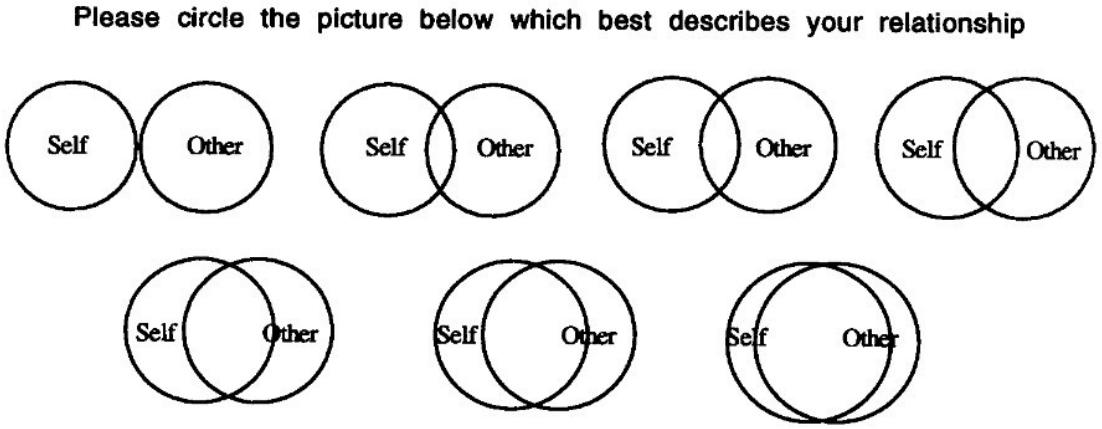
Unidimensional relationship closeness questionnaire (Dibble et al., 2012)

This questionnaire involves a series of 7 point Likert scale questions regarding your closeness to a specific person, for example 'My relationship with this person is close' rated from strongly disagree to strongly agree. Importantly for the current study, the scale is both specific to adults and to a specific social partner. Previous research has indicated that this questionnaire is valid for measuring both romantic and platonic relationships (Dibble et al., 2012). The questionnaire has also been used for both non-autistic (Dibble et al., 2012) and autistic relationships (Sedgewick, Crane, Hill, & Pellicano, 2019; Sedgewick, Leppanen, & Tchanturia, 2019). The Cronbachs alpha on this measure was 0.81, indicating acceptable-to good internal reliability.

Inclusion of the Self in the Other Scale (Aron et al., 1992)

This questionnaire involves a series of 7 increasingly overlapping circles, and participants indicate which pair of circles most represents the closeness of their friendship with that person (see Figure 5). This had the benefit of providing a visual representation of the friendship for participants that may prefer this format and is very quick to complete. Furthermore, this measure has also been used with both neurotypical (Aron et al., 1992) and autistic adults (Morrison, DeBrabander, Jones, Faso, et al., 2020).

Figure 5: Inclusion of the Self in the Other Scale questionnaire



Taken direct from the questionnaire on page 597 (Aron et al., 1992).

Social Interaction Evaluation Measure (Berry, Hansen, & Berry, 1996)

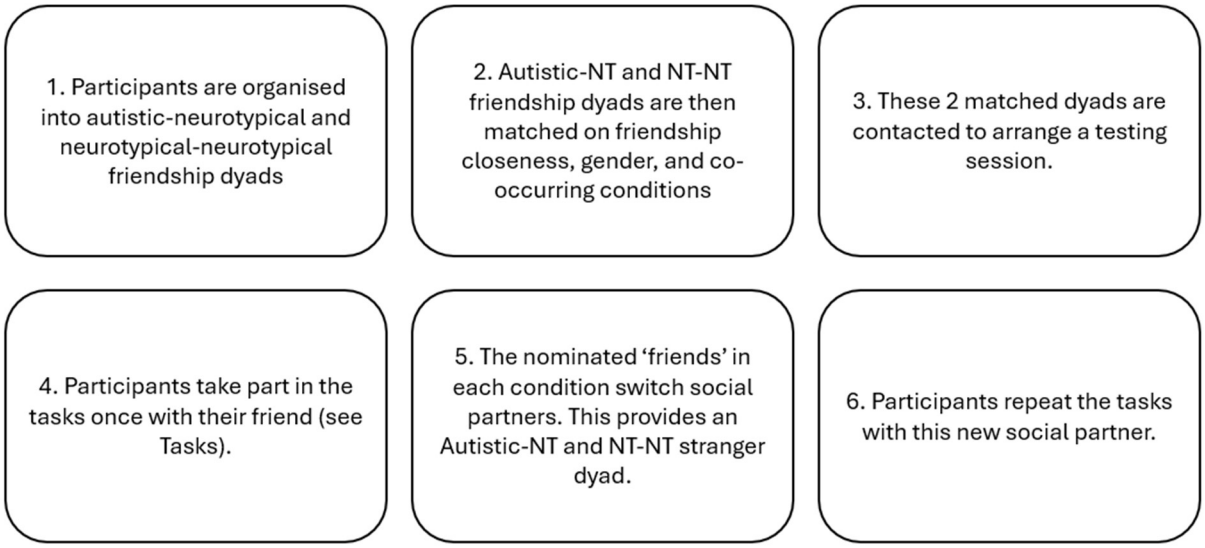
This questionnaire uses a series of 1-9 Likert scale responses to questions intended to evaluate the quality, intimacy, engagement, disclosure, and engagement of the social partner in a social interaction. This measure has been demonstrated to be valid for both neurotypical (Berry et al., 1996) and autistic adults (Morrison, DeBrabander, Jones, Faso, et al., 2020). Participants filled in the questionnaire online anonymously (using their participant ID) after all tasks had been completed with their first social partner, and then again when all tasks had been completed with their second social partner. As before, participants were given the option of stating whether these features of interactions are important for their interactions and reported they agreed with the scales as a useful reflection of their interaction quality.

Dyads and matching procedure

As participants signed up, they nominated their preferred friend (ie, friends were self-selected by participants). This enabled participants to select who they would consider a friend rather than imposing specific criterion of a 'friend' onto a neurodiverse population where the nature of friendships could differ (Petrina et al., 2014). Autistic participants could have nominated another autistic friend however this only occurred twice and in both

instances scheduling conflicts meant that testing was not possible, thus this was not possible to explore (see Discussion of this chapter). The overall process of matching participants is given in the flowchart of Figure 6 and is described in more detail below.

Figure 6: Chapter 3 overall matching procedure



Note: In practice Step 4 and 5 were switched around for half the dyads to enable counterbalancing. NT = neurotypical.

First, friendship pairs were separated into autistic-neurotypical and neurotypical-neurotypical friendship dyads. Friendship closeness within these dyads was calculated by creating an average of the Interaction Quality subscale of the Unidimensional Relationship Closeness scale (Dibble et al., 2012) from both social partners to provide an overall friendship closeness score within each dyad. The Inclusion of the Other in the Self scale (Aron et al., 1992) was collected for participants but not used for analysis because 4 autistic participants responded that the questionnaire did not seem to reflect their friendships (see later Discussion and Appendix 4).

Next, these initial friendship pairs were matched with another pair on gender (with the exception of one group including a non-binary participant matched with a cross-gender dyad), reported closeness to their social partner within 1 Likert point on the Unidimensional relationship closeness questionnaire, and the researcher attempted to match for neurodevelopmental conditions where possible (the first two matching criteria were

prioritised in instances where a conflict emerged due to participant characteristics). Pairs were matched on co-occuring depression, anxiety, and Attention Deficit Disorder (ADD), with the exception of 2 groups that had an unmatched participant with ADD and 1 group with an unmatched eating disorder. In total, 9 neurotypical-neurotypical friend dyads (NTNT-F), 9 neurotypical-autistic friend dyads (NTA-F), 9 neurotypical-neurotypical stranger dyads (NTNT-S), and 9 neurotypical-autistic stranger interactions (NTA-S). This gave a total of 36 dyads for analysis pairings (see Table 2).

Table 2: Chapter 3 dyad characteristics across conditions

	Friend Conditions				Stranger Conditions		
	N dyads	Mean age (SD)	Co-occuring conditions (SD)	Friendship closeness	N dyads	Mean age (SD)	Co-occuring conditions (SD)
Cross-neurotype A-NT	9	22.70 (1.86)	2 ADD, 1 ED, 4 anxiety, 2 depression	6.29 (0.82)	9	22.90 (1.20)	2 ADD, 1 ED, 4 anxiety, 2 depression
Same-neurotype NTNT	9	23.08 (1.18)	2 ADD, 3 anxiety, 2 dperession	6.21 (0.43)	9	22.95 (1.01)	2 ADD, 3 anxiety, 2 dperession

Tasks

Three main tasks were administered during the experiment. All tasks were administered in the order Food Task, No Task, and Word Task, then re-administered in the same order with a different social partner (counterbalanced such that half the participants did the first task with the friend condition, and half began with the stranger condition). All instructions were given in the main breakout room (with all participants present) prior to being placed in breakout rooms. Multiple tasks were used and then analysed together to attempt to control for overall task demands (or lack thereof) on interaction quality and behaviours. Therefore, this enabled exploration of the differences between friends and strangers across neurotypes specifically, in line with the research questions. Details of the tasks are given below.

Food Task: Participants were instructed “Okay, in your pairs, I would like you to design a three course meal and a drink with the other person. However, the catch is that you must both dislike every course. You don’t need to write it down, but you can if you want to. The only rule is that every course must be recognisable as food (for example, you can’t say “our starter will be a table”[3]). The task lasted 10 minutes.

No Task: Participants were instructed that they will be placed back into the breakout rooms, and they are to wait until one of them received an email containing the Word list for the Word task. They were told “You’re free to talk amongst yourselves whilst you wait to receive the word list, just give me a minute or so to send them across” Participants were intentionally left for 2 minutes before the word lists was sent and the Word Task began. This No task period was given prior to all Word task trials, giving 4 trials in total per pair.

Word Task: Participants were instructed that ”One person in each pair will be sent a list of words (see Appendix 5). Once they have received this list of words, the other person must then ask you questions to figure as many of the words as possible. The person with the word list cannot say any of the words, and you aren’t allowed to use letter strategies (e.g, does it start with an A…). Questions don’t need to be closed or yes/no questions, and you’re allowed to come up with your own strategies.” This task was administered 4 times in total, with the order of who received the word list alternating. Equally, the order was counterbalanced across neurotype (such that for half the autistic-non-autistic pairs, the autistic person began with the word list, and for the other half the non-autistic person would begin).

Tasks were selected based upon three main criteria. First, they were intentionally made to be bidirectional in nature; that is, information must be both received and provided within the task itself. This was essential because previous literature has often used contexts wherein information is conveyed in one direction, such as storytelling (Crompton et al,

[3] This rule was implemented to ensure participants were required to gain information about the social partner, rather than potentially being able to rely on common knowledge

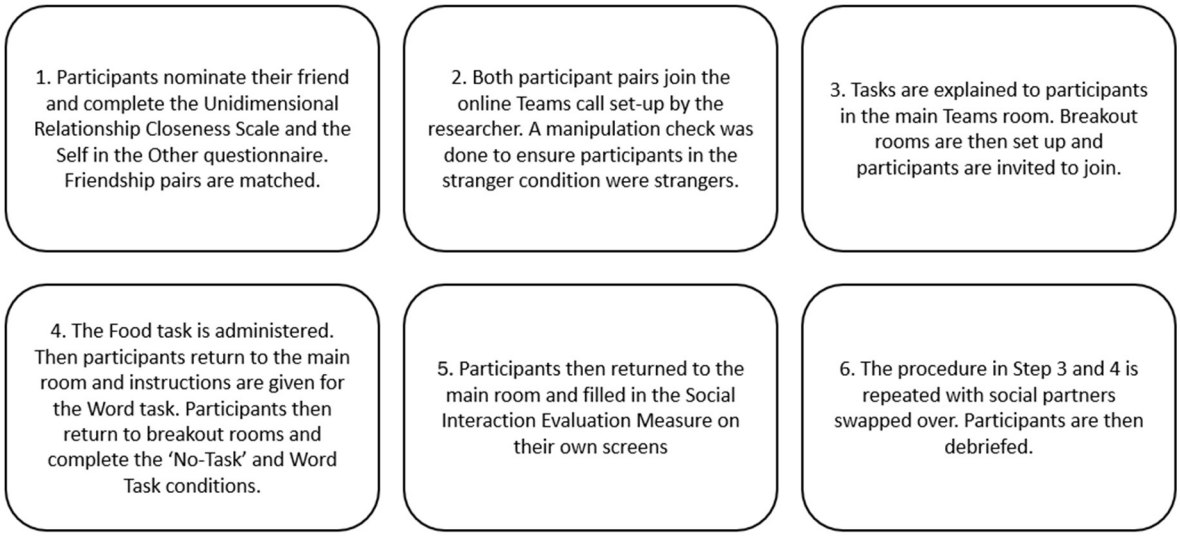
2020). However, effective communication often requires a bidirectional transfer of information, for example feedback on information provided by one social partner. Therefore, bidirectional tasks were chosen to analyse interaction quality and behaviour within the context of mutual engagement and information sharing. Second, tasks were designed as contexts that were sufficiently engaging to facilitate potentially enjoyable interactions. This was important because if tasks were unengaging this may have led to reduced interaction quality simply due to the nature of the task. Third, tasks needed to be applicable within an online setting given the online nature of the research.

The tasks in total took around 25 minutes per dyad, or 50 minutes per session with both a friend and stranger condition. This length of time was deemed appropriate for eliciting sufficient behaviours within the interaction for analysis and to not place undue burden on coders. This length of time also gave participants some time to attempt to familiarise themselves with the stranger to some degree if they wished to do so, in turn ensuring they had enough information to make judgements within the Social Interaction Evaluation Measure.

Procedure

The full procedure is given in Figure 7 below.

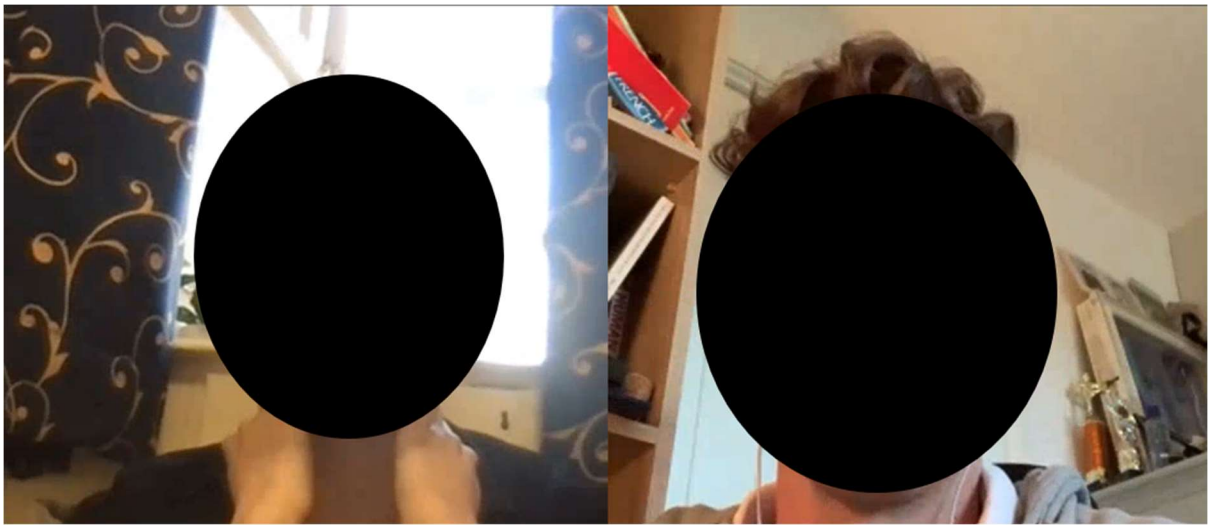
Figure 7: Chapter 3 procedure



Experimental setup

All data collection took place online using Microsoft Teams (https://www.microsoft.com/en-gb/microsoft-teams/group-chat-software). Participants were told prior to the session they would need their camera on for all tasks (except if they had to leave for a brief period) and to try to remain central so they can be clearly viewed. This was the case for most participants, and instances where they were not on camera or camera issues were presented were not coded. Participants took part in the study from their own rooms seperately, with the exception of one participant that took part through booking a room in the library. All participants were alone when taking part in the research. Videos were recorded using the in-built Microsoft Teams recording feature. Permission for video recording was received from participants prior to data collection and data was retained in accordance with the data management plan. An example of the camera setup is given in Figure 8 below.

Figure 8: Chapter 3 example camera setup



Video Coding

Two research assistants were trained to video code by the lead researcher based on previous experience doing video coding and teaching research assistants to code. Coders used Datavyu (v.1.3.8; https://datavyu.org/) and this Datavyu code was exported into Excel using a Ruby script provided by Datavyu (https://datavyu.org/) by the lead researcher. The research assistants were both female undergraduate students in the second year of their psychology degree at Durham University. Participants then coded videos either from the server or, in instances where the server did not enable the time resolution required for coding, downloaded the videos onto an encrypted hard drive that they then coded from.

Coding followed a coding scheme devised by the researcher intended to explore behaviours associated with social enjoyment and potential indicators of a successful social interaction. Key behaviours of interest (Table 3) and language usages (Table 4) are outlined below. Behaviours selected were adapted from measures used by previous studies examining social interactions in a range of contexts (Crompton, Sharp, et al., 2020; Mundy et al., 2003; Rifai et al., 2022). The variables that could be coded was somewhat restricted by the online context. For example, eye contact is both practically challenging to measure online and

ontologically problematic given that eye contact can no longer have a 'dual function' of both giving and receiving information (Cañigueral & Hamilton, 2019; Hietanen, 2018; Jongerius et al., 2020). Therefore eye contact will not be measured in this study directly (see Study 4). Time when participants were not visible on the cameras was also coded and removed prior to analysis (averaging 41 seconds per 20 minute session, usually due to connectivity problems or participants going off camera due to distractions at home). Inter-rater reliability was assessed between the two coders through having both coders code 20% of the videos (6 participant videos) and then calculating Cohen's Kappa for the agreement between coders (Cohen, 1960). An error margin of 160ms was allowed due to potential challenges of online coding (e.g, internet delays, loss of resolution, and synchronicity challenges). Inter-rater reliability scores were 0.84 for behavioural coding and 0.80 for language coding. This reflects a between 'good' to 'great' concordance between raters (Hallgren, 2012). A full outline of the procedure for establishing inter-rater reliability is given in Appendix 6.

