Examining Partner Adaptation Skills in Narratives by Autistic and Non-Autistic Adults

Elizabeth Antoine Carolan

School of Communication Sciences and Disorders

McGill University, Montreal

August 2021

A thesis submitted to McGill University in partial fulfillment of the requirements of the degree of Master of Science

Table of Contents

List of Tables

List of Figures

Abstract

Autism is a condition in which social communication skills differ from those observed in non-autistic individuals. One aspect of social communication that has been previously studied in relation to autism is that of partner adaptation, or the ability to take into account another person's knowledge and beliefs during social interactions. Several studies to date have examined partner adaptation, predominantly using a director task paradigm. Notably, all studies to date have examined partner adaptation in person, whereas this pilot study examined partner adaptation online, via videoconference, due to physical distancing measures imposed by the COVID-19 pandemic. Here, an oral narrative retell task with a common ground manipulation was conducted over videoconference with a pilot sample of six non-autistic and three autistic young adults. The common ground manipulation was carried out in two experimental conditions: (1) the *shared condition*, where the participant and a research confederate watched the preview of a cartoon clip together and (2) the *private condition*, where the participant watched the preview alone. In both conditions, the participant then watched a full cartoon clip and was asked to retell the story to the research confederate. It was predicted that partner adaptation would surface as longer, more detailed and complex narratives in the private relative to the shared condition. The narratives were examined for differences at the group level and for interactions between group and condition on narrative microstructure and macrostructure. In this novel online delivery, preliminary findings indicate that common ground effects are produced differently over videoconference in comparison to in-person as both autistic and non-autistic participants showed an increase in volubility, meaning that they produced longer narratives, in the shared relative to the private condition. In light of these findings, the impact of an online setting on common ground effects is discussed. Results from macrostructure measures suggest a difference between

diagnostic groups on partner-adaptation skills, as non-autistic participants showed decreased story complexity and autistic participants tended to show an increase story complexity in the shared relative to private condition. The overarching aim of the study was to increase knowledge about autistic styles of communication and to contribute to the conversation about neurodiversity and autism that is currently taking place.

Résumé

L'autisme est une condition dans laquelle les compétences de communication sociale sont différentes de celles observées chez les individus non-autistes. Un aspect de la communication sociale qui a déjà été étudié en relation avec l'autisme est celui de l'adaptation au partenaire, soit la capacité de prendre en compte les connaissances et les croyances d'une autre personne lors des interactions sociales. Plusieurs études à ce jour ont examiné l'adaptation au partenaire, principalement en utilisant un paradigme de tâche de directeur. Notamment, toutes les études à ce jour ont examiné l'adaptation au partenaire en présentiel, alors que cette étude pilote a examiné l'adaptation au partenaire virtuellement, par vidéoconférence, en raison des mesures de distanciation physique imposées par la pandémie de la COVID-19. Ici une tâche de récit oral a été menée par vidéoconférence avec six jeunes adultes non-autistes et trois jeunes adultes autistes dans une étude pilote. Cette manipulation de *common ground*[1] a été réalisée dans deux conditions expérimentales : (1) *la condition partagée*, où le participant et un assistant de recherche ont regardé ensemble l'aperçu d'un extrait de dessin animé et (2) *la condition privée*, où le participant a regardé l'aperçu seul. Dans les deux conditions, le participant a ensuite regardé un extrait complet de dessin animé et a été invité à raconter l'histoire au complet à l'assistant de recherche. Il était prévu que l'adaptation au partenaire serait évident par des récits plus longs, plus détaillés et plus complexes dans la condition privé par rapport à la condition partagée. Les récits ont été examinés pour les différences au niveau du groupe et pour les interactions entre les groupes et les conditions sur la microstructure et la macrostructure narrative. Dans cette nouvelle méthodologie en ligne, les résultats préliminaires indiquent que les effets de *common ground* se manifestent différemment en vidéoconférence par rapport à en présentiel. En effet, les

[1] Le terme *terrain d'entente* est utilisé dans le langage familier mais n'apparaît pas dans l'écriture scientifique, à ma connaissance. Donc pour cette raison le terme anglais est utilisé ici.

participants autistes et non-autistes ont produit des récits plus longs dans la condition partagée comparativement à la condition privée. En fonction de ces résultats, l'impact porté par le format virtuel de cet étude sur les effets de *common ground* est discuté. Les résultats sur les mesures de macrostructure suggèrent une différence entre les groupes au niveau des compétences d'adaptation au partenaire. Les participants non-autistes ont réduit la complexité des histoires et les participants autistes ont montré une hausse de la complexité des histoires dans la condition partagée par rapport à la condition privée. Les résultats de cette étude s'ajoutent aux travaux précédents dans le but de contribuer à la sensibilisation aux styles de communication autistes afin de réduire la stigmatisation et les préjugés auxquels les personnes autistes sont confrontées au quotidien. Le but principal de cette étude était d'augmenter les connaissances sur les styles de communication autistes et de contribuer à la conversation sur la neurodiversité et l'autisme qui se déroule actuellement.

Acknowledgements

I would like to extend my heartfelt gratitude to the many individuals who helped make this project happen. First and foremost, I would like to thank Dr. Aparna Nadig for her mentorship and support and for helping me navigate the ups and downs of conducting research during a global pandemic. I could not have done this without you. I would also like to thank my committee members, Dr. Noémie Auclair-Ouellet and Dr. Gigi Luk for their feedback which helped to shape and polish this project and write-up. Thank you also to Dr. Elizabeth Allyn Smith for her input on project methods, to Eve-Julie Rioux for help with transcription methodology, to Mallory Skinner for her insights on autism and neurodiversity, and to Daphnée Dubé for assistance with French translation.

I would also like to thank the PoP Lab members for their assistance in collecting and analyzing data, in particular: Kouro-Maïram Baro, Jordyn Davloor, Yangyilin Guo, Émie Lévesque, Sabrina Rao, Laurianne Rioux, and Shutong Yu. I appreciate the encouragement and support over the past year from Angela MacDonald, Dr. Nida Latif, Ekaterini Tsoraidis, and Aaron Glick - with a special thanks to Aaron for his edits and help creating figures. I am also extremely grateful to the participants without whom this project would not have been possible.

I am thankful to my partner, Samir, for his support and patience throughout my time in grad school and to my parents and siblings for cheering me on from the sidelines and helping me realize this dream. I am also very grateful for the encouragement and love from my friends and classmates during this process, in particular my thesis year pals.

This project was funded by the Centre for Research on Brain, Language, and Music (CRBLM) Research Incubator Award, awarded to PI Dr. Aparna Nadig and co-PIs Dr. Gigi Luk and Dr. Elizabeth Allyn Smith.

Preface

This thesis research was conducted in the Psychology of Pragmatics Laboratory directed by Dr. Aparna Nadig, Ph.D., located in the School of Communication Sciences and Disorders at McGill University. The experiment reported on here was part of a larger study led by Dr. Aparna Nadig, in collaboration with Dr. Nida Latif and additional support by Dr. Kristine Onishi in the Department of Psychology. I contributed to this research by developing the research proposal, creating research stimuli, selecting measures for analysis, devising coding schemes, collecting data, and transcribing narrative retells. Research assistants provided an important role in assisting with all of these tasks, especially Shutong Yu who coded the narrative retells reported here. Data analysis was conducted by me with the guidance of Dr. Aparna Nadig. I wrote this thesis independently.

Notes on Terminology

There are a few notes I would like to make on the terminology used in this thesis. First, I apply the framework of the neurodiversity paradigm, which views brain-based differences as a part of natural human diversity (Walker, 2014). Terminology commonly associated with this framework includes *neurodivergent*, which describes individuals who fall outside of the "typical" range of neurocognitive functioning and *neurotypical,* which describes individuals who are inside this "typical" range (Kapp, 2020). This thesis focuses both on non-autistics and the autistic community. As I am not autistic, I default to self-advocates and research informed in collaboration with autistic individuals for the language to use in this thesis. Therefore, I use the identity-first language (i.e., *autistic individual*) as opposed to person-first language (i.e., *person with autism*), as this is reported to be preferred by a large majority of self-advocates in the autism community (Brown, 2011; Kenny et al., 2016, Bury et al., 2020; Botha et al., 2021). Additionally, I use the term *non-autistic*, as opposed to *neurotypical*, to describe participants in comparison groups when reviewing studies and when discussing my study, as this term is more precise and because this study did not include a thorough screening process. Non-autistic participants could in fact be neurodivergent in ways beyond autism (Bottema-Beutel et al., 2021; Walker, 2014).