Table 3: Chapter 3 behavioural codes

Behaviour	Description	Example
Smiling	Any kind of smiling behaviour, lasting at least 0.5 seconds.	Smiling in response to a joke or getting an answer correct
Nodding head	Moving the head up and down in agreement or to indicate acknowledgement when the social partner is speaking. Note this is also referred to as a non-verbal form of 'backchanneling'	Nodding in agreement, as encouragement, or to indicate that acknowledgement and listening.
Withdrawing the head/body	Moving the head backwards, as an expression of shock or surprise	Moving the head back in frustration or when unsure what to say/do
Frowning	Moving the lips down in an expression of sadness or frustration	Frowning in response to getting a guess at a word incorrect
Arm gestures	Using the arms/hands to explain a specific thing or emphasising a point	Using the arms to indicate 'bigger' when attempting to guess a word

Table 4: Chapter 3 language codes

Language use	Description	Example
Requesting information	Asking a question to the social partner, can be task related but doesn't need to be.	'Is the word a type of person?', 'What do we do next?'
Verbal backchanneling	Small verbalisations to show that the listener is attending.	'Mhm…', 'Okay…', 'Yeah…'
Self-disclosure	Telling something about themselves, can be a full story or a short remark	'Oh yeah my friend/partner/sibling did that…'
Laughter	Laughing at something fun happening	Laughing in response to a joke
Complimenting/encouragement	Saying something good about the other person or encouragement in the tasks	"Good guess!", "Oh wow, well done!"
Interrupting	Speaking whilst the other person has already started speaking. Only includes the person that 'interrupts' first (even if the initial speaker continues talking).	"No it's n-" "Is it a cat?"
Initiating conversation	Attempting to start a conversation unrelated to task demands	"How have you been?", "I'm interested to see what this is all about"
Open responding to initiations	When the social partner seeks to initiate conversation, the respondent offers a follow-up question in response or seeks to continue the conversation..	"I'm good, you?" "Yeah it is cold, how has it been where you are?"
Closed responding to initiations	Closed responses that may make it 'difficult' to continue the conversation.	"I'm good." "It is."

Design

Interaction Quality was examined through comparing mean scores on the Social Interaction Evaluation Measure between social actors across 6 groups (autistic people rating neurotypical friends, autistic people rating neurotypical strangers, neurotypicals rating autistic friends, neurotypicals rating autistic strangers, neurotypicals rating neurotypical friends, and neurotypicals rating neurotypical strangers) using a Kruskal-Wallis test. The behavioural analysis within the study used a two-way ANOVA design, exploring behaviours within dyads. These dyads were either autistic-neurotypical strangers, autistic-neurotypical friends, neurotypical-neurotypical strangers, or neurotypical-neurotypical friends. This gave a 2x2 design with two independent variables; neurotype composition (with the factors cross neurotype or same neurotype) and friendship status (with the factors friend or strangers). Non-parametric tests will be used throughout given the small sample size across groups within the study.

The main outcome variables were Interaction Quality as measured by the Social Interaction Evaluation Measure (RQ1), and overall social behaviours and backchannelling frequencies per minute (RQ2). Note that the study initially intended to also explore the correlation between these behaviours and the interaction quality, however this was not feasible given the nature of the data (see Discussion).

This design had a power of 0.52 assuming a moderate effect size. Note that no previous research has examined the influence of friendship on interaction quality for cross neurotype interactions and therefore this estimated effect size is a prediction based on the effect size of differences in social behaviours between neurotypes (Chita-Tegmark, 2016).

3.2. Results

Analysis will be separated into general interaction quality, and then behavioural variables. All behaviours were examined across all tasks. Frequencies are given per minute for the measure of general social behaviours across all tasks to account for slight differences in session length (e.g, due to technical issues). To carry this out, the number of each behaviour was analysed and then divided by the overall minutes within the interaction (e.g, the

behaviours within a half hour interaction would be divided by 30). This also mirrors analysis in previous studies (Rifai et al., 2022). Note that results should be interpreted with caution given the purpose of the study, small sample size, and key caveats for interpretation (see Discussion).

RQ1: What is the difference between friends and stranger interactions on self-reported interaction quality ratings for autistic and neurotypical adults?

Interaction Quality measures

First, the outcome measure of interaction quality was compared across 6 groups; autistic judgements of an interaction with a neurotypical friend/stranger, neurotypical judgements of an interaction with an autistic friend/stranger, and neurotypical judgements of an interaction with a neurotypical friend/stranger. Both members of each dyad responded to the Social Evaluation measure, giving a total of 72 respondents. Note that this grouping led to twice as many responses from neurotypical-neurotypical interactions because neurotypicals judging neurotypical-neurotypical interactions would occur twice (ie, once from each social partner). Note that there are no data for autistic-autistic judgements as no autistic-autistic social interactions were analysed. The full results the Social Evaluation measure are given below (Table 5), all scores represent a Likert scale from 1-8 where 1 means a highly unpleasant interaction and 8 is a high quality interaction. Note that the conflict subscale is coded such that 1 is no conflict and 8 is high conflict, and the 'who initiated more'/'who had the most influence' questions are coded such that 8 is the social partner and 1 is the respondent.

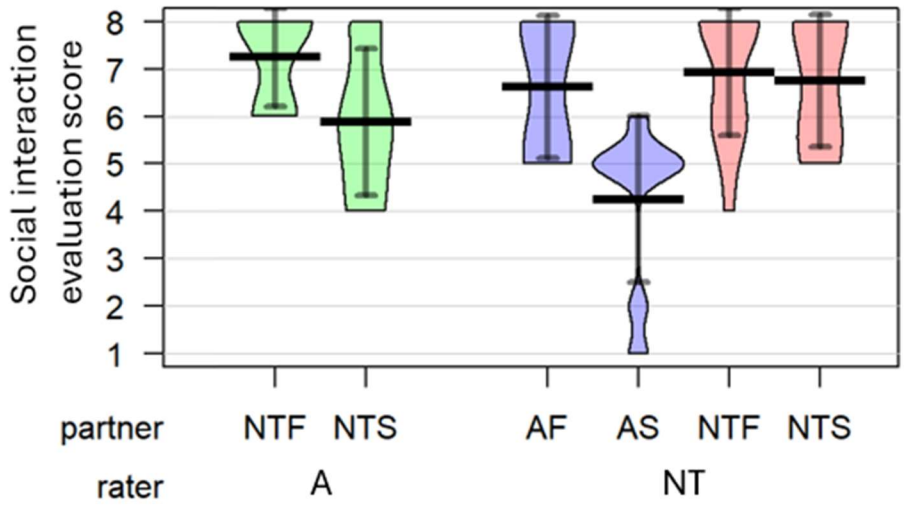
Table 5: Chapter 3 Interaction Quality scores

Rater	Social partner	N	Interaction quality	Self-disclosure	Partner disclosure	Conflict	Who initiated more?	Who had most influence?	Intimacy
Autistic	NT friend	9	7.25	2.56	2.27	1.00	3.03	3.32	5.18
Autistic	NT stranger	9	5.88	3.06	3.30	1.08	3.40	3.91	3.84
NT	Autistic friend	9	6.63	2.40	2.31	1.31	3.20	3.72	5.76

NT	Autistic stranger	9	4.25	3.27	2.75	1.41	3.49	3.85	4.38
NT	NT friend	18	6.94	4.19	3.66	1.67	4.41	4.23	6.84
NT	NT stranger	18	6.75	3.69	3.85	1.30	3.74	3.80	4.00

Of particular importance for this study is the interaction quality column, which is presented below as a pirate plot (Figure 9).

Figure 9: Chapter 3 Interaction quality scores across raters



Note: Green indicates autistic ratings of neurotypicals, blue represents neurotypical ratings of autistic people, red indicates neurotypical ratings of other neurotypicals, A = autistic, NT = neurotypical, error bars indicate 2 standard deviations, beans represent the spread of the data with wider beans indicating more frequent responses.

The possible scores on this subscale ranged from 1-8, with the actual range going from 1-8. A large ceiling effect was evident on the interaction quality measure, with 26 out of 72 respondents (31%) scoring 8 on the interaction quality measure. This ceiling effect, in combination with the overall sample size within groups, led to the decision to use non-parametric tests to analyse the differences in these interaction quality scores. Furthermore,

an initial aim was to make a correlation between social behaviours and interaction quality. However, due to this ceiling effect, this correlation was not possible (see later Discussion).

H1a) In online interactions participants will rate their friend higher on the Social Interaction Evaluation measure relative to rating a stranger.

To examine this hypothesis, a comparison of the median scores of interaction quality across the six groups (autistic rating neurotypical friend, autistic rating neurotypical stranger, neurotypical rating autistic friend, neurotypical rating autistic stranger, neurotypical rating neurotypical friend, and neurotypical rating autistic stranger) was carried out using a Kruskal-Wallis test. There was an overall significant difference $H(3) = 15.05$, $p < 0.01$, partial eta squared = 0.21. This suggests that there is difference between these overall median scores in terms of overall interaction quality, with a large effect size. Therefore, this will be explored in terms of main effects.

To explore this overall effect further, responses were combined across neurotypes. This led to the collapsing of the 6 groups into simply 2 groups: a judgement of a friend or a judgement of a stranger. This enabled the exploration of a main effect of friendships. There was a significant difference between the friend and stranger conditions when neurotype pairings were combined together on a Wilcoxon-signed ranks test (recall that all participants took part in the study once with a friend and once with a stranger; therefore the friendship factor is a repeated measure) even after the Bonferroni correction for multiple comparisons (alpha = 0.017). There was a significant difference in interaction scores across friends compared to strangers, $W(2) = 10.43$, $p < 0.01$, with the mean and median for friends (mean = 6.88, median = 7) being higher than strangers (mean = 5.32 , median = 6). This suggests that interactions with friends were generally rated higher than interactions with strangers.

H1b) Neurotypicals will rate other neurotypicals higher on the Social Interaction Evaluation measure relative to their ratings of autistic people.

To examine a potential main effect of neurotype, responses were combined across friendships. This led to a factor of neurotype composition: either a judgement of an interaction with someone of the same neurotype (neurotypical-neurotypical) or a judgement of an interaction with someone of a different neurotype (autistic-neurotypical). Note this analysis was somewhat limited because of the lack of an autistic-autistic group. There was a significant difference in interaction scores on a Mann Whitney U test across neurotype dyads compared to within neurotype dyads even after Bonferroni corrections (alpha = 0.017), $U(2) = 12.25$, $p < 0.01$, with the mean and median for friends being higher for neurotypical-neurotypical dyads (mean = 5.97, median = 7) relative to neurotypical-autistic dyads (mean = 4.93, median = 6). This suggests that neurotypical-neurotypical dyads were rated as higher in interaction quality relative to autistic-neurotypical dyads.

Taken together, these two results suggest there was a main effect of friendship on interaction quality and a main effect of neurotype composition on interaction quality. It is not possible to explore interaction effects within non-parametric tests, and hence these were not conducted.

RQ2: What is the difference between friends and stranger interactions on neurotypical-based behavioural measures in autistic and neurotypical adults?

The behavioural analysis sought to compare overall behaviours and language use in cross and same neurotype pairs within friendship and stranger pairs. Behaviours and language use codes will be combined together to avoid potential multiple comparisons challenges, particularly given the underpowered nature of the current study, however see Chapter 4 for an exploration of specific behaviours. Therefore, 'behaviours' refers to the sum of the frequency of all behavioural and language codes (Table 3 and 4 in the Methods section) and are given in Table 6 below. All data comes from the 36 dyads that took part (9 autistic-neurotypical friends, 9 autistic-neurotypical strangers, 9 neurotypical-neurotypical friends, 9 neurotypical-neurotypical strangers), with behaviours combined across tasks.

Table 6: Chapter 3 social behaviours, language, and combined social behaviours per minute

Social behaviours per minute per dyad (SD)			
	friend	**stranger**	**Average**
Cross	20.34 (7.34)	16.21 (6.65)	18.33
same	23.15 (6.48)	27.52 (5.91)	25.34
Average	21.74	21.92	
Social language per minute per dyad			
Cross	23.47 (5.66)	18.06 (6.30)	20.77
same	20.08 (4.94)	19.33 (5.37)	19.74
Average	21.7	18.7	
Combined social behaviours per minute per dyad			
Cross	43.75 (6.78)	34.21 (6.43)	39.04
same	43.19 (5.62)	46.82 (5.62)	45.01
Average	43.47	40.52	

H2a) The frequencies of social behaviour and language use will be higher in online interactions for neurotypical-neurotypical pairings relative to cross neurotype pairings.

To examine this, a 2x2 Kruskal-Wallis was carried out with 2 factors; Friendship condition (friend or stranger) and Neurotype composition of the dyad (autistic-neurotypical or neurotypical-neurotypical). The sum of social behaviours and language use per interaction formed the outcome variable of combined social behaviours per interaction. There was no overall significant difference across the Friendship groups and Neurotype groups on the frequency of combined social behaviours on a Kruskal-Wallis test, $H(5) = 9.96$, $p = 0.08$, partial eta squared = 0.13. This suggests there was no significant difference overall across Friendship condition and Neurotype compositions. Given the low power in the current study and the hypotheses outlined, this effect will still be broken down further across friendship and neurotype pairing, however results should be interpreted with caution given this lack of an overall effect.

To compare across friends or strangers specifically, both Neurotype compositions were combined together. This enabled a specific examination of Friendship across groups. The outcome variable was combined social behaviours per interaction, as before. There was no significant difference between neurotypical-neurotypical dyads and autism-neurotypical dyads in terms of the frequency of combined social behaviours, $H(3) = 4.45$, $p = 0.22$, partial

eta squared = 0.06. Therefore, the current study found no significant difference in the frequency of combined social behaviours across cross neurotype pairs in online interactions compared to neurotypical-neurotypical pairs.

H2b) The frequencies of social behaviour/language will be higher in online interactions for friendship dyads relative to stranger dyads.

Finally, combined social behaviour was examined irrespective of neurotypes to examine the influence of friendship. This involved combining Neurotype composition (autistic-neurotypical and neurotypical-neurotypical) together to just examine the influence of the Friendship factor (Friends compared to stranger). The outcome variable was combined social behaviours per interaction, as before. No significant difference was found between friendship and stranger pairs, $H(3) = 1.67$, $p = 0.64$, partial eta squared = 0.05, suggesting that there isn't a significant difference in online interactions for friendship dyads relative to stranger dyads.

3.3. Discussion

Given the two-fold purpose of the current study as a proof of concept intended to explore how cross-neurotype interaction within friendship pairs can be understood using existing measures and to tentatively explore some of these behaviours, results will first be discussed as presented, before discussing methodological challenges and subsequent recommendations. Limitations and future recommendations for behavioural coding within friendship contexts will be discussed in Study 4 so that limitations can be discussed from the perspective of two related studies.

Preliminary results discussion

There was a positive effect of friendship on interaction quality, with interactions with friends being rated as higher in interaction quality relative to strangers. This expands previous studies examining initial first impressions (Cage & Burton, 2019; DeBrabander et al., 2019) because these initial first impressions are limited to the initial stages of meeting a social partner. However, this finding shows that interaction quality more broadly may also

increase as a relationship is built with the social partner. Several mechanisms could be suggested for this. First, neurotypicals report greater social support within friendship dyads (Motomura et al., 2015; Winstead, Derlega, & Lewis, 1992) and in Chapter 2 autistic adolescents highlighted greater trust with their friends compared to strangers. In turn, this trust may reduce potential anxiety (although note this was not measured directly in the current study – see Chapter 4) and hence increase interaction quality.

Alternatively, it may be that a greater sense of shared understanding can be established within friendships. This could be neurocultural understanding within autistic-neurotypical dyads (Gillespie-Smith et al., 2024), but could be developed on a range of characteristics such as internal values or characteristics such as cultural differences. Indeed, this expansion of shared understanding beyond neurotype could be analogous to the development of conceptualisation of masking behaviours (Miller et al., 2021; Perry et al., 2022). Whilst masking was originally considered as a largely autism-specific phenomena (Cook et al., 2018), recent approaches are highlighting that this may simply represent a broader stigma management strategy applicable across a range of characteristics (Miller et al., 2021; Perry et al., 2022). This stigma management may be particularly important within stranger dyads. However, within friendship dyads, the shared understanding from this pre-existing relationship may reduce the emphasis of potential stigma. In turn, this may increase interaction quality within friendship dyads relative to stranger dyads because this pressure to manage stigma is less present. Therefore, greater shared understanding based on a range of characteristics, including neurotype, may have facilitated greater interaction quality within friendship dyads relative to stranger dyads.

Furthermore, there was a significant difference in interaction quality in autistic-neurotypical dyads compared to neurotypical-neurotypical dyads. This replicates previous work in an in-person context (Sasson et al., 2017), and with autistic people being rated more negatively by neurotypicals across video and auditory modalities (Sasson et al., 2017). As above, this is consistent with a stigma-based account wherein differences in behaviour for autistic people may lead to more negative judgements from neurotypicals. Note that this extends these stigma effects to an online video modality. This is important because online video contexts do change the range of behaviours available for social communication; for example, eye

contact can no longer simultaneously give and receive information (Jarick & Kingstone, 2015) and behaviours such as body position and hand movements are less available. This suggests that either some aspects of the behaviours that lead to more negative judgements of interaction quality could be present in both online and in-person interactions (e.g, smiling behaviours are available in both contexts). Or, alternatively, there may be different pathways in both online and in-person interactions that lead to same outcome of lower interaction quality (e.g, perhaps different behaviours are emphasised, but nonetheless these lead to lower interaction quality).

These differences in interaction quality occurred despite there being no significant difference found in overall behavioural frequencies within these dyads. This was unexpected given the existing research showing reduced behaviours in autistic-neurotypical dyads relative to neurotypical-neurotypical dyads (Rifai et al., 2022). Whilst the ceiling effects and small sample size meant that it wasn't possible to correlate these behaviours with interaction quality directly, this could form a direction for future research. In particular, this may suggest that whilst the overall frequency of behaviours may be similar between dyads there could still be differences in the nature of these behaviours. For example, one study has highlighted that smiling synchronicity in peer dyads of autistic and neurotypical people predicts self-reported interaction enjoyment (McNaughton, Moss, Yarger, & Redcay, 2024). Therefore, whilst the frequency of behaviours such as smiling may be similar, it could be that the timing or synchronicity of these behaviour still varied. Similarly, it is also possible that the lack of an overall difference could have masked differences in the specific behavioural strategies used. For example, there may have been a specific difference in backchannelling, consistent with differences in autistic-neurotypical and neurotypical-neurotypical dyads in previous studies (Rifai et al., 2022). However, this difference may have been masked by compensatory increases in a different behaviour (e.g, asking direct questions), leading to no overall difference. Larger scale studies with greater statistical power may seek to uncover differences in the specific behavioural strategies used to achieve interaction quality across dyads.

The current study was also not able to explore interaction effects between neurotype and friendship on interaction quality or social behaviours because of the small sample size.

However, this could form a key avenue for future research (see Chapter 4). Multiple potential mechanisms can be suggested for future interaction studies to explore. First, at the individual level, interaction effects could stem diagnostic disclosure; it is more likely that the neurotypical knew their friend was autistic compared to a stranger, and knowing the diagnosis does appear to reduce the difference in first impression ratings in previous studies (Sasson & Morrison, 2019), suggesting this knowledge could also impact interaction quality overall. However, going beyond this, it is also key to note potential individual differences in autism; it could also be that a friend would know their specific autistic friend, and potentially know some aspects of their difficulties or strengths (e.g, eye contact, see discussion of adaptation in Chapter 2). In turn, this may enable an idiosyncratic shared neurocultural understanding (Gillespie-Smith et al., 2024). This would be consistent with the main effects of friendship seen in the current study. Furthermore, increased contact with a stigmatised group is known to reduce stigma towards that group (Herek & Capitanio, 1996), which may reflect facilitate shared understanding within autistic-neurotypical friendship dyads. However, interaction effects would need to be identified to confirm this. Teasing apart autism knowledge, understanding, and disclosure from the effect of friendship directly wasn't possible in the current study (as almost all neurotypical friends of autistic people knew their friend was autistic), however this could be potentially examined through comparing cross-neurotype interactions between friends to stranger dyads that have high autism knowledge when diagnosis is disclosed, extending previous studies (Sasson & Morrison, 2019).

Nonetheless, whilst the current study was sufficient for a proof-of-concept for whether this exploration is feasible, there are several key methodological challenges in the current study that make interpretations challenging. First, it is of note that participants in the current study were all university students, which is a generally highly educated population that frequently interacts with unfamiliar peers. In turn, it's possible that the current study may underestimate some aspects of differences between both neurotype and friendships. In terms of neurotype differences university populations could have greater knowledge of autism compared to the general population. In turn, greater autism knowledge has been found to relate to reduced stigma towards autistic people (Sasson & Morrison, 2019), so the students may have been less stigmatised relative to the broader neurotypical population.

However, note that education level does not predict attitudes towards autistic people (Kuzminski et al., 2019), suggesting this may not be the case. Second, in the terms of the influence of using a student population to explore friendships, student populations likely have more frequent contact with strangers compared to non-student populations. Indeed, one participant commented directly that they've 'become used to' talking to strangers through university. This problem was compounded by a lower than planned sample size due to logistical challenges and participants initially signing up that were then found to not be legitimate (Pellicano et al., 2023), leading to lower statistical power than intended. Further limitations regarding behavioural measurement will be discussed later in Chapter 5 as they are also applicable to Study 4 and appear to be inherent to this research rather than specific to this study.

The current study was also not able to recruit an autistic-autistic group. This was unexpected, as no neurotype restriction was given on nominating the friend. Despite this, most autistic participants did nominate a neurotypical friend. Several reasons could be suggested for this. First, the autistic sample was university students that were likely to have attended mainstream schools. In this sense, most of their social interactions both currently, and historically, were likely with neurotypicals. Therefore, there may have simply been more opportunities for the participants in the current study to develop friendships with neurotypicals relative to other autistic people. It's also possible that some of the 'neurotypical' friends were autistic but were undiagnosed or didn't self-label as such. Therefore, future studies may seek to confirm this. An alternative explanation is that autistic participants presumed they would need to nominate another neurotypical friend. The recruitment materials did not specify the neurotype of the friend. However, because it was labelled as a friendship study, it is possible that they selected a neurotypical friend as they presumed this was required. Indeed, the vast majority of autism research has examined autistic-neurotypical social interactions, with studies of autistic-autistic social interactions comparatively rarer (Crompton, Sharp, et al., 2020; Rifai et al., 2022). Therefore, future studies may want to target autistic-autistic friends specifically or make this explicit within recruitment materials.

The inclusion of an autistic-autistic group in future studies could be informative because it would enable exploration of neurotype-matching specifically as a factor (ie, same neurotype and cross neurotype interactions could be explored). For example, neurotype-matching but not being autistic itself is associated with interpersonal rapport (Crompton, Sharp, et al., 2020). Therefore, it can be predicted that autistic-autistic stranger groups would report similar interaction quality relative to neurotypical-neurotypical groups. However, it is unclear how friendships may then further influence this. Perhaps there would be a small increase in interaction quality for autistic people with their friend compared to strangers, however this would be substantially smaller than the difference between autistic-neurotypical strangers and autistic-neurotypical friend dyads. This would strengthen the argument that cross-neurotype communication challenges are specific to stranger dyads rather than representing a characteristic of autistic interactions more broadly. Furthermore, demonstrating that friendship increases interaction quality specifically in cross-neurotype dyads would highlight the importance of friendship in potentially overcoming differences in communication styles to achieve neuro-cultural understanding (Gillespie-Smith et al., 2024). Therefore, future studies could use friendships as a context for exploring successful cross-neurotype social communication.

Future recommendations

This current study aimed to demonstrate that examining online interactions in this manner is feasible. In particular, the study was able to elicit high-quality cross-neurotype social interactions via friendships. This approach would enable exploration of the links between interaction quality, behaviours, neurotypes, and existing relationship to a social partner to be explored in greater depth. Examining social interactions in an online context was feasible, and tasks were effective in facilitating a dyadic interaction between participants across both friends and strangers across neurotype groups. Likewise, the self-selective nature of the friend ensured all emotional closeness ratings were high across same and cross-neurotype pairs, ensuring external validity and appropriate matching in this selection process. The use of online methods had two key benefits. First, autistic participants could take part in the study in their home setting, minimising potential uncertainty from coming into a lab setting. Second, a greater selection of friends was available (e.g, a friend could be in a different city and still take part). This may be important when recruiting autistic people

for friendship studies as it could be that the smaller average friendship networks of autistic people (Locke et al., 2010; Sedgewick, Hill, et al., 2019; Sedgewick et al., 2016) means that greater restrictions on the features of the friend on average may disproportionately influence this group. Therefore, this study was able to identify challenges and highlight key recommendations for future studies in terms of measuring cross-neurotype friendships online.

3.4. Interim conclusion

This study represents an exploration of how cross neurotype interactions online can be examined within the context of friendships and presented some tentative initial findings. Challenges for future research were identified, for example the need for more sensitive measures of interaction quality that are applicable to a broader range of social interaction contexts beyond the predominant focus on stranger interactions. Furthermore, recommendations were given for how behavioural components can be feasibly incorporated within these studies given the need to balance large enough sample sizes for sufficient power with coding time. The set-up appeared to be feasible, and was effective in generating and measuring successful social interactions.

The current study had several limitations, particularly in terms of the small size. Therefore, it is necessary to replicate this research with a larger sample size. Likewise, this study focused on adults, enabled greater comparability to existing literature examining cross- and same-neurotype interactions in adults (Crompton, Sharp, et al., 2020; Crompton, Ropar, et al., 2020; Rifai et al., 2022). However, cross-neurotype interactions have not yet been explored in younger populations, for example adolescents. This is important because adolescence involves development in socio-emotional domains (Burnett et al., 2011; Young, Sandman, & Craske, 2019; Youniss & Haynie, 1992), increasing stability of friendships (Blakemore, 2008; Dubois & Hirsch, 1993; Poulin & Chan, 2010; Youniss & Haynie, 1992), and a developmental period associated with risk of psychopathology for autistic people (Billstedt, Gillberg, & Gillberg, 2005; Fujioka et al., 2020; White et al., 2009). Therefore, the next study will explore cross neurotype social interactions in the context of adolescent autistic friendships.

4 Chapter 4: Cross neurotype social interactions between friends compared to strangers in autistic-neurotypical adolescent dyads

Building upon the previous chapter, this chapter aimed to explore cross neurotype friendship and stranger interactions with adolescents in an in-person interaction. Therefore, given that this study builds upon the previous chapter, this introduction will focus on the rationale for extending these findings to adolescents and in-person settings (see Chapter 3 for an introduction to the overall approach).

Adolescent social interactions

Adolescence is a time of considerable social change for both neurotypical and autistic people, as covered in the Introduction, Chapter 2a, and previous literature (e.g, Blakemore, 2012, Kilford et al, 2016). However, two aspects of adolescent social interactions are central to the current study so will be covered in greater detail: friendships in the context of school and cross-neurotype interactions within schools specifically.

Adolscent friendships are often centred around school, with research in this area often examining social networks within the classroom. For example, the most common technique is reciprocal nomination (Yugar & Shapiro, 2001), wherein students are asked to nominate up to 5 classmates as friends or to nominate their best friend specifically. Then, if these friendships are mutual, this is then labelled as an overall friendship dyad. Depending on the nature of the analysis, this can then be used to separate students into these dyads, to label unequal partners (i.e, one person is nominated by another but not vice versa), or to create overall network connectivity maps of students within a classroom (Değirmencioğlu, Urberg, Tolson, & Richard, 1998; Pijl et al., 2011).

The approach has often been adopted to study autistic adolescents within mainstream schools, wherein it is likely that most of their peers will be neurotypical (Chamberlain et al., 2007; Locke et al., 2010). Studies have down that autistic adolescents generally were mutually connected to at least one other friend, however they had a greater likelihood of non-reciprocal nominations overall relative to neurotypicals (Locke et al., 2010).

Furthermore, autistic adolescents in these studies have been demonstrated to show more isolated or peripheral (i.e, largely disconnected from the central classroom cohort) connectivity patterns, and fewer overall nominations by and towards neurotypical peers relative to neurotypical classmates (Locke et al., 2010)

Evidence for how this connectedness to peers may relate to loneliness for autistic adolescents, however, appears more mixed. The previous study did find significantly increased loneliness in their classroom of 7 autistic and 13 neurotypical students (Locke et al., 2010), however a larger scale study of 381 neurotypical and 17 autistic students did not find a significant difference in loneliness (Chamberlain et al., 2007). This difference in loneliness was found despite both studies showing similar results in terms of network connectivity, frequency of nominations, and using identical loneliness measures. Therefore, one interpretation of these results could be that some autistic adolescents may have their social needs met within smaller, close knit friendship groups (see Chapter 2a). Alternatively, perhaps within a larger context (i.e, an entire school) social connections between autistic adolescents can be generated and, whilst these may still be lower in frequency compared to overall neurotypical connections, these connections may nonetheless be sufficient to prevent loneliness for the autistic adolescents. Nonetheless, whilst autistic adolescents do appear less embedded within the social network of mainstream school classrooms relative to neurotypical peers, it remains somewhat unclear how this may relate to their loneliness overall.

Mainstream schools often do include a mixture of neurotypes, including both autistic and non-autistic pupils. Therefore, within this context it is likely that autistic students will frequently interact with neurotypical students and vice versa, including friendships (see Chapter 2a for students discussing this directly). However, little research has been conducted directly examining general social interactions within these classrooms. Most studies have adopted the peer nomination approach (Yugar & Shapiro, 2001) rather than examining interactions quality or attitudes towards autistic people directly. However, some evidence can be taken from young adults in university settings, albeit with the caveat of the need to replicate the findings with a younger sample. For example, neurotypical university students are more likely to state that they would not want to interact with an autistic peer

based on a vignette description or videos (Morrison, DeBrabander, Jones, Faso, et al., 2020a; Sasson et al., 2017). This effect, in turn, appears to decrease with diagnostic disclosure and as neurotypicals become more knowledgeable regarding autism (Sasson & Morrison, 2019) and with training on autism for neurotypicals (Jones, Morrison, et al., 2021; Jones, DeBrabander, et al., 2021). These studies must be replicated within school settings, however they may suggest that similar biases could be providing a barrier for the social interactions and friendships of autistic students within schools.

Live interactions

The current study also took place in person, building upon the online nature of Chapter 3. Conceptually, this means that behaviours such as face looking and eye contact could be explored directly, depending on the spatial resolution and camera set-up used (see Chapter 1). No study to date has examined cross-neurotype friendship interactions within school settings, however some evidence can be inferred from Chapter 2. For example, the adolescents reported experiences of friendships with neurotypicals within school (e.g, with classmates). They also highlighted some behavioural adaptations by friends (e.g, walking side by side) and by themselves to accommodate their friends (e.g, tailoring their own eye contact). However, Chapter 2 was qualitative in nature so it's difficult to confirm how these adjustments may appear in naturalistic interactions. In this regard, some research on live interactions from the adult literature can be drawn upon. For example, in a diffusion chain storytelling context, cross neurotype stranger dyads show significantly fewer backchannelling instances and a lower proportion of mutual gaze (mutual looking towards the face by both social partners) relative to neurotypical-neurotypical dyads (Rifai et al., 2022). In turn, this higher mutual gaze and backchannelling predicted higher rapport ratings of the social partner. Within autistic-autistic dyads, whilst there was significantly lower backchannelling relative to neurotypical-neurotypical dyads, this did not predict subsequent rapport ratings.

However, this previous study did not include a friendship condition, and therefore it remains unclear whether these effects are specific to stranger dyads. For example, perhaps the lack of previous history with a social partner necessitates a greater reliance on behaviours in creating judgements regarding the other person. Therefore, the current study

aimed to explore these cross-neurotype interactions within the additional context of friendships. The in-person nature of the study also provides an avenue to expand upon the behavioural measures in Chapter 3, specifically to examine looking behaviours that are less feasible to measure in an online context. As previously, the overall logic was to understand cross-neurotype friendship interactions as a potential context for eliciting high quality cross-neurotype interactions, and hence friendships can be used as to understand how successful cross-neurotype communication can be achieved more broadly.

Research questions mirror those in Chapter 3, with the research having the benefit of taking place face-to-face in school. Therefore, the first research question was 'What is the difference between school friends and stranger interactions on self-reported interaction quality ratings for autistic and neurotypical adolescents'. Based upon the findings of Chapter 3, this led to the following hypothesis:

- H1) Neurotypical adolescents will rate interactions with autistic strangers as lower in interaction quality relative to neurotypical strangers, however there will be no difference between neurotypical ratings of neurotypical friends compared to autistic friends.

The second research question sought to examine behaviours within dyads. Therefore, the research question was 'What is the difference between friends and stranger interactions on behavioural measures in autistic and neurotypical adolescents?'. The operationalisation of these behavioural measures was key, given the potential variability in the range of behaviours that could be explored. Therefore, overall behavioural frequencies will be reported using a range of behaviours commonly measured across studies (see Chapter 3). Then a more specific examination of mutual gaze and backchannelling will be explored, with these variables measured identically to a previous study in this area (Rifai et al., 2022). Therefore, based upon these three strands of behaviour (overall behaviours, mutual gaze, and backchannelling), three hypotheses were generated.

- H2) There will be a greater frequency of overall social behaviours within neurotypical-neurotypical dyads relative to cross neurotype neurotypical-autistic dyads overall (i.e, a main effect of neurotype dyad). However, there will be no

significant difference between neurotypical-neurotypical and neurotypical-autistic friendship dyads.

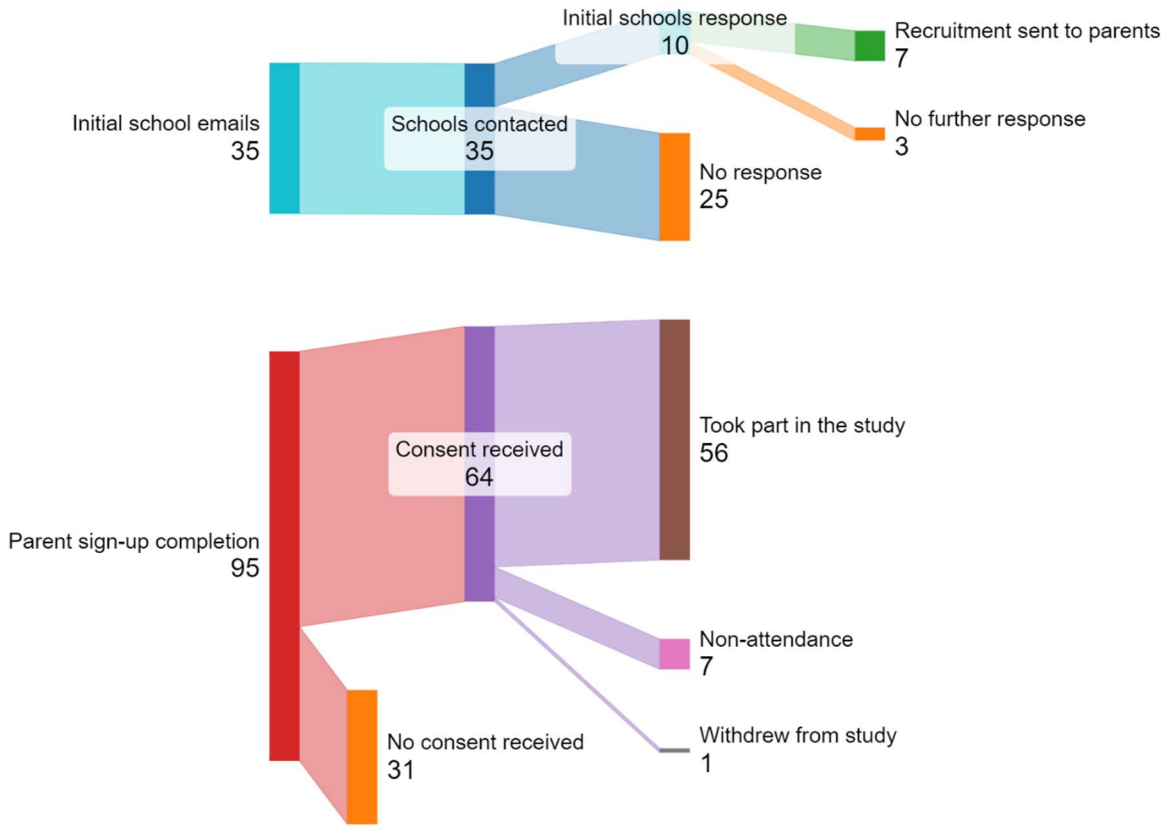
- H3) There will be a greater proportion of time spent in mutual gaze in neurotypical-neurotypical dyads relative to neurotypical-autistic dyads for strangers. However, no significant difference will be seen between neurotypical-neurotypical and neurotypical-autistic friendship dyads.
- H4) There will be a greater frequency of backchannelling within neurotypical-neurotypical dyads relative to neurotypical-autistic dyads. However, no significant difference will be seen between neurotypical-neurotypical and neurotypical-autistic friendship dyads.

4.1. Methods

Participants

Fifty six participants took part in the current study, comprised of 30 autistic and 26 non-autistic participants. Participants were aged 12-17 years (M= 13.87, SD = 1.21, 32 males, 22 females). All participants were recruited from seven different mainstream schools in the Durham area. All autism diagnoses were confirmed by parents. The study originally recruited 64 participants, however eight participants were not available at the point of testing (see Figure 10 for full drop out rates). Participants were not excluded on the basis of co-occuring conditions; seven autistic participants had co-occuring ADHD and two participants had anxiety. One participant within the neurotypical group was in the process of a diagnosis for potential anxiety. Advertisements for the study were sent out to parents via schools (typically via Special Educational Needs Coordinators). Parents signed their adolescents up using Qualtrics and testing took place within the school setting. The study received ethical approval from the Psychology Department Ethics Committee at Durham University. Permission for video recording was received from parents prior to testing and further assent received from the adolescents prior to the beginning of the session. All videos were stored in accordance with the data management plan outlined in the ethics approval. Participants were reimbursed with a £10 Amazon voucher for their time.

Figure 10: Chapter 4 recruitment process



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Dyads and matching procedure

The 56 participants were formed into dyads, with participants taking part into the study once with a self-nominated friend and again with a non-friend pair, counterbalanced for order. It was not always possible to match a participant with a friend (e.g, due to non-attendance on the day, a friend not wanting to take part in the study, or the two autistic and one neurotypical participants that could not label a friend within school), and therefore friendship dyads are lower overall. Friendship pairs were identified through asking

participants to nominate their friend, and then ensuring friendships were mutual, consistent with previous research in this area (Petrina et al., 2014; Pijl et al., 2011). Then, as a comparison for the friendship dyads, 'stranger' created by taking participants from the years above or below the autistic participants, with a check at the beginning of every session (ie; asking if participants knew each other). Participants in the stranger dyad were asked first if they knew each other, then asked if they had spoken before, and finally if they had seen each other around school. Participants had to confirm that they had not spoken before and didn't know each other to be part of the 'stranger' condition. All stranger pairings did report either not recognising their social partner or that they had seen them around school but hadn't spoken previously.

In total, this 22 dyads involved friendship pairs and 28 involved 'stranger' pairs. Four autistic participants noted that their closest friends didn't attend their school but were able to offer an alternative and thus could still take part (see Discussion). Six participants either nominated friends that weren't available on the day of testing (two autistic, one neurotypical participant) or were not mutually identified as friends (two autistic participants and one neurotypical participant). This additionally led to more stranger dyads relative to friendship dyads (see flowchart in Figure 11 for dyad matching).