Introduction

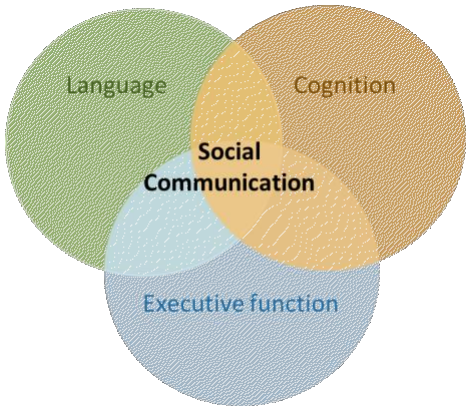
Social communication skills are crucial throughout the lifespan, from childhood to adulthood. These skills affect the ways in which we build and maintain relationships, which can impact mental health (Ishii-Kuntz, 1990), physical health (Umberson & Karas Montez, 2010), procuring and maintaining employment (Argan et al., 2016; Weinberger, 2014), and overall quality of life (Pettit et al., 2011). In autistic adults, these skills have a particular impact as self-advocates from the autism community and autistic-led research indicate that social interactions involving autistic adults are frequently misunderstood and misjudged (Mitchell et al., 2020; Sasson et al., 2017). This has been reported to negatively impact quality of life for autistic adults as this stigma is connected to underemployment or unemployment, barriers to medical and social service access, an increase in autistic burnout, which is a state of distress and/or extreme exhaustion that results from chronic life stressors unique to autistic individuals (Pearson & Rose, 2021; Raymaker et al., 2020), and increased rates of suicidality (Dickter et al., 2020; Gotham et al., 2015; Sasson et al., 2017; Williams et al., 2021). A better understanding of the differences that exist between autistic and non-autistic social communication skills can therefore help increase awareness and acceptance of autistic styles of communication, which has been reported to improve mental health in these individuals (Cage et al., 2018). Increasing awareness and acceptance have also been identified as a priority for research by the autism community (Williams et al., 2021; Pellicano et al., 2014; Gotham et al., 2015), underscoring the importance of these aims.

Social communication skills are a complex set of component skills made up of the interactions between linguistic, cognitive, and executive function abilities (Hyter, 2017; Waite, 2013), as illustrated in Figure 1. A subcomponent of social communication is *partner adaptation*, or the ability to recognize and incorporate the knowledge and beliefs of our communication

partners (Brown-Schmidt & Heller, 2018, Heasman & Gillespie, 2018; 2019). This skill involves the interplay between executive function (e.g., attending to the listener), cognition (e.g., extracting and remembering information about the listener's knowledge and beliefs), and language (e.g., selecting appropriate lexical items, adjusting syntax), and allows us to tailor our messages to our communication partners so we can be effective, efficient, and thoughtful communicators. Social communication difficulties are part of the DSM-5 diagnostic criteria for autism (American Psychiatric Association, 2013). These difficulties significantly impact social functioning and quality of life (Oakley et al., 2021; Chiang & Wineman, 2014). As a result, a large body of research has focused on social communication skills in autistic children, often compared to non-autistic children of the same age. An important, if somewhat smaller, body of research exists on these same skills in autistic adults.

Figure 1

Hyter-Sloane Conceptual Model of Social Communication



Note: Illustration adapted from Hyter (2017).

Previous work on partner adaptation in adults has primarily used a task known as the *director task* paradigm (Nadig et al., 2015). In these tasks, a participant and a research confederate are typically separated by a barrier and one member of the pair has the task information and is instructed to provide the other with instructions to complete the task. Another method to investigate partner adaptation is through oral narrative tasks. In this type of task, participants are either provided with a wordless picture book and asked to tell a story or are shown a short video and asked to retell what they watched (Malkin et al., 2018). Narrative tasks yield linguistically rich data (Stirling et al., 2014) and are considered an efficient means to analyze partner adaptation at several different levels. Previous work on narratives has been conducted with autistic and non-autistic adults (e.g., Geelhand et al., 2020; Colle et al., 2008; Barnes & Baron-Cohen, 2012) and children (e.g., Siller et al., 2014; Capps et al., 2000). Some have additionally included a common ground manipulation, in which the participant shares an experience with a research confederate and the extent to which the participant takes the shared experience into account in their narrative is examined (e.g., de Marchena & Eigsti, 2016).

This study combines methodologies from two previous works on narrative production and partner adaptation in autistic and non-autistic individuals to extend their findings. Barnes and Baron-Cohen (2012) investigated written narrative retells by autistic and non-autistic adults. I build on this work by applying the coding scheme from this study to oral narratives with a common ground manipulation. de Marchena and Eigsti (2016) examined oral narrative retells in autistic and non-autistic adolescents. I extend this work by adding additional measures to analyze how partner adaptation manifests in narratives in both diagnostic groups. I further extend the work by de Marchena and Eigsti (2016) by examining partner adaptation skills in older participants.

Literature Review

Autism and Social Communication

Autism is a form of neurodivergence with differences relative to non-autistic individuals in social, cognitive, and sensory domains that present heterogeneously (Pearson & Rose, 2021; Williams et al., 2021). Autism can also be considered a disability, due to both the barriers faced by autistic individuals in a neurotypical-majority world and to the inherent challenges associated with autism (Ballou, 2018; Bottema-Beutel et al., 2021; M. Skinner, personal communication, May 31, 2021). Currently, diagnosis is based on observable behaviors made according to the criteria in the *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition* (DSM-5; American Psychiatric Association, 2013) which states that, from early childhood, an individual must present with persistent difficulties in social communication and interaction skills, and restricted and repetitive behaviors and/or interests (American Psychiatric Association, 2013; Lord et al., 2018).

Profiles of intellectual and language abilities associated with autism can vary greatly from individual to individual. Intellectual ability can range from severe intellectual disability to above-average IQ (Lord et al., 2018), with estimates that about half of autistic children have intellectual disabilities (Mody & Belliveau, 2013). A systematic review on longitudinal studies reported age-corrected IQ to be relatively stable from childhood into adulthood (Magiati et al., 2014). Similarly, language ability can range from non-speaking to highly verbal. Language profiles in the autistic pediatric population can be roughly grouped into three categories, where up to 30% are minimally verbal or non-speaking, an additional 50% are verbal but with impaired language, and approximately 20% are within or above normal range (Bal et al., 2016; Kjelgaard & Tager-Flusberg, 2001; Paul et al., 2018; Pickles et al., 2014; Norrelgen, et al., 2015; Tager-

Flusberg & Kasari, 2013). Performance on early language measures has been shown to be a relatively good predictor of later language performance in adulthood for the majority of autistic individuals (Magiati et al., 2014; Brignell et al., 2018).

In light of the heterogeneity in autism in language ability and the aim to collect narrative data, the study proposed here targets highly verbal autistic individuals without structural language impairment for two reasons. First, it is difficult to study language skills broadly in autistic individuals, given the high degree of variability. Therefore, limiting the study scope to a well-defined subgroup helps control for variability and allows for easier comparison with other findings and for careful matching with a comparison group. The relative within-group homogeneity increases the likelihood of obtaining data fitting into homogeneity of variance in most of the statistical tests. Second, a fairly high degree of comfort with spoken language ability is required for the narrative retell task in this study. These factors led us to opt to recruit autistic and non-autistic individuals with a relatively high degree of proficiency in spoken language skills. The remainder of this literature review centers on previous research conducted with adults proficient in spoken language and supplements empirical observations from studies conducted with children and adolescents.

Social communication is a universal difficulty in autistic individuals when interacting with non-autistic or neurotypical individuals, as reflected in the diagnostic criteria mentioned above. It is important to highlight that these difficulties arise when autistic individuals interact with neurotypical individuals, as recent research and autistic experience indicates that autistic individuals do not experience these same difficulties when interacting with autistic peers (Crompton et al., 2020a, b, c; Heasman & Gillespie, 2019; M. Skinner, personal communication, May 31, 2021). Social communication is often used interchangeably with the term *pragmatics*;

however, they are not identical. In fact, following the Hyter-Sloane (2013) conceptual model, social communication arises from the interaction of pragmatics, social cognition, working memory, executive function, and affective states (Hyter, 2017; Waite, 2013). In this model, pragmatics is therefore a part of the language component subdomain of social communication. In autistic individuals, including those who are highly verbal, challenges in interaction are reported due to so-called deficits in social communication (Paul & Fahim, 2014; Norbury, 2014; Tager-Flusberg, 2004).

There are several accounts that have been put forth in an attempt to pinpoint the underlying cognitive differences that give rise to social communication difficulties associated with autism. One such account is that of difficulty or "deficiency" with the process of mentalizing, often referred to as the *Impaired Theory of Mind* account (ToM), as first put forth by Baron-Cohen et al. (1985), in which autistic children were found to "lack" ToM skills as measured by false belief tasks. This account is debated in the literature, with several studies reporting significant empirical limitations to ToM as a full account of social communication challenges experienced by autistic people (for discussion see Gernsbacher & Yergeau, 2019; Mottron et al., 2006; Paynter et al., 2016). Other accounts have been put forth to explain social communication difficulties in autism, such as the *Executive Function* account whereby executive dysfunction is posited to create difficulty with acquisition of these skills (see Pennington et al., 1997; Russell, 1997), and the *Weak Central Coherence* account, which states that impairment is caused by difficulty with integration and processing of global information (see Frith & Happé, 1994).