Figure 11: Chapter 4 dyad matching

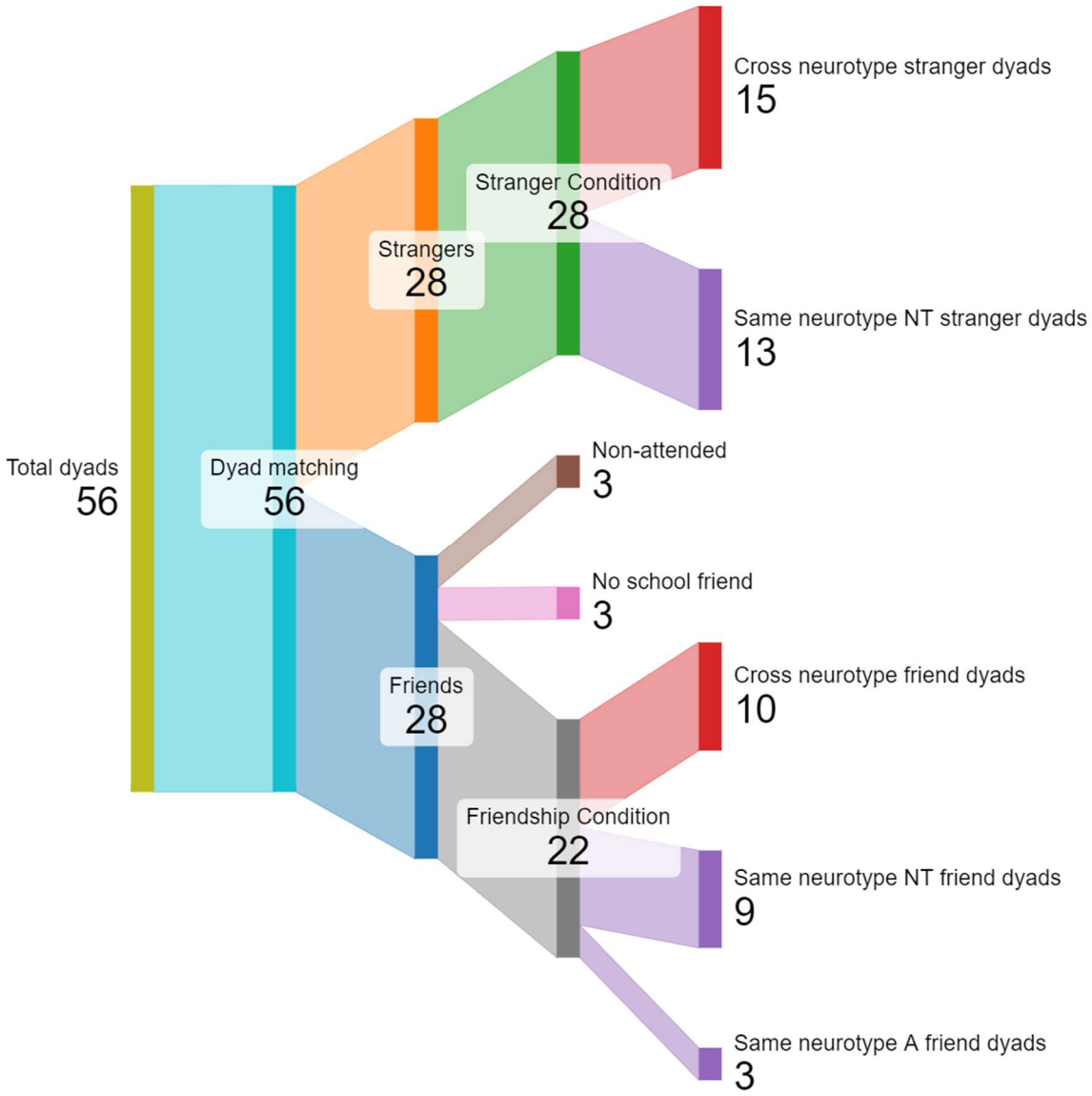


Figure made using https://sankeymatic.com/build/

Characteristics of dyads pairings are given in Table 7. There was no overall significant difference on a one-way ANOVA between dyad groupings on the factor of Age, $F(40,4) = 1.096$, $p = 0.36$.

Table 7: Chapter 4 dyad pairing characteristics

	Friend Conditions			Stranger Conditions		
	N dyads	Mean age (SD)	Co-occuring conditions	N dyads	Mean age (SD)	Co-occuring conditions
Cross-neurotype NT-A	10	13.67 (0.86)	5 ADHD, 1 anxiety	15	14.38 (1.50)	4 ADHD, 1 anxiety
Same-neurotype NT	9	13.86 (1.18)	1 anxiety	13	13.53 (1.35)	1 anxiety
Same-neurotype A	3	12.90 (1.29)	1 ADHD	0	NA	NA

Note: Co-occuring conditions refers to the number of dyads that included 1 person with the mentioned co-occuring condition. No dyads included 2 individuals with co-occuring conditions. Age is given in years. A = autistic, NT = neurotypical

Measures

Interaction Quality Questionnaire

Social Interaction Evaluation Measure (Berry & Hansen, 1996) was used to assess interaction quality after each social interaction. This used a series of self-reported 8 point Likert scale questions to assess self-reported interaction quality, with a score of 8 indicating high interaction quality and a score of 1 indicating low interaction quality. This measure, whilst previously used in autistic and neurotypical adults (Morrison, DeBrabander, Jones, Faso, et al., 2020) as well as those scoring high in anxiety (Lee & Marsella, 2010), has not previously been used in adolescent groups specifically. However, note that there are no existing measures of interaction quality aimed at neurotypical nor autistic adolescents, therefore the current study adopted this measure for consistency with Chapter 3. Results, however, must be interpreted with caution until the measure is validated with adolescents specifically.

Anxiety Questionnaire

The self-report Spence Childrens Anxiety Scale (Spence, Barrett, & Turner, 2003) was used to assess anxiety in the adolescents. This is due to the potential exacerbating role of anxiety on social interactions and motivation, particularly when co-occuring with autism (Spain et al., 2018). The questionnaire is a series of 44 Likert style 0-3 questions ranging from 'never' to 'always' aimed at adolescents (e.g, 'I worry about things'). Scores were tallied to provide an overall anxiety score for each participant, then a mean score produced for each group. In addition, a cut-off T-score of 60 will be used to indicate adolescents with heightened anxiety, following with the standardised norms of the questionnaire for neurotypical adolescents based on the age and gender of the participants. 3 autistic adolescents declined to fill in the questionnaire, leaving a total of 26 autistic adolescent anxiety scores and 25 neurotypical anxiety scores. Chronbachs alpha for the Spence Childrens Anxiety Scale in this study after removing the unscored questions was 0.85, indicating good internal consistency.

Tasks

LEGO Task

Participants were divided into a 'builder' and an 'instructor' (counterbalanced for order, such that for half the trials the autistic person would begin as a builder and half the time the neurotypical adolescent would begin as a builder). The 'builder' was given a set of LEGO blocks required to build a model (see Figure 12 for images of the figures). The instructor was then given the instruction manual for building that specific model (see Appendix 8; all instructions used were taken directly from the LEGO website for set 11013), with instruction manuals only providing visual instruction (ie, no written directions). The instructor was then tasked with telling the other person how to build the model. 'Builders' were not allowed to look at the instructions and 'instructors' were not allowed to touch the blocks. Participants then had up to 5 minutes to build the model correctly together. After one model was complete, participants switched roles and a new model was provided. This took place 4 times so each participant had 2 trials of being the 'builder' and two trials of being the 'instructor'. Note that this replaced the 'Food Task' relative to Chapter 3 because of both the in-person nature of the task and concern that some of the younger participants (e.g, 12 years old) may have been unfamiliar with what a three course meal may include.

Figure 12: Chapter 4 LEGO models

Note: images taken directly from the LEGO website of the set used, https://www.lego.com/en-gb/product/creative-transparent-bricks-11013?age-gate=grown_up.

Word Task

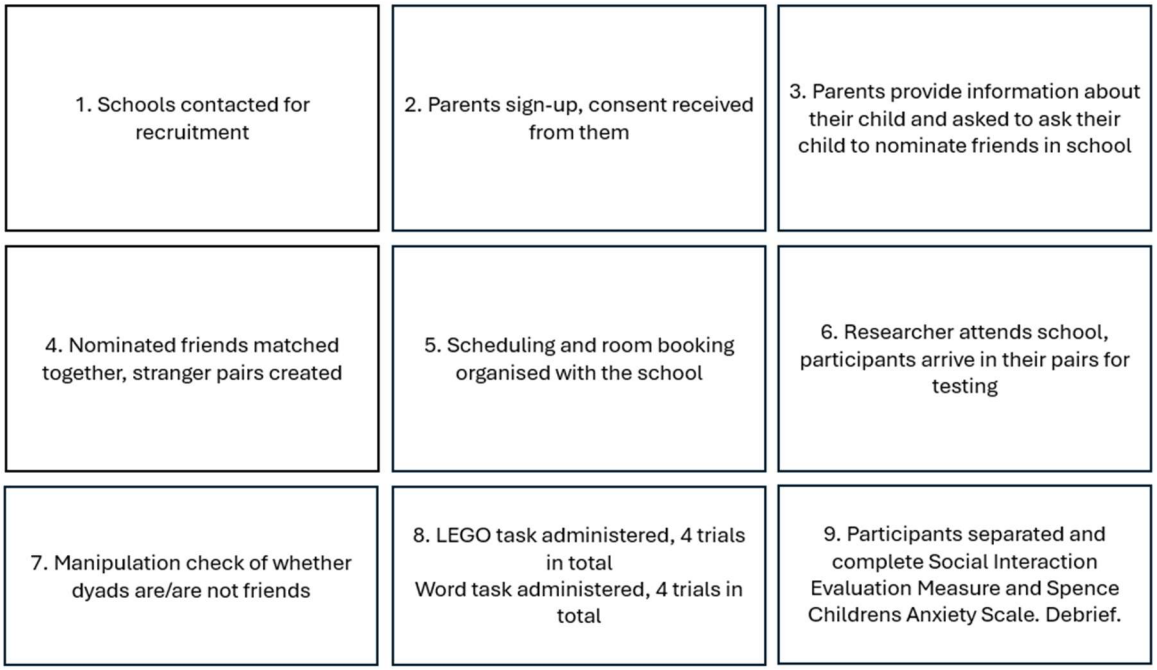
One participant was provided with a word list (see Appendix 5) and the other participant was tasked with asking as many questions as possible to guess the words on the list. Each participant had 3 minutes to guess as many words as possible, and then a new word list was provided to the other participant and the trial was repeated. A total of 4 trials were given. This replicated the method detailed in Chapter 4, with only difference being that

participants were in person so word lists were provided directly and placed on their laps, rather than being sent via email.

Full procedure

The full procedure, from initial contact of schools to final debrief of participants is given in Figure 13 below.

Figure 13: Chapter 4 procedure

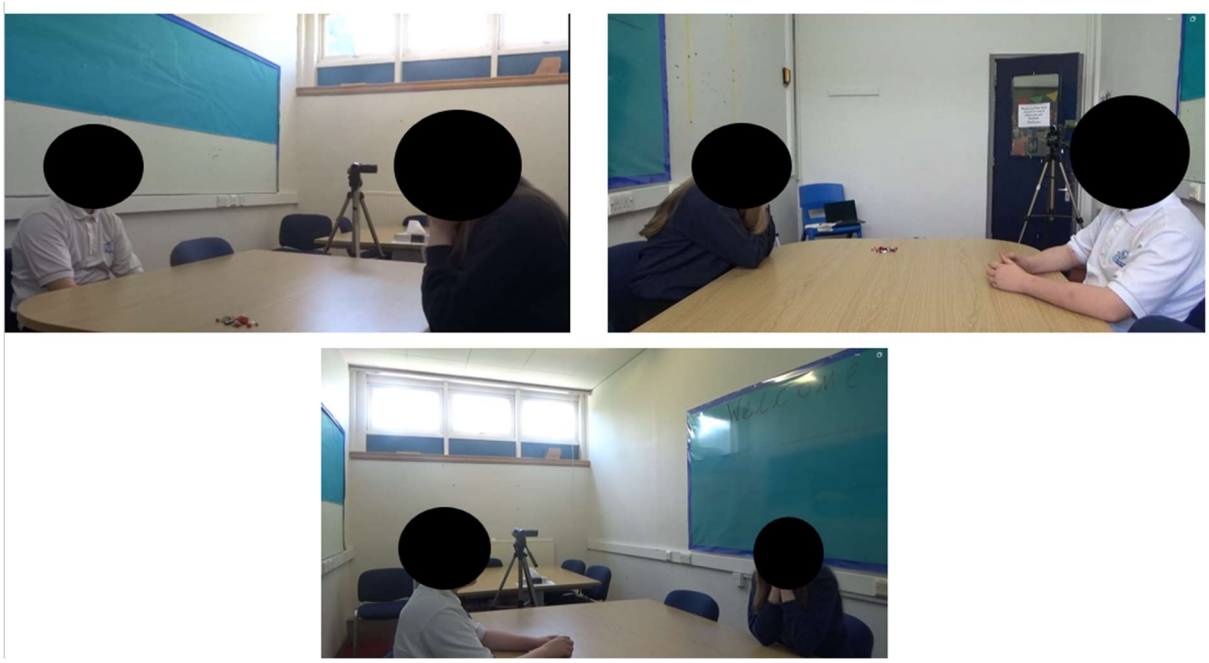


Video coding and coding scheme

Camera set-up

3 cameras were used for testing, with one camera placed diagonally to the side of the shoulder of each participant, and one central camera observing both participants (see Figure 14). This ensured that a clear view was available for behavioural coding, particularly given differences in lighting and room availability between schools, and ensured that sufficient resolution was given for coding eye gaze behaviours.

Figure 14: Chapter 4 example camera set-up



Coding Scheme

The coding scheme was based upon that used in Chapter 3, with some modifications made to account for the in-person setting and to measure mutual gaze directly. The full coding scheme is given in Appendix 7. As with Chapter 3, note that behaviours could mutually occur and hence were coded as overlapping (e.g, smiling and face looking).

Analysis

Video coding followed the same procedure as Chapter 3, with two researcher assistants trained in carrying out the data coding using Datavyu (v.1.3.8; https://datavyu.org/). As before, time when participants were not visible on the cameras was coded and removed prior to analysis. Given the experimental setup, time off camera represented less than 1% of the overall study time (averaging 11 seconds per 26 minute session, usually due to picking up dropped LEGO pieces). Inter-rater reliability was assessed between the two coders through having both coders code 10% of the videos (6 participant videos) and then

calculating Cohen's Kappa for the agreement between coders (Cohen, 1960). Inter-rater reliability scores were 0.80 for behavioural coding and 0.83 for language coding. This reflects a between 'good' to 'great' concordance between raters (Hallgren, 2012).

This code was then exported into Excel using a Ruby script provided by Datavyu (https://datavyu.org/) and then imported into an R script for data managing, inter-rater reliability assessment, and analysis. This followed the same process as Chapter 3. Additionally, an R script was created to determine episodes of shared mutual gaze based upon instances where eye gaze overlapped between the two social partners. Similarly, an R script was created to sum both instances of verbal and non-verbal backchannelling.

Design

Anxiety scores were analysed using between subjects T-tests comparing scores on the Spence Childrens Anxiety Scale between the autistic and non-autistic participants in the study. Interaction Quality was examined through comparing mean scores on the Social Interaction Evaluation Measure between social actors across 6 groups (autistic people rating neurotypical friends, autistic people rating neurotypical strangers, neurotypicals rating autistic friends, neurotypicals rating autistic strangers, neurotypicals rating neurotypical friends, and neurotypicals rating neurotypical strangers) using a one way ANOVA. The behavioural analysis within the study used a two-way ANOVA design, exploring behaviours within dyads. These dyads were either autistic-neurotypical strangers, autistic-neurotypical friends, neurotypical-neurotypical strangers, or neurotypical-neurotypical friends. This gave a 2x2 design with two independent variables; neurotype composition (with the factors cross neurotype or same neurotype) and friendship status (with the factors friend or strangers). Given the small number of dyads, autistic-autistic dyads were not analysed in this study.

The main outcome variables were Interaction Quality as measured by the Social Interaction Evaluation Measure (RQ1), and overall social behaviours, backchannelling frequencies per minute, and the proportion of mutual eye gaze (RQ2). Note that the study initially intended to also explore the correlation between these behaviours and the interaction quality, however this was not feasible given the nature of the data (see Discussion).

4.2. Results

First, it is necessary to highlight the potential differences in anxiety between the groups, as they may reflect a covariate that could explain differences between groups. Then analysis will be separated into general interaction quality (examining RQ1) followed by behaviours (examining RQ2). All behaviours were examined across all tasks. Frequencies are given per minute for the measure of all behaviours and backchannelling, and proportions of time are given for mutual gaze across all tasks to account for slight differences in session length. This mirrors analysis in previous studies (Rifai et al., 2022) to assist comparativity between existing research. All results should be interpreted with caution given the relatively small sample sizes within each group. Given the small sample size of the autistic-autistic group, this was removed from the analysis.

Anxiety measurement

First, outcomes on the Spence Childrens Anxiety Scale were analysed between autistic and non-autistic participants overall. Total mean scores were analysed, before additionally examining T-scores for comparison to a standardised population based upon participants' age and gender. Finally, the subscale of social anxiety within the scale was analysed, with the caveat that the subscale is only made up of 6 items in total.

6 questions within the Spence Childrens Anxiety Scale are not analysed, therefore the theoretical maximum and minimum scores on the questionnaire are 0-114 with a higher score indicated more evidence of heightened anxiety. The actual range of the data was 6-87 across the entire sample. Mean anxiety score for autistic participants that did complete the questionnaire (N= 22) was 42.76 (SD = 23.01) and the mean score for neurotypical participants (N=25) was 41.90 (SD = 15.77). There was no significant difference between neurotypes on an independent groups t-test, t(45) = 0.18, p = 0.85, Cohens d = 0.04.

In terms of the cut off for heightened anxiety scores, 9 autistic participants (40% of the sample) and 7 neurotypicals (28% of the sample) had a T-score representing they were at or above the 85th percentile for anxiety relative to standardised population measures for their

age and gender. These results suggest that overall anxiety scores were high across both groups although a larger percentage of autistic participants fell into the heightened anxiety range.

In terms of factor loading, items 1, 6, 7, 9, 29, and 35 are thought to reflect social phobia (Spence et al., 2003). All participants that scored above the threshold for heightened total anxiety also met the threshold for heightened social phobia (a raw score of 8 across the 6 items). An additional 3 autistic participants met the threshold for heightened social phobia but did not reach the threshold for overall heightened total anxiety. Further analysis was not completed due to there only being 6 items within this subscale, but nonetheless this is consistent with a high proportion of heightened anxiety across groups, and at least part of this relates to high social anxiety specifically.

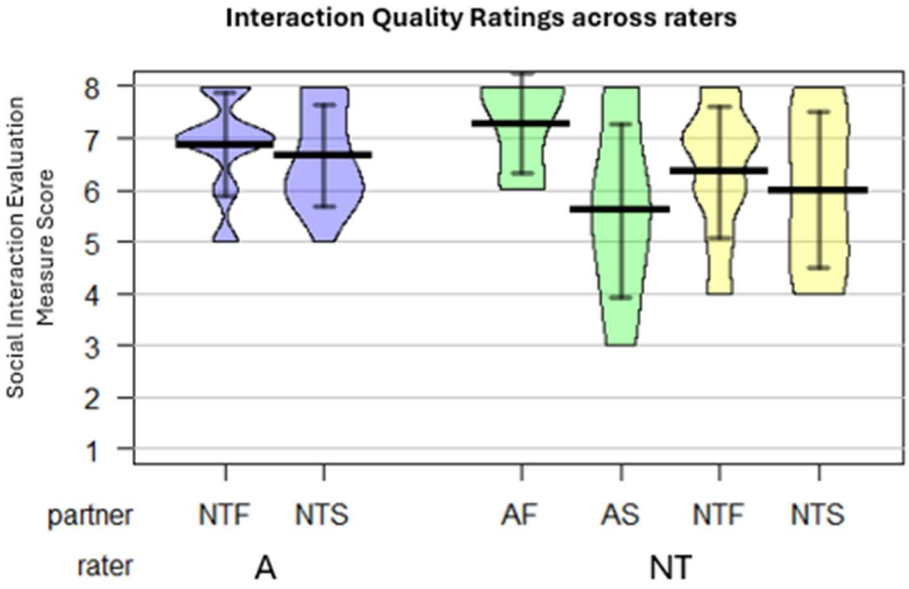
RQ1) What is the difference between friends and stranger interactions on self-reported interaction quality ratings for autistic and neurotypical adolescents?

First, as with Chapter 3, scores on the Social Evaluation Measure were averaged together to produce an overall interaction quality score. Then these average scores were compared across friendship (friend/stranger) and neurotype (same or cross neurotype) dyad interactions to provide an overall indicator of interaction quality (Figure 15). The Social Interaction Evaluation Measure was completed by each participant twice (once following a stranger interaction and then again following a friend interaction, adjusting for the cases wherein the friend was unavailable), leading to 88 questionnaires from 47 total dyads. This gave a power of 0.61 based on a medium effect size, suggesting the study was somewhat underpowered. The theoretical maximum and minimum scores for the measure range from 1 to 8, with higher scores indicating greater interaction quality.

The scores in the sample ranged from 3 to 8. Ceiling effects were evident, with 16 ratings at the maximum across groups (18% of the dataset). 6 groups were used in the analysis: Autistic ratings of neurotypical friends (A-NTF), autistic ratings of neurotypical strangers (A-NTS), neurotypical ratings of autistic friends (NT-AF), neurotypical ratings of autistic

strangers (NT-AS), neurotypical ratings of neurotypical friends (NT-NTF), and neurotypical ratings of neurotypical strangers (NT-NTS).

Figure 15: Chapter 4 interaction quality ratings across dyads



Note: Black bars indicate means and 2 standard deviations from the mean. Bean width indicates the spread of the data, with wider beans indicated a greater number of participants reporting that score. A = autistic, NT = neurotypical, F = friend, S = stranger.

H1) Neurotypical adolescents will rate interactions with autistic strangers as lower in interaction quality relative to neurotypical strangers, however there will be no difference between neurotypical ratings of neurotypical friends compared to autistic friends.

To examine whether there was a significant difference between interaction quality scores across friend and stranger conditions, the analysis first began with an overarching one-way ANOVA comparing mean interaction quality judgements across all conditions. This served to determine whether there was a significant difference between the means of all groups, that could then be broken down further to examine the difference between friends and strangers. However, there was no overall significant difference between means across the six groups, $F(81, 5) = 1.078$, $p = 0.302$, partial eta squared = 0.013. Given the

aforementioned ceiling effects and relatively low number of participants within each subgroup, the test was also replicated using a Kruskal-Wallis signed ranks test and this also indicated no significant difference, H(5) = 3.7481, p = 0.29. These results indicate that no significant difference was found in interaction quality scores across different neurotype pairings. It is therefore not possible to reject the null hypothesis that there is no significant difference between interaction quality ratings across groups. Given that there was no overall significant difference between groups on interaction quality scores, follow up analyses will not be reported here.

RQ2) What is the difference between friends and stranger interactions on neurotypical-based behavioural measures in autistic and neurotypical adolescents?

This analysis will first examine general behaviours, before then examining more specific behaviours that are known to be relevant in cross-neurotype social interactions: namely, backchannelling and mutual gaze behaviours. Note that this thesis has adopted a strict definition of eye contact (see Introduction chapter), therefore mutual looking towards the eyes will be labelled as mutual gaze because the lack of eye tracking techniques meant that determining whether individuals were looking at the eyes of their social partner (and vice veras) required some subjective judgement on the part of the coders. All analyses examined behaviour within 47 dyads using a 2x2, Friendship condition (friend or stranger) by Neurotype composition (cross-neurotype or same-neurotype) two-way ANOVA, with the behaviour being examined as the outcome variable. The achieved power in this sample was 0.51 to detect a medium effect size across the behaviours, therefore the study was somewhat underpowered. Note that there are still relatively few dyads per subgroup (the lowest being 9 within the same-neurotype friend group), and therefore results should be interpreted with some caution. However, non-parametric tests would not allow for the examination of interaction effects relevant for the research questions.

General social behaviour

A composite of all measured social behaviours in the coding scheme except face looking was created given that current guidance on the most important social behaviours for achieving

successful social interactions is unclear, particularly across neurotypes (see also Chapter 3). All behaviours were summed from both social partners to provide an indicator of behaviours within each dyad. A frequency-based measure of behaviours per minute was adopted given that the social behaviours were short, discrete behaviours (with the exception of face looking and mutual gaze; see later analysis). The frequency per minute of general social behaviours is given below in Table 7.

Table 8: Chapter 4 Social behaviours, language, and combined social behaviours

Social behaviours per minute per dyad			
	friend	**stranger**	**Average**
Cross	16.81 (6.42)	10.82 (5.21)	13.82
same	15.97 (4.61)	11.17 (5.01)	13.57
Average	16.39	11.00	
Social language per minute per dyad			
Cross	13.49 (7.41)	15.72 (6.94)	14.61
same	14.31 (6.21)	14.98 (5.92)	14.65
Average	13.90	15.35	
Combined social behaviours per minute per dyad			
Cross	30.30 (6.92)	26.54 (6.23)	28.42
same	30.28 (5.53)	26.15 (5.58)	28.22
Total average	30.29	26.35	

H2) There will be a greater frequency of overall social behaviours within neurotypical-neurotypical dyads relative to cross neurotype neurotypical-autistic dyads overall (i.e, a main effect of neurotype dyad). However, there will be no significant difference between neurotypical-neurotypical and neurotypical-autistic friendship dyads.

A two-way ANOVA was carried out with the factor of friendship condition (friend or stranger) and a factor of neurotype composition (cross neurotype compared to same neurotype), with the outcome variable of combined social behaviours per minute. The error term then reflected individual variation between dyads. This model enabled the exploration of a main effect of friendship condition, a main effect of neurotype composition, and a potential interaction effect of this overall friendship group and neurotype composition on the outcome variable of combined social behaviours per minute. This analysis will then be followed up by post-hoc t-tests to further explore differences between groups.

There was a significant main effect of friendship within the model, F(1, 46) = 5.32, p = 0.03, partial eta squared = 0.09, with friend dyads showing significantly more behaviours relative to stranger dyads. A follow up Welch independent groups t-test was used to examine this difference within same and cross neurotype dyads. There was a significant difference in the frequency of behaviours between friends and strangers within cross-neurotype dyads, t(18.6) = 4.35, p < 0.01 and within same neurotype dyads t(28.4) = 4.35, p < 0.01. Therefore, across both same and cross neurotype behaviours there is significantly more combined social behaviours with friends compared to strangers.

There was no significant main effect of neurotype within the model F(1, 46) = 0.51, p = 0.48, partial eta squared = 0.01. Therefore, there was no difference observed in overall social behaviours in cross-neurotype dyads relative to same neurotype dyads.

There was no significant interaction effect between friendship and neurotype within the model, F(1, 46) = 0.63, p = 0.43, partial eta squared = 0.01. Therefore, there was also no interaction between friendship condition and neurotype dyad composition on overall social behaviours detected in the current study. Given that this interaction effect was not significant, follow up analyses were not conducted and we can conclude that the study failed to reject the null hypothesis that there is no interaction between friendship and neurotype composition on the frequency per minute of overall social behaviours.

Mutual gaze behaviour

Mutual gaze was defined as mutual face looks between social partners in the social interaction, created through examining the overlap in timing of face looking behaviours between social partners. Given that mutual gaze episodes could take place over a period of time (e.g, one long mutual gaze look) results will be presented as a proportion of time spent in mutual gaze relative to the duration of the interaction. The proportions of mutual gaze throughout the interaction are given in Table 8 below.

Table 9: Chapter 4 proportions of mutual gaze across dyads

Mutual gaze proportion per dyad (% of the interaction)			
	friend	**stranger**	**average**
Cross	11.42 (7.43)	8.02 (6.34)	9.72
same	14.21 (5.21)	13.50 (5.68)	13.86
total	12.82	10.76	

H3) There will be a greater proportion of time spent in mutual gaze in neurotypical-neurotypical dyads relative to neurotypical-autistic dyads for strangers. However, no significant difference will be seen between neurotypical-neurotypical and neurotypical-autistic friendship dyads.

A two-way ANOVA was carried out with the factors of friendship condition (friend or stranger), neurotype composition (same neurotype or cross neurotype dyad) and the outcome variable of the proportion of mutual gaze within dyads. The error term then reflected individual variation between dyads. This model enabled the exploration of a main effect of friendship condition, a main effect of neurotype composition, and a potential interaction effect of these independent variables on the outcome variable of the proportion of mutual gaze within each dyad.

There was a no significant main effect of friendship condition, $F(1, 46) = 2.91$, $p = 0.09$, partial eta squared = 0.05. Therefore, there was no significant difference detected between friendship dyads and stranger dyads on the overall proportion of mutual gaze.

There was a significant main effect of neurotype condition , $F(1, 46) = 7.23$, $p < 0.01$, partial eta squared = 0.12,. Therefore, there was a significantly greater proportion of mutual gaze in same-neurotype neurotypical-neurotypical interactions relative to cross neurotype autistic-neurotypical interactions

There was no significant interaction effect of neurotype and condition, $F(1, 46) = 2.41$, $p = 0.13$, partial eta squared = 0.05. Therefore, the influence of neurotype composition on the proportion of mutual gaze within dyads did not appear to depend on whether dyads were friends or strangers.

Despite this lack of an overall interaction effect, note that the hypothesis sought to explore mutual gaze within groups (for example, comparing cross-neurotype strangers to same-neurotype strangers). This may be particularly relevant to better understand the significant main effect of neurotype condition on mutual gaze. To examine this aspect of the hypothesis, within group t-tests were carried out. Note that these results must be interpreted with the caveat that there was no overall interaction effect. First, there was a significant difference between cross neurotype and same neurotype stranger pairs on a Welch independent samples t-test, $t(21) = 2.90$, $p < 0.01$, suggesting that same neurotype neurotypical stranger pairs spent a significantly greater proportion of the interaction in mutual gaze relative to cross neurotype stranger pairs. However, there was no significant difference between the proportion of time spent in mutual gaze between cross neurotype friends relative to same neurotype friends $t(20.3) = 1.75$, $p = 0.09$.

Backchannelling

Backchannelling was defined as the combined frequency of verbal backchannelling (ie, utterances such as “mhm” that indicate attention) and non-verbal backchannelling (ie, head nodding). These behaviours are short in duration, and therefore results were analysed in terms of the frequencies of backchannelling episodes per minute. Frequencies of episodes of backchannelling are given in Table 9 below.

Table 10: Chapter 4 backchannelling frequency across dyads per minute

	Backchannelling episodes per minute per dyad		
	friend	**stranger**	**average**
Cross	9.03 (4.13)	8.65 (4.52)	8.84
same	9.57 (3.21)	10.02 (3.45)	9.80
average	9.30	9.34	

H4) There will be a greater frequency of backchannelling within neurotypical-neurotypical dyads relative to neurotypical-autistic dyads. However, no significant difference will be seen between neurotypical-neurotypical and neurotypical-autistic friendship dyads.

A two-way ANOVA was carried out with the factor of friendship condition (friend or stranger) and neurotype composition (same neurotype neurotypicals or autistic-neurotypical dyads), with an outcome variable of backchannelling episodes per minute. This model enabled the exploration of a main effect of friendship condition, a main effect of neurotype composition, and a potential interaction effect of these independent variables on the outcome variable of backchannelling episodes per minute.

There was no main effect of friendship group, $F(1, 46) = 0.72$, $p = 0.40$, partial eta squared = 0.01. Therefore, the current study failed to reject the null hypothesis that there will no significant difference between friends or strangers on the frequency of backchannelling across dyads.

There was no main effect of neurotype $F(1, 46) = 3.23$, $p = 0.08$, partial eta squared = 0.07. Therefore, the current study found that there was no significant difference between neurotypical-neurotypical and neurotypical-autistic dyads on the frequency of backchanneling within dyads.

There was no interaction between neurotype and friendship groups, $F(1, 46) = 1.74$, $p = 0.19$, partial eta squared = 0.04. Therefore, given that there is additionally no main effects, it is possible to rule out a 'crossover effect' and the results suggest that the factors of neurotype composition and friendship status had no significant effect on backchannelling frequency in isolation or together. No within groups analysis was carried out given that neither the main nor interaction effects were significant.

4.3. Discussion

Results will first be discussed in terms of the anxiety scores and the implications for interpretation, followed by examining RQ1 and RQ2. Finally, the general discussion will discuss some limitations shared with Chapter 3.

Anxiety discussion

Anxiety scores were examined as a potential factor that could influence results. No significant difference was found between autistic and non-autistic participants in terms of anxiety in the current study, which appears to be due to generally high anxiety scores on the Spence Childrens Anxiety Scale across both groups. Autistic adolescents have been found to be score higher on anxiety relative to neurotypicals in previous research (Bejerot et al., 2014; Gillot et al., 2001; White et al., 2009). Therefore, whilst raised anxiety on this measure was to be expected in the autistic group, it was unexpected that anxiety would also be high within the neurotypical group. It is unclear why this may have been the case, however a few suggestions can be made. First, note that participants were recruited via emails sent out from schools (usually from the Special Educational Needs Coordinator; SENCO) to parents to partake in a study involving LEGO and word games with friends and peers. Whilst recruitment materials did not explicitly mention that the purpose of the study was to explore friendships, it is possible that parents that thought their child may be more anxious or in need of friendship support were more likely to sign-up to the study. Similarly, the parents that had more contact with the SENCO previously could have been more likely to reply to the advertisement. This may have led to the overall sample overrepresenting adolescents that are more anxious or in need of support relative to the general adolescent population. Finally, these results could also reflect that neurotypical adolescents self-reported their anxiety. It may be that previous parent or teacher reports have underestimated anxiety in neurotypical adolescents, consistent with existing evidence of informant effects on anxiety reporting (DiBartolo & Grills, 2006).

Alternatively, and not mutually exclusively, it's possible that this may reflect a cohort effect as a result of the COVID-19 pandemic. The pandemic was associated with increased anxiety for adolescents during school closures (Ludwig-Walz, Dannheim, Pfadenhauer, Fegert, & Bujard, 2023), however studies have not yet examined the potential long-term

consequences for anxiety in adolescents. This may be particularly relevant for the adolescents in the current study because they would have been transitioning into high school during the pandemic, and hence this could have led to higher long-term anxiety relative to the standardised (non-pandemic) population scores used for comparison within the Spence Childrens Anxiety Scale. Nonetheless, these heightened anxiety scores must be kept in mind when interpreting the overall results in the current study – 40% of the autistic sample and 28% met the standardised cut off for heightened anxiety. Anxiety, in turn, is associated with increased likelihood of rating themselves as 'disliked' across autistic and non-autistic people (Gurbuz et al., 2024) and lower overall gaze towards the eyes of a social partner (Hessels et al., 2018; Schneier et al., 2011).

RQ1) What is the difference between friends and stranger interactions on self-reported interaction quality ratings for autistic and neurotypical adolescents?

RQ1 sought to explore the difference in self-reported interaction quality across neurotype dyads and friendship/stranger dyads. No significant difference was found overall between the mean interaction quality scores, suggesting that there is no difference between friends and stranger interactions on self-reported interaction quality for autistic and neurotypical adolescents. This suggests that either there was no true difference between groups or, alternatively, a true difference may have existed but was not detected in the current study. A type 2 error is a possibility, given that the study itself was somewhat underpowered and the strong ceiling effects had the effect of 'cutting off' potential variation that may have existed in the population. In turn, this may have minimised potential differences due to this limitation of the measurement. The distribution of the results did somewhat mirror previous findings in Chapter 3, for example with higher mean interaction quality for neurotypicals rating autistic friends relative to autistic strangers, however in this case this difference did not reach significance.

Nonetheless, there could also be other explanations for this failure to detect an effect. First, the Social Interaction Evaluation Measure (or, indeed, any measure of interaction quality) has not been used previously with adolescents because most research in this area tends to adopt either friendship nominations or social network based approaches (Yugar & Shapiro,

2001). Therefore, it could be that the adolescents did not understand the questions effectively. However, steps were taken to minimise this risk, as the researcher was present when participants completed the questionnaire and told participants that they were available to define any terms as needed. Only two participants requested a definition (both for “self-disclosure”) and removing this item from the composite score for interaction quality did not significantly change the overall results.

Second, due to the school setting, it may be that some neurotypical participants knew that the autistic participants were likely to be neurodivergent (e.g, from seeing them with teaching assistants or within the special education needs provision of the school). In turn, knowing that an autistic person is autistic may reduce negative impressions from the neurotypicals (Sasson & Morrison, 2019) and hence could have led to higher interaction quality for neurotypicals rating autistic participants. In turn, this may have reduced the potential effect size of any difference that did exist due to the moderating effect of knowing the diagnosis of the social partner. Finally, it is possible that the heightened anxiety across the sample may have contributed to this failure to detect an overall effect on interaction quality. Anxiety does predict expectations of rejection across autistic and non-autistic groups (Gurbuz et al., 2024) and therefore it could be that this expectation of rejection could have led to overall lower interaction quality. This explanation is perhaps plausible for the stranger interactions, however it would perhaps be unexpected that this would also lower interaction quality within friendship dyads wherein rejection is perhaps less likely (see Chapter 2a).

RQ2) What is the difference between friends and stranger interactions on neurotypical-based behavioural measures in autistic and neurotypical adolescents?

The current study found that there was a significant main effect of friendship on the frequency of combined social behaviours within dyads, but no main effect or interaction effect of neurotype composition. Little previous research has focused on behaviours within friendship dyads for autistic or neurotypical people (see also Chapter 3), therefore it was somewhat unexpected to find this main effect of friendship. One potential explanation may be that adolescents were more socially motivated and engaged with their friends relative to

strangers, and hence were more likely to display social behaviours regardless of neurotype. This would be consistent with research on social development during adolescence suggesting that relationships with peers become increasingly important (Choudhury et al., 2006; Kilford, Garrett, & Blakemore, 2016b; Lenroot & Giedd, 2006; Qualter et al., 2013) and the high value placed on friendships by adolescents (Helseth & Misvær, 2010). Alternatively, this significant difference of friendship on overall social behaviours could also have emerged from the high levels of anxiety within the current sample. For example, perhaps the heightened anxiety meant participants in both groups were less likely to try and engage with a stranger social partner through initating more behaviours, perhaps due to potential fears of rejection (Gurbuz et al., 2024). However, they may have felt comparatively more comfortable with a friend. This does somewhat mirror the discussion in Chapter 2 wherein autistic adolescents highlighted "playing it safe" with strangers compared to "being themselves" with friends. Therefore, it is possible that these results could relate to the impact anxiety may have on interactions with strangers relative to friends.