More recently, the *Double Empathy Problem* has been posited by Milton (2012). This account attributes social communication difficulties not to "deficiencies" related to autism itself

but to a mutual misunderstanding between autistics and neurotypicals of their unique social communication profiles, akin to misunderstanding due to cultural differences (for further discussion, see Crompton et al., 2021; Davis & Crompton, 2020, Heasman & Gillespie, 2017; Milton, 2012; Mitchell et al., 2020). This lack of mutual understanding has been reported to give rise to less efficient communication in social interactions between autistic and neurotypicals in comparison to social interactions between autistic individuals only or between neurotypical individuals only (Crompton, 2021a). This theory fits in with the neurodiversity paradigm as it imagines autism under a social model lens, viewing it therefore as a brain-based difference rather than a pathology, as is the case under the medical model. This is the view that I hold and as a result, I reframe any use of a deficits-based and medical model approach in the literature review to a differences-based account, in line with the social model of disability and the neurodiversity paradigm. I use this same differences-based approach in my predictions, results, and interpretation.

It is important to note that social communication refers to a wide range of skills. In this study, I have chosen to focus specifically on partner adaptation. This specific skill relates to an individual's ability to tailor language to communication partners based on inferences about their internal states and beliefs in the context of social interaction (Brown-Schmidt & Heller, 2018). This skill has also been referred to as *perspective-taking* or *audience design* (Horton & Gerrig, 2002; Isaacs & Clark, 1987); however, I opt to use the term *partner adaptation*, as this more accurately reflects the skill targeted in the experimental task used in this study. As this study examines partner adaptation in the context of a narrative retell task, I discuss previous findings on narratives produced by autistic individuals. Following this, I review findings on partner adaptation in autistic individuals in prior works.

Characteristics of Narratives Generated by Autistic Individuals

Narrative skills in autistic and non-autistic adults are important to review, as these findings will factor into predictions I make regarding narrative skills across diagnostic groups and between common ground conditions. In autistic adults, findings regarding narrative skills are currently somewhat limited. Therefore, I begin this section by discussing findings from autistic youth and then focus on the studies available on adults.

Microstructure Skills

Microstructure refers to the form and content used in narratives and specifically encapsulates expressive vocabulary and morphosyntax. Findings across studies regarding the microstructural skills of autistic individuals have been somewhat inconsistent, likely due to the wide range of structural language profiles of autistic individuals. Siller et al. (2014) reported that stories produced by autistic children (age range: 5-8 years) were shorter relative to the non-autistic comparison group, as measured by total number of utterances in groups that were well-matched on standardized measures of receptive and expressive vocabulary. Similarly, Capps et al. (2000) reported that autistic children and adolescents (age range: 5-15 years) produced shorter narratives relative to the comparison group as measured by propositions in groups matched on language age, as determined by standardized tests. In a meta-analysis, Baixauli et al. (2016) reported that medium-to-large effect sizes were found on the number of words used in narratives, with non-autistic children and adolescents (age range: 6-15 years) producing longer narratives relative to autistic children. It is important to note, however, that not all studies included in this meta-analysis matched groups on language or verbal IQ measures and therefore findings could be possibly explained by group differences in structural language abilities. de Marchena and Eigsti (2016), however, reported no group differences in story length as measured by the total

number of words in a sample matched on receptive vocabulary in a study conducted with adolescents (age range: 12-17 years).

Findings in studies with adults show a similar pattern of inconsistency regarding microstructure, or structural language ability, in autistic individuals, likely pointing to an impact of individual differences on these skills. Geelhand et al. (2020) reported that the non-autistic group in their sample produced significantly more words in their narratives relative to the autistic group. However, Colle et al. (2008) reported no differences in word count and McCabe et al. (2013) reported no differences in total number of propositions, or verbs and their arguments used as a measure of quantity, between groups.

However, the generalizability of findings from these studies is limited by the fact that each study used different story elicitation and transcription methods. Two studies elicited oral narratives by asking participants to tell a story using a wordless picture book as a prompt (Colle et al., 2008; Gellhand et al., 2020), one study showed participants short video clips from a television show and asked them to write down retells of the clips (Barnes & Baron-Cohen, 2012), and one elicited oral personal narratives using several open-ended prompts asked by a research assistant (McCabe et al., 2013). Methods to segment utterances in transcription also varied. One study divided utterances based on propositions (McCabe et al., 2013), one study segmented material according to story episodes (Colle et al., 2008), and one determined utterance boundaries using syntactic and prosodic information, which is most in line with the methods used in this study (Geelhand et al., 2020). Participants in Barnes and Baron-Cohen (2012) produced written narratives and presumably sentences were segmented as written by the participants.

An additional limitation of these studies is that none included an efficiency measure, which describes how relevant or correct the information in the retell is. This measure is typically represented as a proportion of correct or relevant information units to the total output of the retell, either in duration (seconds, minutes) or as quantity (words, utterances) (Nicholas & Brookshire, 1993; Oelschlager & Thorne, 1999). While these measures are frequently included in language analysis of adults with language and cognitive impairment (Beales et al., 2018; Marini et al., 2011), including an efficiency measure would add dimension to macrostructure measures by assessing the relevancy of the output and not just overall quantity.

These studies all matched diagnostic groups on language ability using measures of verbal IQ. The verbal IQ measures in these studies measures vocabulary skills only and therefore does not provide information on structural language ability. Therefore, differences in structural language ability could also impact the findings of these studies. This is discussed further in the *Macrostructure Skills* and the *Discussion* sections.

The results from these studies discussed in this section provide an inconsistent picture of the differences between autistic and non-autistic individuals on microstructure skills in narrative-based tasks. Interpretation of these inconsistencies is limited by important differences in elicitation and transcription methodologies. However, these findings could also be tapping into the highly variable presentation of traits across autistic individuals, even amongst the subgroup of highly verbal autistic individuals featured in these works.

Macrostructure Skills

Autistic individuals have also been shown to employ elements of macrostructure in narrative discourse differently compared to non-autistic peers. *Macrostructure* encompasses cohesion (e.g., story grammar elements such as *character*, *setting*, *conflict*, *resolution;* reference

to character mental state) and coherence (e.g., pronominal reference, conjunction) (Baixauli et al., 2016; Peristeri et al., 2017), both of which are important for a speaker to consider when telling a story as they can help the listener follow along and understand the story or message the speaker is trying to convey. In their meta-analysis, Baixauli et al. (2016) reported differences in macrostructure on both measures of *coherence*, or global story organization, and *cohesion*, or sentence-level story organization, where autistic children and adolescents had more difficulty with these skills relative to non-autistic peers with a large effect size. Measures of coherence varied, but one that was used in several studies was frequency of causal and temporal conjunctions, as in Diehl et al. (2006) and Rumpf et al. (2012). In both of these studies, authors found no overall group differences in the number of story elements used or recalled in autistic and non-autistic children.

Similarly to children, autistic adults have also been reported to perform differently on measures of macrostructure relative to non-autistic peers. Specifically, narratives by autistic adults have been reported to have fewer causal conjunctions (Geelhand et al., 2020; McCabe et al., 2013; Colle et al., 2008), fewer referential expressions (Geelhand et al., 2020), and more ambiguous pronominal reference (Colle et al., 2008). In a task where participants were asked to provide written narrative retells, those produced by autistic adults were found to provide less information as measured by the number of story grammar elements used and the treatment of these elements (detailed vs. gist) relative to a non-autistic comparison group (Barnes & Baron-Cohen, 2012). These studies suggest that autistic individuals' use of macrostructure elements related to discourse organization differs relative to that of non-autistic individuals.

Reference to mental state terms is another component of macrostructure. Mental states terms (MST) in narratives add to story coherence by linking story character mental states to story

events (Capps et al., 2000; Guajardo & Watson, 2002; Peristeri et al., 2017; Siller et al., 2014). Findings regarding MST in narratives by autistic children have been somewhat inconsistent. Some studies have shown an overall difference in the frequency of MST, with autistic children employing these terms less frequently in comparison to non-autistic peers on narrative generation tasks (Rumpf et al., 2012; Capps et al., 2000). Using similar tasks eliciting narratives, other studies have found no difference in frequency of MST between autistic and non-autistic children. However, when these studies examined subgroups of MST (such as emotion, cognition, physiology, perception, and desire), autistic children were found to use a smaller range of terms relative to non-autistic children. Specifically, they used fewer words denoting cognitive states (e.g., "know", "confused"; Siller et al., 2014) and emotions (e.g., "fear", "happy"; Kauschke et al., 2016). Among personal narratives, Bang et al. (2013) found no difference in the total number of MST produced or in proportion of MST per utterance in autistic children relative to non-autistic peers on a summary score of MST. While the findings from Bang et al. (2013) are not directly applicable to the present study given the difference in narrative discourse context (personal vs. generated story retell), they provide additional insight into related skills. Participants in these studies were matched on language, using either verbal IQ or standardized language assessments; however, it is important to note that these studies vary in age range and task, thus impacting interpretation of findings across the studies.