In terms of mutual gaze, there was a significant main effect of neurotype, with neurotypical-neurotypical dyads showing a greater proportion of mutual gaze relative to autistic-neurotypical neurotype dyads. This is consistent with existing research on eye gaze in autism, for example a similar study also found a significantly higher proportion of mutual eye gaze in same neurotype neurotypical stranger dyads relative to cross-neurotype stranger dyads (Rifai et al., 2022). However, note that follow-up post hoc tests revealed that there was no significant difference between same neurotype friendship dyads and cross neurotype friendship dyads on the proportion of mutual gaze. This suggests that the effect of neurotype on mutual gaze could be greater in stranger dyads relative to friend dyads. However, given that there was no significant interaction effect, this must be replicated with a larger sample to confirm this finding. This would be an important finding given that the vast majority of existing eye gaze studies in autism have been conducted in the context of stranger pairs (Hanley et al., 2015; RajKumar et al., 2019; Rifai et al., 2022).

There was also no main effect of friendship dyads on the proportion of mutual gaze. This suggests that there was no difference in the proportions of eye contact within friend dyads compared to strangers overall. This finding could have stemmed from the heightened

anxiety within the sample. Anxiety is associated with lower eye gaze overall relative to non-anxious populations (Hessels et al., 2018; Schneier et al., 2011). Therefore, it is possible that anxiety decreased potential mutual gaze across groups that then made it difficult to detect a relatively small effect of friendship dyad. There is some evidence for this when comparing this study to previous research, for example 13.5% of the time spent in neurotypical-neurotypical stranger dyads in this study was mutual gaze. However, in previous studies, this proportion of mutual gaze in neurotypical-neurotypical dyads was 18.7% (Rifai et al., 2022a). This suggests that this heightened anxiety may have had an overall effect on the mutual eye gaze proportions that made it difficult to detect any differences between friends compared to strangers.

Finally, the current study found no significant difference between dyads in terms of the frequency of backchannelling. This was unexpected given that existing studies in this area have found backchannelling to be significantly more common within neurotypical-neurotypical dyads relative to autistic-neurotypical dyads (Rifai et al., 2022). This lack of a difference in backchannelling in the current study may reflect differences in task demands as the previous study in this area focused on a storytelling context using diffusion chain modelling (Rifai et al., 2022). In a diffusion chain, generally one interlocutor is speaking directly to the other in a one-way transfer of information, and then the receiver would become the speaker for the next member of the 'chain'. In this sense, information flows predominantly in one direction and this, in turn, may provide a large amount of opportunities for backchannelling behaviours to be used to indicate attention. However, in the current study, participants were either giving or receiving instructions to build a model or asking questions to guess words within a word list. In this sense, there was a bidirectional flow of information needed to complete the current task. Within this task context, it may be that there is less importance placed on backchannelling as a strategy for showing attention because interlocutors need to more directly ask questions to receive the information. Further research across different task types with a repeated measures design may be a useful avenue for exploring this possibility in future research.

Overall, these behavioural results indicate that there was significantly more overall social behaviours within friendship dyads relative to stranger dyads regardless of neurotype,

potentially due to greater engagement or the effects of anxiety on interactions with friends relative to strangers. Second, that there was a greater proportion of mutual eye gaze within same-neurotype dyads relative to cross neurotype dyads, extending previous findings on adults (Rifai et al., 2022) to adolescents. This could be due to a large difference in mutual eye gaze in stranger same-neurotype dyads relative to stranger cross neurotype dyads, however the lack of an overall interaction effect means this should be interpreted with some caution. Finally, there was no significant difference in backchannelling across groups, potentially due to differences in task demands. However, these results have the caveat that anxiety scores were high across both autistic and neurotypical groups. Therefore, some of these findings may reflect co-occuring high levels of anxiety in both groups.

4.4. Quantitative measurement discussion

Three key discussion points are shared across Chapter 3 and 4 and hence will be discussed here: interaction quality measurement, power discussions, and the role of knowledge of diagnostic categories. First, a key strength of both chapters is that they successfully elicited high-quality cross neurotype social interactions. However, this led to a measurement challenge as there was a ceiling effect on the Social Interaction Evaluation Measure in both studies. This was particularly unexpected in Chapter 3 given that this measure has been used previously in both neurotypical and cross-neurotype adult dyads (Berry & Hansen, 2000; Berry et al., 1996; Morrison, DeBrabander, Jones, Ackerman, et al., 2020; Sasson & Morrison, 2019). However, all previous studies examined strangers, so it is possible that this measure is less sensitive to detecting differences in generally 'high quality' social interactions. Therefore, there is a strong need to develop more sensitive measures of interaction quality that will retain this sensitivity for both adults and adolescents. One strategy for this would be to contextualise interaction quality within the questions; for example, "think back to a time when you enjoyed speaking to a close friend. How would you rate this interaction relative to that one?". In turn, this may allow for greater variability in interaction quality to be captured across studies.

Furthermore, studies in both Chapter 3 and 4 were underpowered, reducing the likelihood to be able to detect an effect if one did exist. This is usually improved by simply increasing

the sample size within studies. However, there were three key barriers to increasing sample size in the current studies: first, there was the need to fraction out groups into friend/non-friend and cross/same neurotype dyads. This meant that even a relatively large sample size would lead to a relatively low sample within each dyad subgroup. Second, recruitment and testing with friendship dyads involves key challenges. These were both theoretical (e.g, deciding what to do if friendships are not mutual and determining appropriate cut-offs) and practical (e.g, if one friend does not attend the testing session this can result in no data being able to be collected). Third, and perhaps most challenging, increasing the sample size requires substantial increases in coding time, necessitating a trade-off between the statistical power necessary and time resources for sufficient coding of the data.

There are some potential tools that could ease coder burden in future studies, hence enabling feasibility of larger scale studies, and these can be understood at theoretical and practical levels. Theoretically, there is currently little guidance in the literature on what behaviours relate to interaction quality within cross-neurotype friendship dyads. If some key behaviours could be identified, similar to how backchanneling is known to play a role in neurotypical interactions (Rifai et al., 2022), then coding could be made more specific and target only key behaviours. At a practical level, alternative data collection tools such as remote eye tracking (Caruana et al., 2018; Franchak et al., 2010; Ye et al., 2012) or software tools could enable some coding to be analysed automatically. For example, software has already been developed to detect behaviours such as head nodding (Wei, Scanlon, Li, Monaghan, & O'connor, 2013) and verbalisations likely to indicate backchannelling (Wang, Williams, Dilley, & Houston, 2020). The use of these techniques would likely involve additional challenges, for example in the current study it would likely require bringing participants into the lab or participants using specific software at home (with the caveat that this would mean a loss of control of extraneous factors such as lighting), but would enable larger sample sizes without substantially increasing coding time.

Finally, both studies have the caveat that it was unclear whether social partners knew the diagnostic label of the social partner (that is, whether their friend was autistic or whether the stranger was autistic). Diagnostic disclosure has been shown to improve first impression ratings in adult autistic-neurotypical stranger dyads (Sasson & Morrison, 2019) and is more

likely that an autistic persons friend would know their diagnosis compared to a stranger. Therefore, it could be that simply knowing the other person is autistic is driving results rather than friendships specifically. One strategy to rule this out would be to share diagnostic status, hence holding constant this factor of diagnostic disclosure. However, this approach was not taken in the current study for two reasons. First, there are ethical concerns in sharing diagnostic status because there is no guarantee that someone would know their friend is autistic and that the autistic person would feel comfortable sharing this. Second, there was the risk of potentially biasing social behaviour and judgements by informing participants that someone in the group is autistic. Indeed, note that it is more naturalistic for strangers to be uninformed about an autistic persons diagnosis and this likely does the reflect the reality of most autistic peoples interactions with strangers compared to friends. Nonetheless, future studies could circumvent some of these concerns by examining social interactions within contexts wherein diagnosis may be known but interactions could still occur between friends or strangers, such as autistic support or social groups. This would enable exploration of interaction quality and friendships in a naturally occurring context wherein diagnostic disclosure is likely to be made.

Beyond simple disclosure, it is also possible that friends of autistic people may simply know more about autism which may be driving potential differences between friends and strangers. This would also be consistent with previous research highlighting higher first impression ratings from neurotypicals towards autistic people in those with higher autism knowledge (Sasson & Morrison, 2019). However, in the context of friendships, the directionality of this would be difficult to determine with the methods used in the current thesis. For example, whilst those high in autism knowledge could be more likely to befriend autistic people, it is also possible that befriending autistic people increases general autism knowledge. To explore this possibility, future research may aim to explore contexts where cross-neurotype friendships are likely to develop and determine whether autism knowledge predicts later cross-neurotype friendships or vice versa. For example, this could be carried out as a longitudinal study within a school setting using autism knowledge and friendship questionnaires with structural equation modelling approaches.

5 General Discussion

The current thesis overall aimed to better understand cross-neurotype communication within the context of friendships for autistic people. To achieve this, a mixed methods approach was used. This included two qualitative interview studies; speaking directly to autistic participants and their parents. Then, building on these qualitative findings, interaction quality and behaviour were examined between friends compared to strangers in adults online and adolescents in person. The key findings from these studies will be summarised, linked together, and future directions highlighted. Finally, a general reflection on co-production throughout the project will be provided to inform future directions of the approach taken in the overall thesis.

5.1. Research Question 1: How do autistic adolescents conceptualise their own social interactions, friendships, and neurotype specific behaviours such as eye contact (Chapter 2a)?

Autistic adolescents (n= 15; age range 12-17) often felt that the onus was placed on them in social interactions. This was particularly striking when participants would discuss adaptations to social interactions that they would make to ensure others were comfortable, relative to adaptations that they felt others would make to ensure that they themselves were comfortable. For example, many autistic teenagers discussed managing conversation topics and their behaviours, particularly when speaking with strangers. This likely stems from the predominant focus in the literature on the characteristics of autistic people, particularly within the medical model (see Introduction), rather than acknowledging the dyadic nature of interactions.

Similarly, the participants often discussed the role of shared understanding and mutual trust as important aspects of their friendships, rather than shared neurotype specifically. They felt that the potential 'cost' of making a social faux pas was lower with their friends compared to strangers and this often made them feel more willing to 'be themselves'. Whereas, with strangers, they often discussed preferring to 'play it safe' due to uncertainty in what the social partner would deem appropriate and the potential consequences of a faux pas. This extends on previous research, expanding on the role of uncertainty within

social interactions (Jenkinson, Milne, & Thompson, 2020; McGuire & Michalko, 2011) and the potential role that anxiety and fear of rejection are known to play in social interactions (Acker et al., 2018; Gurbuz et al., 2024) through adding this friendship component. Given that participants reported that these barriers of uncertainty and fears of rejection are lower with friends relative to strangers, this may highlight that some of this research may be specific to stranger interactions.

Finally, eye contact findings were somewhat mixed, with high individual variation between participants. This is consistent with existing quantitative and qualitative research (see Introduction for a review of these). Participants also described how their friends often adapted to their eye contact (e.g, walking side by side) or that they themselves adapted their eye contact depending on their social partner. In particular, eye contact served as one example of a behaviour that participants described as either being adapted within cross-neurotype friendships or was simply emphasised less. This expanded upon the notion of autistic and neurotypical communication styles (Crompton, Sharp, et al., 2020; Rifai et al., 2022) by highlighting that potentially distinct communication styles can converge to achieve shared neurocultural understanding (Gillespie-Smith et al., 2024) and mutually rewarding social interactions. Therefore, Chapter 3 and 4 sought to explore how this may be occurring.

5.2. Research Question 2: How do autistic adolescents with communication challenges and their parents conceptualise their own social interactions, friendships, and neurotype specific behaviours such as eye contact (Chapter 2b)?

Chapter 2b examined autistic adolescents with communication challenges or social anxiety (n = 10; age range = 12-17) such that a standard interview would not be appropriate. This study also drew upon the insights from parents, due to the difficulty in gaining the perspectives from this sample. Nonetheless, participants in this study did emphasise the role of shared understanding – similar to Chapter 2a. However, there was greater uncertainty in what shared understanding may look like for this group, particularly without language. This is an essential area for future research, given that this sample is highly underrepresented in the literature (Russell et al., 2019), however implications of sampling cut across the thesis so these will be explored separately (see Sampling Implications).

There was also greater discussion of potential barriers for autistic people in Chapter 2b. This took the form of institutional barriers, for example one parent described the difficulty in supporting their adolescents friendships due to GDPR restrictions on revealing the details of the other child. There were also peer-based barriers, particularly in terms of neurotypical uncertainty and stigma towards stimming behaviours or bullying within school. Nonetheless, perhaps some of the most insightful findings from this study came from discussing potential adaptations to current research (see Sample implications section).

In terms of both Chapter 2a and 2b together, both studies were successful in gaining the overall perspectives of autistic adolescents on their friendships, social interactions, and eye contact. Friends were highlighted as important in both studies, albeit with the caveat of uncertainty regarding what friendship may look like for autistic people with communication challenges or social anxiety. Both studies also discussed the essential role of neurotypicals in the social interactions of autistic people, underscoring the importance of a dyadic approach to understanding social interactions. Therefore, Chapter 3 and 4 sought to explore this further using quantitative analysis of interaction quality and behaviours within autistic-neurotypical and neurotypical-neurotypical friend and stranger dyads.

5.3. Research Question 3: How does interaction quality and communication styles differ in cross-neurotype friendship dyads relative to cross-neurotype stranger dyads for adults (Chapter 3)?

Chapter 3 aimed to examine whether more negative interaction quality within autistic-neurotypical dyads relative to neurotypical-neurotypical dyads extended to friendships (n = 36; age range = 18-30 years). In turn, this could expand on previous research on stranger interactions (Crompton, Sharp, et al., 2020; Gillespie-Lynch et al., 2015). Furthermore, Chapter 3 aimed to build upon the mixed results regarding how behaviours may or may not differ in cross-neurotype friendships found in Chapter 2a by directly examining social behaviours in cross-neurotype friendships compared to same-neurotype friendships. Finally, the study was also able to examine these questions specifically in an online context, in turn expanding existing research on cross-neurotype interactions to not only to incorporate friendships but also online interactions.

The first key finding of Chapter 3 was that self-reported interaction quality was significantly lower for neurotypicals rating autistic strangers, however there was no difference between interaction quality ratings for neurotypicals rating autistic friends compared to neurotypical friends. This expanded earlier research examining first impressions wherein neurotypical adults gave significantly lower first impression ratings to autistic adults (Crompton, Sharp, et al., 2020; DeBrabander et al., 2019) by introducing this friendship component. In particular, our findings highlight that these lower ratings may be specific to stranger dyads. Several mechanisms for this could be suggested, for example greater likelihood of diagnostic disclosure and autism knowledge amongst friends (Sasson & Morrison, 2019). Alternatively, based on the findings in Chapter 2a, it may be that differences in communication style are simply less emphasised within friendship dyads and perhaps other features of the dyad (e.g, shared interests or trust) become more important.

There was no significant difference found in the frequency of social behaviours and language use between autistic-neurotypical and neurotypical-neurotypical dyads within this study. This does have the caveat that the study was underpowered and a combination measure was used which could have masked potential differences in individual behaviours. Nonetheless, this finding would be consistent with friendship dyads not necessarily adapting their behaviour to the social partner, but rather emphasising the importance of some of these behaviours less. For example, perhaps potential differences in eye contact or backchanneling remain within friendship dyads, but because both social partners are aware of it they are less likely to interpret this negatively. In other words, factors such as pre-existing neurocultural understanding may moderate the relationship between behavioural differences and overall interaction quality.

However, more unexpectedly, there was also no significant difference between autistic-neurotypical and neurotypical-neurotypical dyads, albeit with the sample and measurement caveats mentioned previously. This could reflect the online nature of the study; perhaps overall differences in dyadic behaviours are lower within online interactions relative to in-person interactions. This may reflect the differences in which behaviours are available in an online setting, for example eye contact and body posture differs in an online setting. Alternatively, this may suggest that whilst overall frequencies of behaviours may be similar,

perhaps differences remain in the nature of these behaviours, such as their synchronicity (McNaughton et al., 2024). This underscores some of the measurement challenges in behavioural research which underpin the whole thesis and hence will be discussed separately (see Measurement Implications).

5.4. Research Question 4: How does interaction quality and communication styles differ in cross-neurotype friend dyads compared to cross-neurotype stranger dyads for adolescents (Chapter 4)?

Finally, Chapter 4 aimed to expand Chapter 3 to understand interaction quality across dyads in adolescents within school settings (n = 56; age range = 12-17). Furthermore, the in-person nature of the study enabled the measurement of behaviours such as mutual gaze and backchannelling within dyads. In turn, this could expand existing knowledge on cross-neurotype differences on 'first impressions' and behaviours within stranger pairs (Rifai et al., 2022) to incorporate the influence of pre-existing friendships.

First, there was no significant difference between friends and strangers or neurotypical-neurotypical and autistic-neurotypical groups in terms of interaction quality, contrary to Chapter 3. In terms of friends compared to strangers, this could reflect sample and friend differences between the two studies. For example, Chapter 3 had adults self-selecting friends across the university, compared to Chapter 4 participants self-selecting within a school setting. The greater potential scope of selecting a friend in Chapter 3 may have increased the overall difference between friends and strangers given that closer friends could have been selected. Likewise, limiting friendships to within school meant that a few participants weren't able to select their first choice friend because they reported their close friends as being outside of school. This limitation is relevant for broader peer nomination studies, which generally do take place within school settings (Almquist et al., 2014; Chamberlain et al., 2007; Pijl et al., 2011). Nonetheless, these additional restrictions may have reduced the overall effect size relative to Chapter 3 and in turn led to difficulty detecting this effect if it did exist.

Likewise, it was unexpected that no significant difference was found in backchannelling between dyads, given that other studies have a found a significant difference between

autistic-neurotypical and neurotypical-neurotypical dyads (Rifai et al., 2022). This may reflect power limitations stemming from the small sample size (see Measurement Limitations). However, these differences could also stem from other differences between the thesis studies and previous literature; for example, the previous study used interactions from diffusion chain modelling involving storytelling. Storytelling is a context wherein one speaker would be expected to speak for an extended period of time. Therefore, within this context, backchannelling to demonstrate continued attention may be particularly important. However, Chapter 3 and 4 used discussions around food, word tasks or LEGO building, respectively. These tasks likely demanded a greater bidirectional transfer of information relative to more linear storytelling, and also had alternate means to demonstrate attention was being maintained (e.g, asking questions or collecting the correct block). In turn, backchannelling may not have been as necessary within the contexts used in the current study because of greater bidirectionality of the interaction, more contextual cues were available to show attention and alternative strategies for demonstrating attention may have been more efficient. No studies to date have explored backchanneling behaviours across contexts, however this may be a useful avenue to confirm this potential explanation. This would potential lead to a conceptual shift from considering behaviours as important for specific communication styles and towards understanding behaviours within their wider context.