Similarly inconsistent results are found in studies on MST with autistic adults. Geelhand et al. (2020) found in a language-matched sample that when autistic and non-autistic adult participants were asked to generate a story using a wordless picture book, autistic participants produced fewer MST relative to non-autistic counterparts. On the other hand, Colle at al. (2008) reported no differences between the autistic and non-autistic groups in the use of MST in the

context of a wordless picture book narration task. However, the authors reported that autistic participants were less likely to link the emotions of a character to an event in the story, thus showing a difference in how MST were employed. This study did not match participants on structural language ability, which therefore limits the interpretation of these findings. In a study where participants were matched on verbal IQ, a proxy of structural language ability, McCabe et al. (2013) reported no difference in the frequency of MST used between groups on personal narratives. Again, findings on MST in personal narratives are not directly equivalent to those used in narrative retells but are included here as complementary information. I now turn to a discussion of partner adaptation skills.

Partner Adaptation in Autistic Individuals

One aspect of social communication that has been shown to manifest differently in autistic individuals relative to non-autistic peers is that of *partner adaptation*. This refers to the ways in which a speaker tailors their language to their listener by recognizing and incorporating the listener's knowledge, beliefs, and experiences. Partner adaptation is commonly referred to as *audience design* or *perspective-taking* (Brennan & Hanna, 2009; Horton & Gerrig, 2002). I use the term *partner adaptation* because the task used here involves social interaction and thus is narrower in scope than perspective-taking, which describes a wider skill set (Brennan & Hanna, 2009).

Partner adaptation is a skill that manifests in both production and comprehension (Malkin et al., 2018). The proposed study investigates partner adaptation in a narrative retell task, therefore discussion here is limited to studies that have also investigated this skill in production tasks (for a discussion of how partner adaptation manifests in comprehension in autistic individuals see Abbot-Smith et al., 2020). One task that is commonly used to study partner

adaptation in production is called the *Referential Communication Task*, also often referred to as the *Director Task*, in which two people communicate in order to arrange pictures or objects. There are two roles, the director, who gives the instructions, and the matcher, who follows the instructions to complete the task. In these tasks, *common ground*, or the shared knowledge between communication partners, is usually manipulated whereby the director and matcher have access (usually visually) to some of the same information, but not all (Brown-Schmidt & Heller, 2018; Malkin et al., 2018). For example, in Isaacs and Clark (1987), participants worked in dyads where they were both given a set of the same postcards featuring New York City landmarks and each participant's set was not visible to the other person. The participant in the director role had the postcards ordered in front of them and had to give directions across a barrier to their partner to arrange them in the same order.

In a recent systematic review, Malkin et al. (2018) investigated the use of *verbal reference*, or the choice of how a speaker refers to an object or person, in autistic children and adults in a variety of discourse contexts. Of particular relevance are two studies, Nadig et al. (2009) and Fukumura (2016), which both employed referential communication tasks with a visual manipulation of common ground (i.e., in a *shared* condition, director and matcher see the same stimuli; in a *privileged* condition, matcher cannot see all of the stimuli that the director sees). Findings from these two studies suggest that autistic children, in comparison to non-autistic children, have difficulty using verbal reference in context-appropriate ways, as the autistic participants in these studies either provided too much or not enough information as determined by the social context. However, the study by Nadig et al. (2009) highlighted the importance of investigating individual differences, as autistic participants with higher structural

language ability and IQ were found to better adapt directions to their listener's perspective relative to autistic participants with lower structural language ability.

Nadig et al. (2015) investigated partner adaptation in adults in a task that involved a common ground manipulation based on shared prior experience, which parallels the manipulation that will be used in my experimental task. In this study, autistic and non-autistic adult participants assumed the role of the director and were asked to describe tangram figures, over several rounds of a matching game, to a research confederate who acted as a matcher. Previous studies from non-autistic individuals have shown that over the course of an interaction, a phenomenon called *lexical entrainment* emerges, where communication partners come to use the same term when discussing an object that does not have a known name (Brennan & Clark, 1996), which ultimately serves to improve efficiency in interaction (Garrod & Anderson, 1987). These lexically entrained terms, called *referential pacts,* have been shown to be partner-specific (Brennan & Clark, 1996). In Nadig et al. (2015), referential pacts referring to the tangrams were developed between the director and the matcher in both diagnostic groups after completing several rounds of the task. Additionally, interactions became more efficient with subsequent rounds showing a decrease in duration in both groups, with the autistic group having a longer average round duration relative to the non-autistic group.

After completing the third round, the experimental manipulation was introduced where the matcher either left for a moment and came back or a new matcher was introduced. In the non-autistic group, those with the new matcher took longer on the task in comparison to those that continued with the same matcher. Additionally, the non-autistic participants with the new matcher showed less carry-over of referential pacts established with the previous matcher

compared to those that continued with the same matcher. Both of these findings demonstrate a disruption of lexical entrainment in the non-autistic group, due to adaptation to a new matcher.

In the autistic group, those in the new matcher condition also took longer to complete the task in comparison to those in the same matcher condition. In fact, the autistic participants in the new matcher condition took *longer* in the first round with the new matcher than they did in the first round with the previous matcher – a finding that was not seen in the non-autistic group. These findings demonstrate partner sensitivity in the autistic group and also point to an increase in effort required to adapt to a new partner, relative to the non-autistic group. Looking at the referential pacts, the autistic individuals were marginally more likely to show a carry-over effect to the new matcher compared to the non-autistic group. At the individual level, a difference emerged whereby some autistic individuals actually completed the task faster with the new matcher by carrying over these pacts while others with less carry-over actually took longer on the task with the new matcher relative to the non-autistics. Much like the findings in Nadig et al. (2009), this study highlights that looking at performance solely at the group level can mask important findings regarding partner adaptation that emerge at the individual level, with partner adaptation being evident in some autistic individuals and less so in others. This is a point that will be considered in the analysis plan for the study proposed here.

Another paradigm that has been used to examine partner adaptation is in the context of a narrative retell task, such as in de Marchena and Eigsti (2016). As in Nadig et al. (2015), common ground was established by shared prior experience. Here, participants, who were autistic or non-autistic adolescents, retold stories from cartoons to a research confederate under conditions of common ground (i.e., the *shared* condition) or in the absence of common ground (i.e., the *private* condition). To manipulate common ground, the participant viewed a short

preview of the video either alone (*private*) or with the research confederate (*shared*) prior to watching the full clip alone. Afterwards, the participant was asked to retell the story from the full clip to the research confederate so that they could learn enough information about the story to complete a short quiz afterwards. In this scenario, the authors expected shorter narratives in the shared condition than the private condition, as participants could rely on shared knowledge in their retells. This phenomenon is referred to as a *referential shortening effect* and was measured as the total number of words produced in the private condition minus the total number of words in the shared condition.

Effects of referential shortening were reported in the non-autistic group as total word counts and were found to be lower in the shared condition relative to the private condition (p = 0.01, Cohen's d = 0.47*)*. There was no referential shortening effect in the autistic group, as total word count did not significantly differ between the two conditions (p = 0.50, Cohen's d = -0.11). Within the autistic group, there was an effect of age where older participants showed a greater referential shortening effect. Additionally, age and greater social skills as measured by the *Social Responsiveness Scale* (SRS; Constantino & Gruber, 2005) taken together were found to predict 45% of the variance in referential shortening for autistic participants. Given the trend of an interaction between age and greater social skills in the autistic group, it is possible that stronger effects of referential shortening will be seen in autistic adults in the current study. Again, these findings also highlight the role that individual differences can play in partner adaptation skills.

Predictions in Context of Previous Research

In this study, I investigated differences between autistic and non-autistic groups in a narrative retell task with a common ground manipulation. Specifically, differences in narrative ability were examined by microstructure and macrostructure measures and differences in partner

adaptation were explored by examining group differences in the aforementioned measures across shared and private conditions. It is important to note that prior studies were conducted in person whereas the current study, as described in the methods, was conducted entirely online. Therefore, I explore the impact of this methodological difference when interpreting findings in the context of previous work.

For narratives, I predicted that the autistic and non-autistic groups would show similar performance on (1) microstructure to the extent that groups have similar language abilities. At the level of (2) macrostructure, I predicted that the autistic group would (a) use fewer story grammar elements relative to the non-autistic controls (Barnes & Baron-Cohen, 2012, McCabe et al., 2013; de Marchena & Eigsti, 2016) and that (b) the autistic group would show less frequent usage of MST in connection with story grammar elements relative to the comparison group (Geelhand et al., 2020; Barnes & Baron-Cohen, 2012).

On partner adaptation measures, that is, the differences in measures across the shared and private conditions, I predicted that (3) referential shortening effects would be seen in microstructure and macrostructure measures in non-autistic and autistic adults. In Marchena and Eigsti (2016), a referential shortening effect in total number of words was found in retells of the older autistic adolescents, therefore I believe this would be present in the older sample featured in this study. de Marchena and Eigsti (2016) did not include macrostructure analysis, however I predicted that macrostructure measures would also show referential shortening effects in both groups. These predictions are summarized in Table 1.

Table 1

Summary of Study Predictions

Item	Measure	Group difference predictions	Common ground manipulation predictions
1. Microstructure	Volubility (e.g., total number of words); grammatical complexity (mean length of utterance)	Aut = NAut	
2a. Macrostructure	Story Grammar Composite Score (SG)	Aut < NAut	
2b. Microstructure	Counts of MST tied to story grammar elements (i.e., character, conflict, resolution; SG x MST)	Aut < NAut	
3.Partner adaptation a and b	Microstructure (volubility, grammatical complexity); macrostructure (SG, total number of mental state terms)		Private > Shared for non-autistics Private > Shared for autistics

Note. Aut = autistic group; NAut = non-autistic group; MST = mental state terms.

Methodology

This study was conducted as part of a larger study in Dr. Nadig's lab, with collaborator Dr. Nida Latif, that examined individual differences in social problem-solving and communication in autistic individuals as compared to non-autistic individuals (see Latif et al., 2019). In addition to the measures reported here, the full study protocol involved experimental tasks that examined social and non-social prediction and self-report questionnaires related to social personality characteristics. As this study was conducted from Montreal, Quebec, a bilingual city, participants were tested in either English and French according to their preference.

The narrative and perspective-taking task described here employed a mixed design with a between-subjects factor of diagnosis (autistic, non-autistic) and a within-subjects factor of common ground condition (private, shared).

Online Delivery of Study and Ethics Considerations

Due to the COVID-19 pandemic and McGill's prioritization of remote human participant research, this study was conducted remotely in an online format, approved by the McGill Faculty of Medicine IRB. The consent form, questionnaires, and standardized test materials needed for this study, as discussed in the *Participants* section*,* were presented using LimeSurvey (version 3; LimeSurvey GmbH, 2017). The standardized tests and the experimental task were conducted using Webex (version 41.5.5.12; Cisco, 2021), a secure video-conferencing platform. All platforms used in this study were compliant to the McGill Cloud Directive (McGill University, 2021). Research assistants were required to complete ethics training (TCPS-2), download anti-virus software onto their personal or lab computers, and connect to the McGill secure VPN when handling confidential data.

Three undergraduate volunteer research assistants helped with the collection and analysis of the data presented here. Research assistants were bilingual in English and French and played both the tester and research confederate role during data collection. They tested in the language in which they were most comfortable and played the role of the research confederate in the language in which they were less comfortable. I was also involved in data collection and was a tester in English and the research confederate in French, resulting in two teams of two research assistants to run data collection. Study procedures varied slightly for autistic participants (e.g., collecting diagnostic reports), therefore research assistants were made aware of group

membership prior to testing to prepare the appropriate materials. Research assistants were also involved in coding, as described in the *Procedures* section.

Recruitment

The recruitment process was conducted online. Non-autistic participants were recruited through the McGill Psychology Human Participant Pool in collaboration with Dr. Kristine Onishi of the Psychology Department as a part of the larger study. Autistic individuals were recruited online from autism organizations, schools, and clinics through email, social media, and personal contacts. Flyers were posted or sent out to these institutions with instructions to email the Psychology of Pragmatics (PoP) lab if interested in participating. Once an interest email was received, I or a research assistant followed-up with a screening email to ensure that participants met study inclusion criteria. If eligible, unique Webex links were created and sent out to participants the day before their study session. At the beginning of the first session, participants accessed the study consent form on Limesurvey with a unique token. Participants read through the consent form and signed electronically. The tester was present on the Webex videoconference call during the consent process to answer questions and provide explanations as requested. Participants were asked whether they wanted to receive a copy of their signed consent form. In the instances participants requested a copy, the consent form was exported from Limesurvey and emailed to the participant. Emails were routinely deleted from the PoP lab email account as an added security measure.

Participants

For this thesis, a pilot sample of nine participants were recruited that included six non-autistic participants (age range: 20 – 21 years) and three autistic participants (age range: 20 – 29 years). These nine participants were selected based on availability of coded data at the time of

writing. Data from an additional 30 participants was later obtained and will allow for a more complete analysis in the future. Inclusion in the autism group was determined in one of two ways: (1) possession of a formal diagnosis from a licensed psychologist or psychiatrist; or (2) achieving a score at the 32-point cutoff or above on the *Autism Quotient* (AQ; Baron-Cohen et al., 2001), a 50 question self-report measure that screens for elevated presence of autism traits. In the non-autistic group, no participants reported receiving a formal diagnosis of autism or other neurodevelopmental disorders prior to the study and all scored below the cutoff on the AQ. In the autistic group, two participants had received a formal diagnosis prior to this study. The other autistic participant had a score of 39 on the AQ, confirming an elevated presence of autistic traits. This participant was also self-diagnosed as autistic, which is recognized as a valid form of diagnosis by the autism community. Receiving an autism diagnosis, especially in adulthood, is often challenging due to barriers such as lack of specialized professionals, financial inaccessibility, distrust of professionals due to prior negative experiences, and concern about stigma associated with autism, among others (Lewis, 2016; Huang et al., 2020). Therefore, self-diagnosis is often a first and important step to navigating the complex system of formal diagnosis (Lewis, 2016).

Information on age, education and gender was collected through completion of an intake questionnaire at the beginning of the study. Participants had completed at a minimum some university. All participants identified as female and all but one participant spoke English as a native language. All participants were asked to rate their proficiency in speaking, understanding, reading, and writing in English on a scale 0-10, where 0 indicated no proficiency and 10 indicated high or native-like proficiency on a questionnaire adapted from the *Language and Social Background Questionnaire* (LSBQ; Anderson et al., 2018). The one non-autistic

participant who was not a native speaker of English rated herself at proficiency level of 8 in speaking, understanding, and writing and 7 for reading and was therefore determined to have a high proficiency in English.

Participants also completed standardized measures related to language and intelligence. To measure non-verbal IQ (NVIQ), the *Raven's Progressive Matrices* (Raven et al., 2003) was administered. To accommodate for remote testing, visual test stimuli were shown one-by-one in a Google Slides document over screen share and experimenters noted responses on a paper test form.

The Sentence Repetition Task Form A (SRT; Spreen & Benton, 1969; Strauss, Sherman & Spreen, 2006) was administered as a language screener. This screener was used as a brief characterization of expressive language abilities and cannot be considered a comprehensive language test. A more complete standardized assessment of language was not possible due to the length of the larger study protocol. However, the narrative task allowed for comparison of structural language abilities, as detailed in the *Results* section. The SRT task was adapted for remote testing where audio stimuli were presented one-by-one in a Google Slide presentation via shared screen and computer audio from the experimenter. It should be noted that scores on this auditory task were impacted by internet connection speed and reliability. Participants and experimenters were asked to rate the quality of the audio stimuli, presented in the *Results* section. If the quality was rated to be less than 4 out of 4, data from this task was excluded.

Table 2

Demographic Characteristics of Participants by Diagnostic Group

	Non-autistic (n = 6)		Autistic (n = 3)	
Variable	Mean (SD)	Range	Mean (SD)	Range
Age in years	20.50 (0.55)	20-21	24.67 (4.51)	20-29
Education in years	14.83 (0.41)	14-15	16.33 (2.89)	13-18
NVIQ	41.83 (24.94)	80-84	49.00 (15.88)	31-61
SRT*	70.67 (49.09)	14-100	76.67 (23.01)	54-100
AQ	11.67 (6.41)	4-22	38.33 (0.58)	38-39
Gender	6 females		3 females	
Location	Quebec: n = 4 Canada: n = 2		Quebec: n = 2 US: n = 1	

Note. Education refers to total number of years completed; NVIQ was measured by the *Raven's Progressive Matrices* (Raven et al., 2003) and is reported by percentile; SRT refers to the Sentence Repetition Task (Spreen & Benton, 1969) and is reported by percentile, note that one non-autistic participant was removed due to poor audio quality; AQ refers to the *Autism Quotient* (Baron-Cohen et al., 2001). Participants were located in Quebec, in another Canadian province, or in the US. *For the SRT, n = 3 non-autistics due to poor audio/video quality during the call.

Video Stimuli for Narrative Task

When selecting a source for the video stimuli for the narrative retell task, Dr. Nadig and I concluded that *Looney Tunes,* as was used in the study that this experimental task is based on (Marchena & Eigsti, 2016) was not optimal for the age of our targeted participants nor for the enhanced narrative measures used in this study. Therefore, we set out to find a different source using five selection criteria for video stimuli: (1) the show should contain dialogue, as this is likely to elicit more detail in the narratives, providing richer data for analysis; (2), the show should be available in English and French, as this study is being run in both languages; (3) the register in the French version of the show must be appropriate for speakers of Québécois French;

(4) the show should be a cartoon, and not a live-action show, to ensure characters display equal amounts of naturalness when speaking in the English and French versions; and (5) the content should be engaging to the adult participants.

Using these criteria, we selected the American cartoon *The Simpsons* (Groening, 1989) to use for video stimuli. The Quebec version of this show was dubbed in Montreal and is one of the few television series to be dubbed in Québécois French (Ploudre, 2003). This means that the idiomatic expressions, syntactic structures, and phonology used in the show will reflect those used by speakers of French in Canada compared to the European French register of other dubbed series (Dr. E. Allyn Smith, personal communication, April 5, 2020). Five episodes of *The Simpsons* were edited into 2-minute clips (called *full clips*) with a complete narrative arc featuring setting, character, conflict, and resolution. From the full clips, 20-second clips (called *previews*) were created as the basis of the experimental manipulation, shown prior to the full clips. Clips featured the main characters of *The Simpsons* because story arcs featuring these characters were the most readily available, allowing us to select narratives that were clear and cohesive.