A significant difference was found in mutual gaze between groups, with a greater proportion of mutual gaze seen in neurotypical-neurotypical dyads relative to autistic-neurotypical dyads. This is consistent with previous research in this area (Rifai et al., 2022) demonstrating that mutual gaze is lower in cross-neurotype dyads and that these dyads tend to be rated as lower quality. However, no significant difference was found in the differences between friend and stranger dyads. This suggests that the differences in eye gaze between neurotype dyads are consistent between friendship pairs compared strangers. In turn, this may be consistent with the previous suggestion that within cross-neurotype friendships interlocutors may not ‘adapt’ their behaviours relative to strangers but, instead, place less emphasis on these behaviours when making interaction quality judgements. However, this would need to be confirmed by directly examining the

relationship between mutual gaze and interaction quality across friend/stranger cross neurotype dyads in future research.

Across these four studies there are several implications and future directions that span across studies. Therefore, these will be taken in turn. They will be broadly structured in terms of implications for research priorities, sample implications, implications for measurement, and broader co-production reflections.

5.5. Implications

Implications for research frameworks

The current thesis has a range of implications for future priorities and frameworks through which to analyse autistic social interactions. The introduction outlined the distinction between the medical and social models, and the influence these models have had across autism research. This section will take this further to examine how the current studies can inform these overarching models and the wider implications this has for autism research. Note that co-production of research will not be directly discussed here because this topic requires its own section (see Co-production reflections).

Autistic participants in the current thesis in Chapter 2a and 2b were often focused on their own behaviour, rather than that of their social partners. Likewise, in Chapter 3 and 4, there was a key focus on dyadic behaviours in an attempt to go beyond individual characteristics. This was important because the predominant focus of the literature has been on attempting to understand autistic communication by understanding autistic social cognition in isolation. For example, attempts are often made to understand autistic social motivation (Chevallier et al., 2012; Clements et al., 2018), autistic Theory of Mind (Baron-Cohen, 1997; McGuire & Michalko, 2011), and autistic behaviours such as eye gaze (Nation & Penny, 2008; Stuart et al., 2023) or eye contact (Mcdowell, 2010; RajKumar et al., 2019; Senju & Johnson, 2009a). Going further, interventions have often been focused on these individual domains for autistic people (Rao et al., 2008; Sansosti, Powell-Smith, & Kincaid, 2004; Wang & Spillane, 2009). This focus on individual characteristics in research overlooks that all these domains

and behaviours must occur with a social partner in naturalistic contexts, and hence the role that social partners must have in facilitating social interactions.

In turn, this focus on individual characteristics for autistic people in research and intervention influences wider messaging about autism to the general public. For example, NHS guidance (https://www.nhs.uk/conditions/autism/what-is-autism/) outlines that autistic people may "find it hard to understand how others think and feel", overlooking the bidirectional nature of potential misunderstandings (Brewer et al., 2016; Milton, 2012), and the potential role of social partners within attempts to communicate. In turn, this societal messaging likely underlies why autistic participants often felt the onus was on them in social interactions and often struggled to outline what others may do to help them in social interactions.

Some attempts have been made in reducing this onus on autistic people in more recent research. For example, there is increasing emphasis on understanding social interactions in a dyadic manner, shifting the focus away from individual characteristics to understanding features of interaction dyads (Crompton, Sharp, et al., 2020; Crompton, Hallett, et al., 2020; Crompton, Ropar, et al., 2020; Rifai et al., 2022). Furthermore, there is greater recognition of the impact of stigma on autistic social interactions and the role that knowledge about autism can have in minimising this (Botha et al., 2022; Deguchi et al., 2021; Gillespie-Lynch et al., 2015; Underhill et al., 2019). In turn, this is beginning to be implemented at a wider societal scale, with the UK Department of Health and Social Care prioritising the need to "improve understanding and acceptance of autism within society" (The national strategy for autistic children, 2021) and highlighting the role of changing the behaviour of non-autistic people towards autistic people and their families.

However, there is still need to expand research into minimising the stigma and barriers to social interactions autistic people can face and the nature of successful cross-neurotype dyads. First, interventions targeting improving understanding of autism for non-autistic people have small samples and are often limited to educational settings (Chown, 2010; Gillespie-Lynch et al., 2015; Ranson & Byrne, 2014; Underhill et al., 2019). Implementing this training via schools would be one avenue for improving social outcomes for autistic people,

however it may also risk creating a cohort effect wherein those who have already graduated from school, such as current employers, may 'miss' the training. Therefore, there is a need to build a broader evidence base to then implement this training in wider settings, for example through necessitating Disability Confident employers to undergo this training as part of gaining accreditation for the scheme. Similarly, there is a need to ensure these training program encompass the vast variation within autism, including understanding of autistic people with additional communication needs (see Sampling implications).

Friendship as a priority

Another overarching finding within this thesis was how important friendship was considered for the autistic adolescents. In Chapter 2a and 2b adolescents directly reported the importance of their friendships, and in Chapter 3 and 4 autistic adults and adolescents were able to nominate their friends and these sometimes (in Chapter 3) led to greater interaction quality relative to stranger dyads. Indeed, even when differences were not significant relative to strangers, both Chapter 3 and 4 did achieve high quality (i.e, at ceiling level) social interactions in terms of interaction quality were achieved within friendships. This replicates previous findings regarding the role of high quality friendships in improving quality of life for both autistic adolescents and adults (Van Heijst & Geurts, 2015; Mason et al., 2018; Mazurek, 2014; Sedgewick, Leppanen, et al., 2019). Furthermore, this highlights the potential use of friendship dyads as a context for examining high-quality cross-neurotype social interactions. This then raises the question of what are the features of these friendships for autistic people and, in turn, how can these be replicated within studies and facilitated on a wider scale.

Autistic adolescents interviewed in Chapter 2a highlighted that shared neurotype could potentially facilitate shared understanding but was neither necessary nor sufficient for a successful friendship. This was mirrored in Chapter 3 and 4, wherein autistic participants overwhelmingly nominated neurotypical peers as friends. Autistic people choosing neurotypical would perhaps be unexpected based on the literature, given that autistic-autistic information transfer between strangers has been shown to be more effective than cross-neurotype communication (Crompton, Ropar, et al., 2020), there is evidence of greater rapport between autistic-autistic stranger pairs (Crompton, Sharp, et al., 2020; Rifai

et al., 2022a), and qualitative research with autistic people has highlighted the importance of this shared understanding that can emerge from shared neurotype friendships (Crompton, Hallett, et al., 2020). However, it's important to note that this previous research does not rule out the possibility of successful cross-neurotype social interactions, nor do they suggest that shared neurotypes are sufficient alone for friendships. Therefore, the current research builds upon the role of shared versus cross neurotype to highlight the role of others factors in facilitating friendships.

As mentioned in the introduction, the potential dichotomy of 'autistic' and 'non-autistic' communication styles within the Double Empathy model does come with the risk of oversimplifying social interactions and minimising potential individual differences. This is particularly relevant within pre-existing friendships, wherein social partners have a wider range of information about their social partners to drawn upon when making social judgements. Autistic participants in Chapter 2a outlined that having shared interests, mutual trust, and a shared understanding with their friends were the most important aspect of their friendships. This is consistent with recent research highlighting the importance of shared neuro-cultural understanding in friendships (Gillespie-Smith et al., 2024), particularly given that friends have more opportunities to understand the differences in experiences and perspectives of each other. Therefore, the current thesis expands this notion of Double Empathy and highlights that this empathy 'gap' can be bridged within the context of friends.

In behavioural terms, autistic participants also discussed how their neurotypical friends would often either adapt to them in an idiosyncratic manner, for example by minimising eye contact through simple adjustments like walking side-by-side, or simply didn't mind if they were to make a specific social faux pas. This provided evidence of both a strategy of adaptation of communication styles and a strategy of neurotypical friends simply not minding different communication styles when they understood their friend. This evidence of equifinality was then explored further in Chapters 3 and 4, finding no behavioural differences between friends compared to strangers. This supports the idea of cross-neurotype friendships placing greater emphasis on these external dyadic factors, such as trust and shared understanding, rather than specific behaviours in determining their overall interaction quality. However, one caveat is that the current thesis could not directly

correlate these behaviours to interaction quality – Therefore, future studies should carry out this correlation to confirm this conclusion. Nonethetheless, these studies did highlight the importance of friendships for autistic people, particularly in ensuring high quality interactions with neurotypicals.

This importance of friendship raises one key implication: how can we use this evidence to support autistic people in making friendships? This would be impactful as some participants in Chapter 2a described being placed with other autistic people within school in order to facilitate potential friendships, even when they already had neurotypical friends within their class. The autistic adolescents then reported feeling they had little else in common with the autistic peers or that their own experiences of autism were simply different. Therefore, identifying and using these shared interests between people could provide more effective strategy for developing friendships for autistic people that may desire them. This would be consistent with studies examining autistic communities online around interests such as Minecraft (Stone, Mills, & Saggers, 2019), wherein both the shared interest and a sense of shared understanding could be achieved to develop friendships. In turn, this could be expanded further to include a more diverse range of interests, particularly interests that may be more common amongst autistic girls (Sedgewick, Hill, et al., 2019). Similarly, in terms of shared understanding, achieving greater shared neurocultural understanding between autistic and neurotypical people may be beneficial in supporting friendships. This would encompass some of the anti-stigma training outlined previously. However, note that perhaps one unique benefit of friendship is that it enables an individualised account of the perspectives of the friend. Therefore, more generalised training may not be wholly sufficient for facilitating friends. Nonetheless, these training programs may be beneficial to at least improve interaction quality in the early stages of friendship formation (i.e, before an individualised shared understanding has been achieved).

Sample implications

Across the thesis there has also been several implications in terms of who is taking part in current autism research. This is essential for both the autistic people, in terms of ensuring that a wide range of perspectives and views are accommodated within research, but also in terms of the neurotypicals, wherein their use as a ‘control group’ is often assumed but not

directly tested. Therefore, this section will analyse these implications first in terms of the inclusion of autistic people with communication challenges and social anxiety before discussing neurotypical samples in terms of potentially co-occuring conditions and anxiety.

Inclusion of a broader range of autistic people

A key future direction is to understand how to increase the understanding of autistic people with additional needs. One barrier to this is the lack of research focus in this area (Russell et al., 2019), particularly in terms of understanding their social experiences with neurotypicals. Whilst there are studies attempting to understand friendships for autistic people (Black et al., 2022; Mazurek, 2014) and people with intellectual disabilities (Fisher et al., 2016; Gilmore & Cuskelly, 2014; Tipton et al., 2013; KWilliams et al., 2021), there are very few studies examining both these features together (Walton & Ingersoll, 2013) or when co-occuring with communication challenges specifically. Likewise, all studies to date attempting to increase neurotypical understanding of autism have focused on autistic people with typical-like language abilities (Gillespie-Lynch et al., 2015; Ranson & Byrne, 2014; Underhill et al., 2019). Therefore, there is a need to ensure that the potential future directions for increasing neurotypical understanding highlighted previously extend to autistic people with additional needs.

Adolescents and their parents in Chapter 2b discussed the role of friendships, however the picture was less clear relative to Chapter 2a. Some parents highlighted that their adolescent didn't appear to be interested in friendships, they weren't certain what this would look like for their adolescent, or that there were institutional barriers such as GDPR regulations preventing them knowing about their adolescent's friends. These conflicting findings perhaps highlight both the diversity across autistic people with additional needs and the need for further research the understand the nature of friendship within this group, particularly for autistic people with few or no words. It may be that some of the barriers for this group are shared with autistic people without communication challenges, albeit with potential differences in the severity of these barriers (e.g, stigma, uncertainty). On the other hand, some barriers may be qualitatively unique to this group, for example it remains somewhat unclear what friendship even looks like or means within a group that has

difficulties using language. It may be that some shared understanding can be achieved, but this may appear qualitatively different relative to autistic people who are able to speak (e.g, this may be a more internal shared understanding). For example, one autistic participant in Chapter 2b with social anxiety disorder and selective mutism discussed spending time together with their friends on call even without communication. In this case, even without communication, there was still a tacit understanding of being 'together'. Therefore, there is a need for studies that can explore what friendship may mean, and how it may appear, within this group. An ethnographic approach within a care or school setting may be a useful avenue for this, analogous to similar approaches adopted in the intellectual disability literature (Simplican, 2015).

However, the biggest insights from this study stem from the methodological successes and challenges associated with collecting data from autistic people with communication challenges and social anxiety. All adolescent participants in Chapter 2b could not take part in the standard interviews of Chapter 2a and yet, with relatively minor adjustments, data was collected from 5 out of 10 autistic adolescents. A diverse range of alternative responses were offered to participants, and the researcher discussed appropriate options with the parent for each adolescent. This approach of drawing on parental expertise regarding the idiosyncrasies of their own adolescent proved to be invaluable, with parents suggesting a range of adjustments or techniques and the researcher working with them to find a feasible approach within the means of the project.

The two most effective approaches that were feasible within the study were giving participants the opportunity to provide written responses within their own time and the ability to interview parents first, with their adolescent present, and then interviewing the adolescent afterwards. In terms of written responses, some participants with communication challenges found writing about their experiences much easier than verbalising them. This may relate specifically to difficulties in expressive language for these autistic people (Kjelgaard & Tager-Flusberg, 2001). On the other hand, observing a parent answer the questions appeared to be particularly effective for autistic adolescents with co-occuring social anxiety. Indeed, in these contexts, parents often highlighted that a trusted adult can be conceptualised as a 'bridge' for social communication that wouldn't be possible

on a 1 to 1 basis. These adjustments can be incorporated into existing interview studies for autistic people with relative ease, widening the range of potential perspectives in current autism research.

Parents also provided additional suggestions that, whilst not feasible in the current study, represent future directions for this research. Some parents highlighted the need to build a relationship with the adolescent first, understand their idiosyncrasies, and then introduce simple questions over time to build up a full "interview" over months. Alternatively, one parent highlighted the role technology could play in understanding their adolescent's friendships, for example wearable camera technology. This approach has been used elsewhere in the literature, commonly to understand eye contact or attention (RajKumar et al., 2019; Ye et al., 2012; Yurkovic et al., 2021), however they highlighted the role this could play in seeing the direct perspective of their adolescent when engaging with friends or peers. This approach would be analogous to similar approaches examining the visual experiences and social environments of toddlers in previous research (Smith et al., 2011).

Overall, there is a need to develop more methods that would be applicable to this autistic people with additional needs. There has been some novel developments in this area, for example Photovoice adopts a highly participant-led, structured approach using photographs (Sutton-Brown, 2014) to gain the perspectives of underrepresented groups, including autistic people (Do et al., 2021; Ha & Whittaker, 2016; Lam et al., 2020). Similarly, a range of alternative communication strategies are being developed (Antão et al., 2018), such as Talking Mats (Bradshaw et al., 2018), the use of PECS to facilitate responses to questions (Greenberg, Tomaino, & Charlop, 2014), synthetic speech production applications (Schlosser et al., 2007), and sign language (Goldstein, 2002). However, evidence for these techniques is currently limited to small sample sizes, demonstrates high variability in efficacy between participants (Antão et al., 2018), and often requires a period of training with the adolescent. Therefore, whilst expanding the use of alternative communication strategies is essential to gain the perspectives of this group, there may not be a simple 'one size fits all' approach to data collection for autistic people with additional needs.

Neurotypical control implications

Within current autism research, autistic people or dyads including them are generally (but not always) compared to neurotypicals or neurotypical dyads (see Introduction for a range of examples). The logic is that comparison with neurotypicals enables other factors, for example age or gender, to be held constant to determine the difference that can be attributed to the autism diagnosis. Importantly, this assumes that other factors are held constant. Two key assumptions are then needed. First, what constitutes the 'autism' variable that you're looking to examine. This question is not trivial, as the majority of autistic people have at least one co-occuring condition (Simonoff et al., 2008) and therefore to study just 'autism' is unlikely to represent the experiences of all autistic people. Furthermore, differences emerge over time between autistic and non-autistic people due to a complex interplay of biological and societal factors (Karmiloff-Smith, 2009), therefore it is difficult to fractionate which differences stem from 'autism' and which stem from societal responses to autistic people or subsequent interactions. Second, we must then assume how these variables can be controlled for between groups to gain information about autism specifically. For example, matching neurotypical and autistic participants on anxiety requires the assumption that anxiety is additive, rather than may interact, with autism (ie, if we held anxiety constant, this would have the same effect on both groups). This can make determining appropriate comparison groups difficult. Solving these challenges is beyond the scope of the current thesis, however one key contribution can be made: the importance of measurement within neurotypical groups.

Chapter 3 and 4 both used neurotypical-neurotypical dyads to make comparisons that could then be interpreted in terms of cross-neurotype social interactions. However, both groups had relatively high levels of other neurodevelopmental conditions and Chapter 4 had high levels of anxiety across the neurotypical group. This could be interpreted as a potential strength; indeed, it enabled a greater degree of matching for co-occuring conditions across both studies. But, particularly in the case of Chapter 4 and the high levels of anxiety in the neurotypical group, this can limit conclusions that can be made about autism specifically. This is not to state that this is a problem, but rather that this underscores the importance of collecting this data from autistic and neurotypical people when conducting social research. Other variables do systematically vary with autism, and some variables may be heightened

within a neurotypical control group, but it is impossible to determine this if they aren't measured. This is perhaps particularly concerning in some more recent research examining dyadic interactions. For example, none of the studies examining cross-neurotype interactions that the thesis was based on measured anxiety across their samples (Crompton, Sharp, et al., 2020; Crompton, Ropar, et al., 2020; Rifai et al., 2022; Sasson et al., 2017). Therefore, it is possible that some degree of these previous findings may relate to anxiety rather than autism specifically. One key contribution of the current thesis is the importance of measuring variables such as co-occuring conditions and anxiety when attempting to make generalisations about autism specifically.

5.6. Implications for measurement

Chapter 3 and 4 shared some key measurement limitations that will be essential to overcome for future research. These challenges stemmed predominantly from attempts to quantify inherently subjective phenomena such as friendship, interaction quality, and what behaviours constitute a 'quality' social interaction. Through examining these specific limitations existing measurement can be improved to better capture the nature of friendships for autistic people.

Measuring high interaction quality

One key strength of both studies was that they were able to elicit successful cross-neurotype social interactions in terms of interaction quality rated by both social partners. This included both neurotypical-neurotypical interactions (wherein interaction quality was generally high across both friends and strangers) but also autistic-neurotypical interactions between friends. This is important because it highlights that potential communication barriers between neurotypes (Crompton, Sharp, et al., 2020) can be overcome within the context of friendships. However, this also represented a key challenge as ceiling effects were shown across most groups on the Social Interaction Evaluation Measure (Berry et al., 1996). This was unexpected given that this method has been used with autistic and neurotypical adults (Morrison, DeBrabander, Jones, Faso, et al., 2020) and adolescents (McNaughton et al., 2024) without ceiling effects previously. However, these studies specifically examined stranger dyads. Therefore, it appears that the Social Interaction

Evaluation Measure may not be sensitive enough to detect differences between interactions that are likely to be high quality – such as those with friends.

There are two approaches that could be taken to minimise ceiling effects when examining interaction quality across dyads. First, the tasks themselves could be altered to make them less likely to elicit such a high quality interaction. However, this approach would risk reducing engagement in the interaction from both autistic and non-autistic participants which, in turn, may influence behaviours due simply to how engaged participants were in the task. Indeed, the high engagement in the thesis is a strength of the approach taken. Similarly, it is perhaps more ethically dubious to design experiments that are intentionally less likely to elicit high-quality interactions, particularly given the likelihood that autistic people would blame themselves for potentially negative interactions (see Chapter 2a).