Procedures

The larger study took place over two testing sessions of approximately 1.5 hours each. The tasks for this study took place mostly during the first testing session. The tasks were presented in the following order during the first session: (1) intake questionnaire; (2) sentence repetition; (3) narrative retell with common ground manipulation; (4) NVIQ. The AQ was completed during the second testing session. All testing for this study was completed over videoconference with myself or a trained undergraduate research assistant using personal or lab computers.

The narrative retell task with common ground manipulation is based on the protocol of de Marchena and Eigsti (2016). Participants were first shown a 20-second preview of the cartoon *The Simpsons* followed by a 2-minute full clip. Following each clip, participants were asked to retell the story that they had just watched to a research confederate, who was a research assistant that joined the testing session for this task only. The participant was told that the research confederate was unfamiliar with the content of the 2-minute video clips. Participants watched two clips in each of two experimental conditions: *shared* and *private*. In the shared condition, participants watched the 20-second preview with a research confederate in order to establish common ground. In the private condition, participants watched the preview alone while the research confederate was in a separate breakout room on Webex. The participant watched the full clip alone in both conditions as a way to maintain an acceptable reason to retell the story to the research confederate. Participants and research confederates were given a brief multiple-choice quiz, as it was found in de Marchena and Eigsti (2016) that including a short quiz motivated the participants to increase the amount of detail in their narratives. An example of a quiz is included in Appendix A. Before beginning the experimental trials, the participant and research confederate completed a practice trial following the private condition procedures, as was the case in de Marchena and Eigsti (2016). Participants and research confederates met each other for the first time at the beginning of the task and interacted minimally during the task. Research confederates were instructed to engage non-verbally during the participants' retells by orienting themselves to their web cameras and reacting when appropriate (e.g., smiling, nodding, etc.). Non-verbal engagement was deliberately chosen in order to avoid interrupting the participants' audio signal on Webex. Conditions were counterbalanced across participants using a latin-square design. Each condition had one clip featuring an older character (Homer, Marge)

and a younger character (Bart, Lisa) and one clip from each gender to reduce chances of gender or age-related effects.

Thirty-six narrative retell samples were transcribed, as each of the nine participants produced two retells in each of two experimental conditions. I transcribed all files included this pilot sample. Reliability was not available at the time of writing, however, data processing is ongoing and includes reliability scoring of transcription and coding. Transcripts followed conventions of the Codes for Human Analysis of Transcript software (CHAT; V 12-Feb-2021 MacWhinney, 2000). When determining utterances, a maximum of two independent clauses conjoined by "and" were allowed per utterance except in cases where verb-phrase (VP) ellipses occurred, meaning that the subject of an independent clause was dropped as it was referentially connected with the subject of another independent clause (e.g., "He went to soccer and she took the bus and went home", where "and went home*"* indicates a clause with VP ellipsis, see Thordardottir, 2018; Nippold, 2016). Grammatical and semantic cohesion, prosody, and pauses were also considered when determining utterance boundaries (Thordardottir, 2018). Repetitions, reformulations, and filler words such as "um" and "uh" were coded and excluded from analysis.

The MOR command was used to create an additional parsed tier in the transcripts that was necessary to run analysis using the accompanying Computerized Language Analysis software (CLAN; V 12-Feb-2021; MacWhinney, 2000). This command also enabled identification of any words that were not recognized by the CLAN dictionary or spelled incorrectly. In cases where words needed to be replaced, either as a new entry to the CLAN dictionary or with the correct spelling, a word list called changes.cut was created and added to the local CLAN files and the command CHSTRING was performed, calling upon this word list, to replace words across the full set of transcripts in this sample. For analysis, the command

EVAL was used to extract the following measures from each of the retells: (1) total number of words (TNW); (2) total number of different words (TNW_Diff); (3) total number of utterances (TNUtt); and (4) mean length of utterance in words (MLUw).

Next, transcripts were coded for story grammar complexity and for MST by one trained research assistant. The coder also assisted with data collection and it was therefore not possible to keep her naive to group membership. As stated above, reliability was not available for these files at the time of writing. For story grammar coding, the coder rated four story grammar elements, *setting, character, conflict,* and *resolution* on a scale from 0-2 for each element, where 0 = no mention of the element; 1 = partial treatment of the element; 2 = complete treatment of the element. This coding scheme is based on that created by Barnes and Baron-Cohen (2012) with minor changes made to better suit the present study's video stimuli. For *setting*, differentiation was made between physical and key settings because the clips used in the present study had multiple settings whereas those in Barnes and Baron-Cohen (2012) each took place in a single location (e.g., a hospital, an office building). *Character* was updated to focus on the main story character, as more than two characters appeared in each video in the present study compared to the original study where clips always contained two characters. The criteria for obtaining a score of 1 in *conflict* was slightly adapted to include mention of either the goal *or* the obstacle, as the original criteria only required that the "narrative defines a character as wanting something" (Barnes & Baron-Cohen, 2012, p. 1561), which was not always appropriate for the storylines in the clips used here. The criteria for rating for each element are described in detail in Figure 1. Scores were then summed together to yield a total story grammar score with a maximum of 8 points possible.

Table 3

Coding Scheme for Story Grammar Macrostructure Analysis

	Score of 0: No mention of element	Score of 1: Partial treatment of element	Score of 2: Complete treatment of element
Setting	no mention of any settings of story	mentions 1 key setting or mentions 1 or more other physical settings	mentions multiple key setting of the story
Character	no mention of the main character or labeling main character without context	mentions the main character and defines character in relation to other characters OR story line	situates the main character in relation to both other characters and storyline
Conflict	no mention of goal or obstacle	mentions goal or obstacle without integrating it into story	mentions goal or obstacle without integrating it into story
Resolution	does not mention what happens at end of conflict	resolution of more local issue or mentions central resolution of a goal without elaboration	describes a central resolution and ties it back to goal or obstacle, elaboration of impact of resolution

Each utterance of the transcript was read through to identify MST, that is, any vocabulary item that related to the following categories: (1) *perception* (e.g., hear, see, saw); (2) *physiology* (e.g., sick, messed up); (3) *cognition* (e.g., choose, think, forget); (4) *emotion* (e.g., afraid, fun, obsessed); or (5) *desire* (e.g., try, hope, want). These categories were based on those used in Bang et al. (2013). Additionally, MST were categorized based on whether or not they were connected to a story grammar element. MST were summed for each retell to yield a total number of mental state terms. Mental state terms in connection to a story grammar element (SG x MST) were also summed and a proportion was calculated for each retell by dividing the total number of MST by the number of MST used in connection to story grammar elements.

Results

Statistical Analysis

All statistical analyses were carried out using JASP (Version 0.14.1; JASP Team, 2020). Figures were created using R (version 4.0.2; R Core Team, 2020). As mentioned earlier, pilot data that was coded and available for analysis at the time of thesis submission was a sample of six non-autistic and three autistic participants. However, we later obtained data from a full sample of 39 participants (23 non-autistics, 15 autistics) that are being processed. Therefore, to best answer the research predictions, which were based on prior work using group designs, and in light of the upcoming increase in sample size, I examined performance on the experimental task using mixed ANOVAs with data from the pilot sample. Additionally, I carried out this analysis plan on the pilot sample to learn this process as a part of my master's thesis training.

To justify the choice of this analytic plan, in the planned analyses not presented here, the full sample size is predicted to have adequate statistical power based on a prior study that compared narrative macrostructure between autistic and non-autistic participants. Using a similar paradigm, Barnes & Baron-Cohen (2012) found a very large effect size of $d = 1.25$, with more complex story grammar scores in the non-autistic group. A sample size calculation using this prior finding as a benchmark, one-tailed, with an allocation of .65 ($\frac{n\ autistic}{n\ non-autistic}$) indicated that we will have 95% power ($\alpha = .05$) to detect this effect with a sample of 13 autistic participants and 18 non-autistic participants, calculated using G*Power (version 3.1.9.7; Faul et al., 2007).

Returning to the pilot sample of nine participants, the focus of this thesis, full descriptive data are presented in Table 4 and Table 5 and differences between the two conditions are presented in Table 6. From these tables, it can be seen that microstructure scores tended to be higher in the shared condition compared to the private condition for both groups, which is

contrary to my prediction. On macrostructure measures, the non-autisitic group produced slightly more complex narratives in the private condition whereas the autistic group produced somewhat more complex narratives in the shared condition. This suggests a divergent pattern based on group that runs contrary to my prediction that referential shortening would be reflected in macrostructure measures in both groups. Additionally, it can be seen that there was a high degree of variability amongst the three autistic participants.

Table 4

Microstructure and Macrostructure Performance by Individual and Group Averages in the Private Condition

Participant	Diagnostic Group	TNW	MLUw	SG	MST	SG x MST
Participant A	Non-autistic	338.50	15.14	6.00	18.00	0.90
Participant B	Non-autistic	342.50	19.63	6.00	6.50	0.88
Participant C	Non-autistic	356.00	16.46	6.00	13.50	0.88
Participant D	Non-autistic	233.50	20.82	6.00	7.50	0.81
Participant E	Non-autistic	511.50	17.54	7.50	8.00	0.82
Participant F	Non-autistic	526.00	18.52	7.50	11.50	0.97
Participant X	Autistic	164.00	14.97	4.00	5.00	1.00
Participant Y	Autistic	407.00	18.49	6.00	16.50	0.88
Participant Z	Autistic	592.50	19.56	8.00	15.00	0.60
Non-autistic mean (SD)		384.67 (112.82)	18.02 (2.08)	6.50 (0.77)	10.83 (6.25)	0.87 (0.06)
Autistic mean (SD)		387.83 (214.89)	17.67 (2.40)	6.00 (2.00)	12.17 (6.25)	0.83 (0.21)
Overall mean (SD)		385.72 (139.65)	17.90 (2.04)	6.33 (1.20)	11.28 (4.72)	0.86 (0.12)

Table 5

Microstructure and Macrostructure Performance by Individual and Group Averages in the Shared Condition

Participant	Diagnostic Group	TNW	MLUw	SG	MST	SG x MST
Participant A	Non-autistic	444.50	19.57	6.50	9.50	0.66
Participant B	Non-autistic	357.00	16.47	5.50	16.50	0.71
Participant C	Non-autistic	489.00	17.98	5.50	10.50	0.86
Participant D	Non-autistic	307.50	18.12	6.00	5.00	0.50
Participant E	Non-autistic	436.50	15.30	7.00	7.00	0.95
Participant F	Non-autistic	390.00	19.19	7.00	15.00	0.80
Participant X	Autistic	178.00	15.94	5.50	4.50	1.00
Participant Y	Autistic	549.50	18.04	7.00	15.50	0.59
Participant Z	Autistic	515.50	22.23	7.00	22.50	0.85
Non-autistic mean (SD)		404.08 (65.79)	17.77 (1.62)	6.25 (0.69)	10.58 (4.47)	0.74 (0.16)
Autistic mean (SD)		414.33 (205.38)	18.73 (3.20)	6.50 (0.87)	14.17 (9.07)	0.81 (0.21)
Overall mean (SD)		407.50 (115.22)	18.09 (2.11)	6.33 (0.71)	11.78 (6.02)	0.77 (0.17)

Table 6

Difference in Averages Between Condition (Private - Shared) on Microstructure and Macrostructure Performance by Individual and Group

Participant	Diagnostic Group	TNW	MLUw	SG	MST	SG x MST
Participant A	Non-autistic	-106	-4.43	-0.5	8.5	0.24
Participant B	Non-autistic	-14.5	3.16	0.5	-10	0.17
Participant C	Non-autistic	-133	-1.52	0.5	3	0.02
Participant D	Non-autistic	-74	2.7	0	2.5	0.31
Participant E	Non-autistic	75	2.24	0.5	1	-0.13
Participant F	Non-autistic	136	-0.67	0.5	-3.5	0.17
Participant X	Autistic	-14	-0.97	-1.5	0.5	0
Participant Y	Autistic	-142.5	0.45	-1	1	0.29
Participant Z	Autistic	77	1.52	1	-0.5	0.01
Non-autistic mean		-19.41	-2.22	0.25	0.25	0.13
Autistic mean		-26.5	-1.06	-0.5	-2	0.02
Overall mean		-21.78	-1.83	0	-0.5	0.09

Mixed ANOVAs were conducted on the pilot sample with the between-subjects factor of diagnosis (autistic, non-autistic) and the repeated factor of perspective (shared, private) in the partner adaptation task with a common ground manipulation. Results are reported as significant at $p < .05$ and effect sizes are presented as either Cohen's *d* or partial eta-squared where tests meet assumptions of normality. Non-parametric tests are used and reported in cases where data does not meet assumptions of normality. Interpretation of results for the sample presented here weigh heavily on measures of effect size (Sullivan & Feinn, 2012), given the very small sample size and low statistical power. For Cohen's *d,* effect size benchmarks are as follows: $d = 0.2$ is a small effect, $d = 0.5$ is a medium effect, and $d = 0.8$ is a large effect. For partial eta-squared (η^2), effect size benchmarks are: $\eta^2 = .01$ is a small effect, $\eta^2 = .06$ is a medium effect, and $\eta^2 = 0.14$ is a large effect.

Session Quality and Familiarity with Stimuli

Information was collected on the audio and video quality of the SRT and the retell task, shown in Table 7, given that participants and experimenters did not complete testing on the same equipment given that they used their own personal computer equipment and internet for testing.

Table 7

Participant and Experimenter Rating of Audio and Video Quality of Stimuli by Diagnostic Group

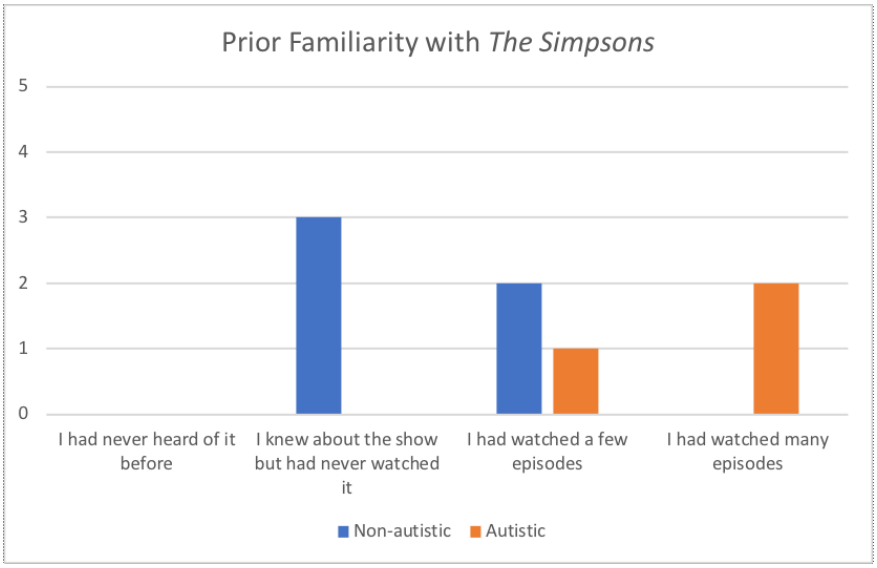
	Non-autistic (n = 6)	Autistic (n = 3)
Variable	Mean (SD)	Mean (SD)
Audio & video quality rating of narrative task by participant	3.60 (0.548)	4.00 (0.00)
Audio quality rating of SRT task by participant	3.40 (0.894)	4.00 (0.00)
Overall video and audio quality rating of session by experimenter	3.40 (0.894)	4.00 (0.00)

Note. Rated on a Likert scale of 1-4 where: 1 = *poor*; 2 = *fair*; 3 = *good*; 4 = *excellent*. *Ratings here are shown for n = 5 for the non-autistic group as this survey was added after one non-autistic participant had completed testing.

Additionally, information was collected at the end of the narrative task on the participants' familiarity of *The Simpsons* prior to the testing session. Responses are shown in Figure 2 below. In the same survey, participants indicated whether they had previously seen the episodes the clips in the retell task originally came from. Importantly, none of the participants reported seeing the episodes the clips came from prior to the task. This survey appears in Appendix B.

Figure 2

Participants' Prior Familiarity with The Simpsons Television Show by Diagnostic Group



Note. Participant responses by diagnostic group in response to survey question: "Before watching the clips in the study today, how familiar were you with *The Simpsons?*". For non-autistic participants, n = 5 as survey was added after one participant had completed testing. For autistic participants, n = 3.

Narrative Measures

The results presented in this section focus on trends that emerge at the group level. Information on performance at the individual level is presented in Tables 4-6.

Microstructure

It was predicted that the autistic and non-autistic participants would perform similarly on microstructure measures. Microstructure analyses provide an additional baseline characterization of the language abilities of the present sample (Nippold et al., 2017). Language measures included: (1) *quantity*, measured by total number of words and total number of utterances; (2)

semantic diversity, measured by total number of different words; and (3) *morphosyntax*, measured by mean length of utterance in words; and (4) *efficiency*, measured by total number of words over total story grammar scores out of a maximum of 8. With the current pilot sample, no significant differences were found between the two groups, as shown in Table 8, supporting my prediction on microstructure. Additionally, these results suggest that any differences found between diagnostic groups in results on macrostructure or partner adaptation measures cannot likely be attributed to a difference in baseline language ability.

Macrostructure

Two predictions were made regarding group differences at the level of macrostructure collapsed across conditions. First, the autistic group was predicted to use fewer story grammar elements relative to the non-autistic comparison group. Second, the autistic group was predicted to use MST in connection to story grammar elements less frequently than the non-autistic individuals. In the pilot sample, no significant statistical differences were found between groups on either measure, shown in Table 8. These findings suggest that the narrative retells told by autistic and non-autistic groups did not differ overall in story grammar complexity.