Therefore, a better approach may be to design measures of interaction quality that are more sensitive at higher levels. This could perhaps be done by anchoring questions to pre-determined social interactions. For example, “Think back to a time you’ve enjoyed chatting with a friend or family member. How would you rate the interaction you just had relative to that interaction”. This could anchor scores to an already successful social interaction when interactions are expected to be high-quality, but would also risk introducing a potential difference based upon the quality of the recalled social interaction.

In addition, note that measures of interaction quality are based on aspects of social interactions that are deemed important to neurotypicals (for example, self-disclosure, intimacy, and reduced conflict). From the friendship literature and Chapter 2a, autistic people do seem to report some factors as particularly important in their friendships (Black et al., 2022; Daniel & Billingsley, 2010), such as trust and the ability to be themselves away from the pressure of masking (Black et al., 2022; Cook et al., 2018). Therefore, there also may be differences in what aspects of interactions are important for autistic people. This possibility was anticipated in Chapter 3 and 4, and hence a manipulation check regarding whether the interaction quality measure captured aspects important to their social interactions was asked to each participant. The autistic participants did agree that the interaction quality measures captured their experiences well, however it is still possible that

the relative weightings of different components of interaction quality may differ across neurotypes. Therefore, there is a need to co-design measures of interaction quality with autistic people to ensure they best capture their experiences, perhaps drawing on co-produced projects within the literature (McKinney, 2022).

Behavioural coding

The second key limitation in the current study related to behavioural coding: the sample size/coding trade-off. Large scale studies of behaviours within dyads require substantial coding time investment, with this increasing when information such as temporal resolution must be maintained. For example, a simple frequency count of a few behaviours may take an experienced coder around 30 minutes for a 15 minute interactions. However, when timing information must be retained (e.g, to measure mutual gaze) coders must also code the onsets and offsets of specific behaviours. In turn, this can double or even triple coding times depending on the complexity of the behaviour being coded. Then this faces an additional problem of scale as more behaviours are added, with this further multiplying coding times. Therefore, it is often not feasible to hand-code the large datasets often needed for analysing subgroups using parametric tests (for example, non-parametric tests were used in Chapter 3 as some specific groups had less than 10 participants).

One means to improve this is greater specificity on which behaviours are measured, for example only coding backchannelling and eye contact. However, this requires knowledge on which behaviours are most important for interaction quality within a social interaction, and how this may vary across dyads or contexts. Some progress has been made in this area, with the frequency and proportion of backchannelling and mutual gaze found to be related to first impression judgements for neurotypical-neurotypical dyads but not autistic-neurotypical dyads (Rifai et al., 2022). Predictors also may go beyond simple frequencies; for example, smiling synchronisation has been found to predict interaction quality for both autistic and neurotypical adolescents (McNaughton et al., 2024). However, all previous studies in this area have examined autistic-neurotypical stranger social interactions wherein interaction quality or rapport were substantially lower for autistic-neurotypical groups (McNaughton et al., 2024; Rifai et al., 2022). Therefore, there is no current guidance on

which behaviours may be important indicators of interaction quality in autistic-neurotypical friendship (or similarly high quality) social interactions.

Alternatively, the use of technology can help overcome some of these coding limitations. There has already been considerable advancement in this area (see Chapter 4 for a discussion of existing alternative methods for coding), however it is equally likely that further progress will be made in this area in the future. In particular, machine learning models are being developed to study social interactions and non-verbal behaviour for both neurotypical (Lee & Marsella, 2010) and autistic people (Georgescu et al., 2019). These models have the potential to rapidly code aspects of social interactions which, in turn, would allow larger samples and statistical power for understanding social interactions and friendships across neurotypes. However, it is essential to keep in mind the potential "black box" nature of this machine learning; that is, it is both difficult to know how specifically these machine algorithms came to their conclusions (for example, why it predicted that an interaction would be 'low quality'), and they cannot tell us whether any potential differences stem from features of the autistic person, features of the dyad, or they are a response to changes in behaviour from the social partner (e.g, a response to initial stigma). Therefore, there is the risk of perpetuating existing biases and stigma regarding autistic social interactions because the model is likely to be trained on a real, but biased, dataset. These methods do show some promise in potentially improving our understanding of social interactions for autistic people in the future, but their interpretation and use must be treated with caution.

5.7. Co-production reflections

Greater co-production would likely have benefited the current thesis. Chapter 2a and 2b did involve some co-design, particularly around the development of the interview schedules, and the findings from these studies directed the aims of the remainder of the thesis. The original thesis proposal placed greater emphasis on eye contact specifically and how this may be modulated as a result of friendships, stemming from qualitative work in this area (Trevisan et al., 2017). However, taking into account the feedback from autistic advisors and recent evidence showing that autistic people's research priorities emphasise the role of improving neurotypical understanding (Cage et al., 2024; Pellicano et al., 2013; Pellicano,

Dinsmore, & Charman, 2014; Pellicano & Stears, 2011), the thesis focus shifted towards friendships and using these as a framework for understanding how successful cross-neurotype social interactions can be achieved. Therefore, the co-design approach taken was successful in guiding the research in the early stages, co-designing tools for data collection, and bringing the perspectives of the community into the research itself (Rosen & Painter, 2019).

Nonetheless, if the thesis were to be conducted again, a greater emphasis would be placed on greater embedding of the direct perspectives of the autistic community in the research throughout. For example, the thematic analysis in Chapter 2a and 2b could be informed by co-analysing these results with autistic people. In this sense, the meaning constructed from autistic adolescents could be informed directly by a co-researchers lived experience of autism. Similarly, whilst friendship and interaction quality measures were selected based on prior use with autistic and neurotypical populations, these measures could also be co-produced with autistic adolescents and adults to ensure they capture the important features of autistic friendships and social interactions. This would be particularly useful for autistic adolescents, wherein there are currently no existing measures of interaction quality validated directly for this population (see Chapter 4). Due to time constraints, these approaches weren't feasible in the current study, however they would both benefit the research itself and enable a more community-led approach to the measures and analysis across the thesis.

It would have also been informative to have involved autistic people with communication challenges and social anxiety directly in designing the methodological approaches for Chapter 2b. However, note that there are barriers to co-production with autistic people with communication challenges and social anxiety. Indeed, perhaps one limitation of current co-production in autism research (Ha & Whittaker, 2016; McKinney, 2022) is that the co-researchers in these projects are generally autistic people that are comfortable advocating for themselves. Therefore, there is a need to expand existing co-production to incorporate a wider range of perspectives using some of the methods highlighted in the current thesis (see Chapter 2b). Their insights, in conjunction with experts in this area such as Speech and Language Therapists, would likely have substantially increased the availability

to gain of the perspective of a greater range of autistic participants and enabled their insights to be received throughout the life of the project.

A final future recommendation for research in this area would be to develop a co-production panel of a diverse of autistic lived experiences embedded early within the project for the lifetime of data collection and analysis. In turn, this lived experience can guide the aims and design of the research throughout the thesis. An example of this approach can be found in a PhD project aimed at understanding transitions to adolescence for girls with neurodevelopmental conditions (McKinney, 2022).

5.8. Final conclusions

The current thesis aimed to better understand cross-neurotype communication within the context of friendships for autistic people. Findings highlighted that autistic adolescents often felt the onus was on them in social interactions, but nonetheless friendships are important for them and can be achieved with neurotypicals. However, there are key barriers to understanding these friendships for autistic people with communication challenges and social anxiety, and recommendations were given for developing understanding in this group. Furthermore, it is possible to elicit high-quality cross-neurotype social interactions through the use of existing friendship pairs in both adults and adolescents. In turn, the ability to consistently create high-quality cross-neurotype social interactions will enable future research to explore predictors and factors that contribute to high-quality cross neurotype social interactions. The thesis was also able to replicate stigma effects from neurotypical adults towards autistic strangers, however this effect was not seen in friendship dyads. Whilst behavioural evidence within cross-neurotype interactions in the current study requires replication in larger samples, the thesis nonetheless was able to demonstrate how behaviours can be explored within high quality cross neurotype social interactions. In turn, this thesis demonstrated the value of using friendships as a context to better understand how to facilitate more successful social interactions for all.

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6 Appendices

Appendix 1a: Further quotes for themes constructed in Chapter 2a

RQ1: Theme 1	RQ1: Theme 2	RQ2: Theme 1	RQ2: Theme 2	RQ3: Theme 3
"If I see someone I don't know, I'm not gonna talk to them… So I don't really know what others do that helps me talk to them…"	"I don't really know what to do, I don't really… So I know how to start a conversation, that's the part I had some help with. But, but after that…"	"Uh, with my friends it's a lot easier because…Yeah, they know you're autistic, and they… Cause they know that I'm autistic and things and we can have a laugh 'cause we know a lot about each other… And like, they get it… But with a stranger it's more difficult because… It's new…"	"My friends, if I'm upset, it's somewhere that I can… Talk about it, and they can try and help us feel better and, just sort of be there for support… Because you can trust them"	"I think that in some situations it's really important because it can make the other person feel more comfortable and acknowledged."
"I don't, don't really like socially	"So I… I think of everything first. What to do if I'm	"Friendship for me is when… It's when people are	"Friendship is having someone you can trust	"Usually when I'm talking to someone… I

interacting with people who… who aren't my friends. So I don't really do it."	at an event or doing something, or any situation. And think about how I can… Act accordingly? Like, show my surprise, anger, happiness, stuff like that. But if someone I don't know comes up to me unexpectedly, and I haven't had that time to prepare, it would be really awkward and I wouldn't know what to say.	not closely related to you… You have a positive bond with over a shared interest… And can do things together and it's more fun than doing it alone."	really, and who supports you in most of your decisions. Who wants to spend time with you and who's just overall just, like friendly, to you I guess."	always try to make eye contact to show them I am engaging with what they are saying… I can also get the emotion across that I'm paying attention."
"I find talking to others… Kind of awkward and difficult I guess? Most people, I	"After a while you realise… Most people have a quite similar… Aspect… Rules?	"So, my neurotypical friends, they might not at first understand like,	"Trust is so important to me. Because, I've got no clue what a persons like when	"Again, it kind of depends on the context. If I'm in class and looking down and

don't really know how they'll react…"

To most things. So it's spotting what's similar between some conversations and figuring it out… But like, if you haven't had experience with that conversation, someone could like, say something slightly differently or make it a different kind of conversation to what you expected and… It can be hard to realise how they're saying things and what they are trying to

an autistic brain. Because it's different, right? So often I outline that it is, y'know, I let them know what I'm like, what helps, that kind of thing. I think, taking those measures has… It's been how I've been able to… Intensify? Some of my friendships."

I first meet them.

writing, and talking, then I don't really need eye contact. But I guess sometimes it's… Sometimes you need to?"

	say”.			
“Talking to some people… If I don’t know them… I’ll severely dial back the craziness. I think it makes me a more enjoyable person to talk to, for them.”	“For me, starting… Starting a conversation is a problem. Once a conversations going I know what to say, because they’ve given me a topic, that I can speak and discuss. But starting a conversation anywhere that’s not online, it’s pretty difficult.”	Yeah, uh, my best friend… He's got… He has an autistic brother and so he understands me really well… And we get on amazingly.	“For friendship… Sometimes you need another person with you… And to trust them to help you, sometimes… Even in games, it’s something you can concentrate on together and need to trust them to help you.”	“I think it would be good if I could do eye contact… But I think some situations are more important than others… but that's one of the reasons why I'm more comfortable around certain people. Because like, I'm comfortable now, I'm very comfortable now, but that's because you know that I'm autistic, and so you won't be offended by me not making eye

			contact.”
“I think one strategy for me is that I listen to them and what they’re talking about… Then try to add something to their conversation topic… To show you understand it… Then add comments on what they want to say”	“So, if you’ve got autism, it’s a bit harder to think how people are going to react when you first start talking. But after you seen how they’re reacting, then that can be fine. Or sometimes it can be hard to know whether you should keep going in a conversation or just stop it there and go and do your own thing…”	“It’s easier when they start the conversation for me so I don’t have to. Because then if they start the conversation you know they want to talk… But if they started it, you know their mind is free.”	“Eye contact is important in engaging, not being rude, to make sure that everyone can listen to each other and you’re paying attention. But it’s not the most important thing, because if the drive for the conversation isn’t there, no common activity, no one is going to talk. I guess eye contact doesn’t keep you in conversations, topics do.”, Stephen
	“In serious situations it’s the worst, because it’s hard to know how to react	“I wouldn’t approach people. I was… Worried they would say no to me. Like,	“I don’t really make eye contact with people, but I get my point across all the same. So

properly to stuff like that…”	protection.” , Paul	it can’t be that important?”, Emma

Appendix 1b: Further quotes for themes constructed in Chapter 2b

Theme 1

RQ1: Subtheme 1	RQ1: Subtheme 2	RQ2: Theme 2	RQ2: Theme 3	RQ3: Theme 4
"I have one friend. If you don't count the middle-aged white women that I interact with in my school."	"It's like… They can express how they're feeling, but then…The way they express it then is not acceptable by us [referring to NT society]."	""One thing is eye contact if they 'void making eye contacts. And, just understand that I'm not gonna be very good at socializing, and I might... Act differently than… [Neurotypicals]…. That makes it easier."	"Her friends at home, they're all younger than her. Children that live where we do that are her age, she doesn't play with. Again, they have a lot of…Freedom. But I don't let her have that because she has no road sense. She has the road sense of a 5-year-old. It's not safe."	"Not insisting on eye contact, that's that's an important thing. And I used to do that when she was like a lot younger to make sure she understood my point. But obviously once we realized, you know, that she had autism and should be diagnosed, it was like well, I'm doing the complete wrong thing.

				The complete opposite; I shouldn't be insisting on eye contact. I know that she's listening. I don't need to see her looking at me to understand that she's listening because she could be doing three things at once and still be taking in the entire conversation, so yeah.”
“I think there's a lack of opportunity to be perfectly honest with	“At school, she was excluded from the classrooms	““I feel like… It's, you know, our our whole family, it, he takes the lead. It's just	“And you know some of his friends he’s had since 12-13	

you. I mean, since she's been in secondary, the groups that she had to be friends have been quite limited and particularly now [referring to COVID restrictions]. But I think people have… Certainly people have similar interests and she has some who were a kind of safe, a safe person to express opinions with, maybe.”	all the time because, of course she couldn't sit still. She couldn't concentrate, she wouldn't be quiet. And I had to end up taking her out of school in year one because the school where she was at were making her mental health issues massive. They weren’t so good and that was education-those were teachers, who are the first line of support	easier that way. So I don't, I don't think friendships are important to children like him.”	started to go to the [social club] in Newcastle and we just weren't comfortable with that.”

	really, alongside health visitors, they just need to understand… That not all children are naughty.”		
“All of his friends are either autistic themselves, or he's got a couple who've got Tourettes and then things like that so…You know, he has a bit of an eclectic group of friends, which… Is nice”	“And I think he knows that coming now… He will just take himself away and be quiet, but he’d get a bit annoyed with it and I think he finds that whole thing [the diagnosis] a ...Hindrance on his life and doesn't really want to buy into it	“He’s not bothered. He doesn’t give a crap about friendships.”	“She does like being part of a group. And just like she likes doing Snapchat and then FaceTimes her friends and…But she's always, she's overzealous with it, so she never wants to stop and... We have to keep an eye on her with it and

	and admit it, to be fair.”	pull her away sometimes…”
“He's extroverted, you know, he wants to be centre of attention and then the behaviours that he displays, which at the moment is aggression. And you can clearly see it's frustration because he can't communicate...”	“But depending on their level of anxiety and what happened and, time of the month, things like that, there can be a level of limited sort of, limited, limited social interaction with those that she does know, and is familiar with as well. And it can still be non-verbal sometimes as well. So this is very chatty for, for her, so yeah… [Participant was present and commenting during the interview]”	“So, he had his friends over for a sleepover, which was quite amazing, cause like, it's something he wouldn't normally do. But afterwards he went nonverbal for a few days and just basically sort of shut down a little bit. And I think it was like he's used up all his social spoons, if

you wanna
say…”

“His friends now
are… They’re
gaming. Yeah, it's
gaming online,
majority. So you
know, in a way
he does have
that… And he's
got some good
friends there
with good
people. But
they’re in
London, Texas,
you know. But
like he’s in
control, he can
go on and off
when he wants.
He doesn’t have
that expectation
on him online.”

Appendix 2: Data collection tools created but not used in Chapter 2b

Art methods: Participants were allowed to draw or visualise their feelings regarding social interactions, friendships, and eye contact. However, this strategy may have been more useful within a face-to-face format so that the researcher and parent could scaffold the interaction.

Modified PECS: A series of images were created mirroring the PECS images showing images of sadness, happiness etc. It was then intended that the participant could use these to show their views on social interactions, friendships, and eye contact via pointing or indicating their feelings. This was not selected by any of the participants, perhaps due to uncertainty in learning the new PECS images.

Multiple choice questions: A Likert scale ranging from 0 (strongly disagree) to 7 (strongly agree) was created and questions adapted to fit this format. No participants selected this option as most participants that were happy with this response format were also happy to simply write their responses to the open questions.

Appendix 3: Interview schedule and questionnaire used in Chapter 2b

https://drive.google.com/drive/folders/1uctq_Lwp1DI4uzwKOqJMB4Y9Ak10CYGR?usp=drive_link

Appendix 4: Inclusion of the Self in the Other Scale

This scale was not used due some (4) participants highlighting that they felt close to their friend, but that the 'overlapping' nature of the circles did not relate to their personal experiences. This was detected by participants writing this at the end of the initial questionnaire in the 'manipulation check', and they were then emailed asking if they would like to discuss their thoughts further. All participants agreed to this and were called virtually to share their experience. They discussed how this was because they had experiences of co-dependency with friends or had experiences in the past wherein friends had treated them poorly. Therefore, they preferred to think of themselves as 'close but separate'. This suggests that this scale may not be effective for people with past experiences of relationship trauma (e.g, 'mate crime' or co-dependency issues. This has not been explored in the literature, but could be an avenue for future research.

Appendix 5: Word lists used in Chapter 3 and 4

https://drive.google.com/drive/folders/1uctq_Lwp1DI4uzwKOgJMB4Y9Ak10CYGR?usp=drive_link

Appendix 6: Procedure for establishing inter-rater reliability in Chapter 3 and 4

Step 1: Overlapping coding from both coders was collected together.
Step 2: Both sets of coding were synchronized to the same start point of coding to adjust for systematic differences in overall timings due to differences in video synchronisation. This involved shifting all timings on one video forward or backward by around 120ms so that the 'start time' matched across both videos.
Step 3: An R script was created that examined whether each coding instance was 'present' or not in the other video, with a margin of error of +/-160 ms in the start time.
Step 4: Consistency between these scripts was then analysed in terms of a kappa co-efficient based on the degree of agreement between the two raters. A margin of error within 160ms was deemed as an agreement instance, outside of this was deemed as disagreement).
Step 5: This was carried out individually for each behaviour/language, and then averaged together to provide an overall agreement score for both behaviours and language use.

Appendix 7: Coding scheme used in Chapter 4

https://drive.google.com/drive/folders/1uctq_Lwp1DI4uzwKOgJMB4Y9Ak10CYGR?usp=drive_link

Appendix 8: Instruction manual for Lego tasks in Chapter 4

https://drive.google.com/drive/folders/1uctq_Lwp1DI4uzwKOgJMB4Y9Ak10CYGR?usp=drive_link