Table 8

Expressive Language Measures by Diagnostic Group

	Non-autistic (n = 6)	Autistic (n = 3)			
Variable	Mean (SD)	Mean (SD)	df	*p* value	Effect size
TNW	394.38 (103.84)	401.08 (193.27)	7	0.387	0.058
TNW_Diff	132.42 (24.82)	143.75 (53.32)	7	0.387	-0.454
TNUtt	21.38 (6.08)	20.42 (8.34)	7	0.697	-0.139
MLUw	17.90 (2.11)	18.203 (2.607)	7	0.704	0.135
SG*	6.13 (0.59)	6.25 (1.40)	7	0.697	0.222
MST	10.71 (3.10)	13.17 (7.42)	7	0.488	0.517
SG x MST	0.81 (0.09)	0.82 (0.16)	7	0.905	-0.111
Efficiency	61.74 (16.28)	61.25 (21.18)	7	0.939	-0.027

Note. TNW = total number of words; TNW_Diff = total number of different words; TNUtt = total number of utterances; MLUw = mean length of utterance in words; SG = total story grammar score; MST = total number of mental state terms; SG x MST = proportion of mental state terms used in connection to story grammar elements; Efficiency = total number of words over total story grammar score. Student t-tests were conducted to compare measures across groups. *For SG, a Mann-Whitney U test was conducted as data did not meet the assumption checks and thus effect size is given by the rank biserial correlation. All other effect sizes are given by Cohen's *d.*

Partner Adaptation in Social Interaction

This section reports results related to partner adaptation in social interaction and encompasses both microstructure language measures (i.e., volubility and morphosyntax) and macrostructure narrative measures (i.e., story grammar, mental state terms).

Microstructure

One of the main predictions in this study concerns referential shortening effects on microstructure measures as a result of common ground manipulation in the shared and private conditions. I predicted that both groups would show less volubility in the shared condition relative to the private condition. To investigate this, Pearson's correlations were first run on the measures of volubility extracted from the narrative retells to determine the measure of volubility to be used in the ANOVA analysis. The following measures were compared: (1) total number of words, (TNW); (2) total number of different words (TNW_Diff); and (3) total number of utterances (TNUtt). TNW was found to be highly correlated with both TNW_Diff (r = .960) and TNUtt (r = .946). Given that volubility measures were highly correlated, TNW was selected for analysis as this same measure used in de Marchena and Eigsti (2016), allowing for a more direct comparison of findings.

For TNW, there was no significant main effect of condition $F(1,7) = 0.365$, $p = 0.565$, partial $\eta^2 = 0.050$, or of diagnostic group, $F(1, 7) = 0.006$, $p = 0.942$, partial $\eta^2 = 0.001$. However, there was a small-to-medium effect size of condition, suggesting that both groups tended to produce more words in the shared condition relative to the private condition. Additionally, there was no significant interaction of condition and group, $F(1, 7) = 0.009$, $p = 0.928$, partial $\eta^2 = 0.0008$). However, as shown in Figure 3, a trend to produce slightly more words in the shared condition relative to the private condition appears in both groups, suggesting a difference in performance contingent on the condition.

Regarding morphosyntax, no significant main effect of condition for MLUw, $F(1, 7) = 0.949$, ($p = 0.362$, partial $\eta^2 = 0.119$, or of diagnostic group were found, $F(1, 7) = 0.766$,($p = 0.410$, partial $\eta^2 = 0.099$. Additionally, there was no significant interaction of condition and

group, $F(1, 7) = 0.119$, $p = 0.74$, partial $\eta^2 = 0.017$. As with the volubility measure above, Figure 3 depicts a trend of medium-to-large effect size that runs counter to the prediction of a referential shortening effect due to common ground, as MLUw in both groups was seen to increase slightly in the shared condition relative to the private condition. The autistic group appears to have produced slightly longer utterances overall relative to the non-autistic group, with a medium effect size.

Taken together, these trends run counter to the prediction that referential shortening effects would be reflected in microstructure measures in the shared condition for both groups given similar language skills, as has been previously typically reported in the literature.

Macrostructure

The second prediction regarding partner adaptation was that both groups would additionally show referential shortening effects, or decreased story complexity, in the shared relative to the private condition. This was investigated by examining total story grammar scores and total number of MST used. For total story grammar, scores were averaged across the two trials in each condition, out of a maximum score of 8. There was no significant main effect of condition $F(1, 7) = 0.063$, $p = 0.668$, partial $\eta^2 = 0.028$, or of group, $F(1, 7) = 0.062$, $p = 0.858$, partial $\eta^2 = 0.005$). Additionally, no significant interaction of condition and group was found, $F(1, 7) = 1.800$, $p = 0.563$, but there was a trend with a large effect size, partial $\eta^2 = 0.205$, whereby the autistic group tended to provide more complex stories and the non-autistic group tended to provide less complex stories in the shared condition compared to the private condition.

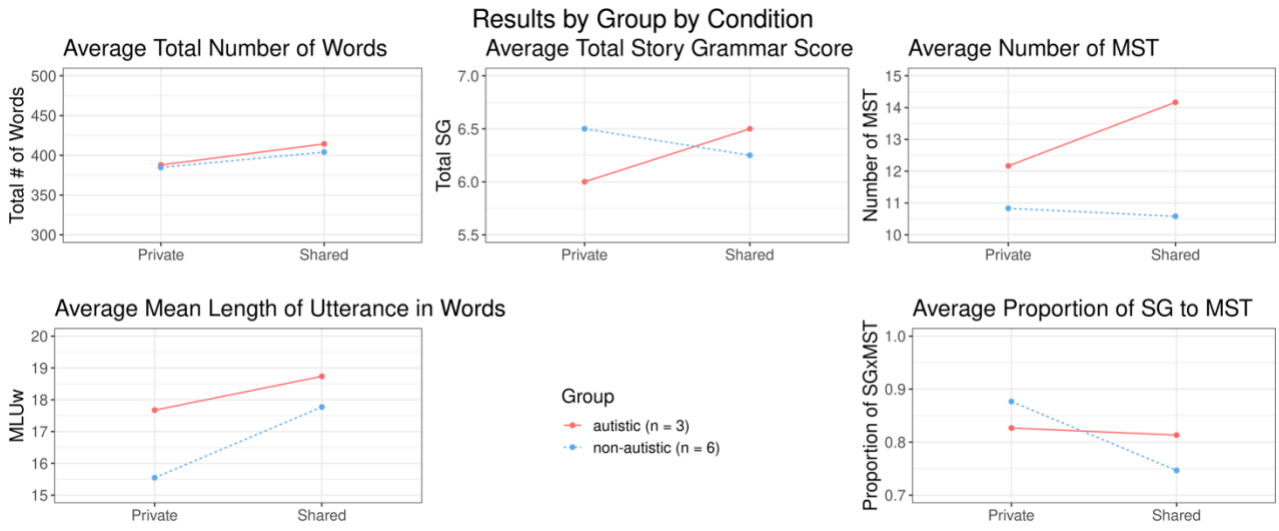
For the mental state terms, the total number of terms used was summed and averaged across the two trials in each condition. There was no significant main effect of condition $F(1, 7) = 0.174$, $p = 0.689$, partial $\eta^2 = 0.006$) or of group, $F(1, 7) = 0.535$, $p = 0.488$, partial $\eta^2 =$

0.051). Additionally, no significant interaction of condition and group was found, $F(1, 7) = 0.288$, $p = .608$, partial $\eta^2 = 0.011$).

Taken together, these trends run counter to my prediction of partner adaptation, or decreased story complexity, in the shared versus private condition. Instead, the preliminary data reported here are suggestive of an impact of partner adaptation on narrative retells in the non-autistic group, as evidenced by trends of decreased macrostructure complexity, specifically in total story grammar score. The data from the autistic group is difficult to interpret at this point, given the limitations of the sample size and the high degree of variability. Interestingly, initial trends appear to indicate a possible interaction of group and condition for story grammar scores, which would follow prior work showing a difference in how effects of common ground manifest between these two populations, as in Nadig et al., (2015). However, more data points are necessary to confirm these trends. Results from this study are discussed in context of prior works on this topic in the next section, including study limitations and suggestions for future research.

Figure 3

Descriptive Plots of Results by Group by Condition



Discussion

This study was designed to investigate the differences between autistic and non-autistic young adults in narrative and partner-adaptation skills, that is, how they adapt their speech to their conversation partner in a social interaction. Data processing and analysis on the full sample is still underway and in this thesis I presented results from a pilot sample consisting of six non-autistic participants and three autistic participants who are similar in age, gender, years of education, NVIQ, and structural language skills. The homogeneity in the background characteristics of the pilot sample indicates that differences that emerge between the groups can likely be attributed to diagnosis. Thorough documentation of individual participant responses to the task are provided in Tables 4-6 in the *Results* section, demonstrating very different individual responses within each group in this pilot sample. Given the low statistical power and uneven groups, it is not surprising that no statistically significant difference emerged. In discussing the current findings, I will focus on trends in the data supported by medium or large effect sizes which may reach significance if this pattern continues to be evidenced in the full sample analysis.

Microstructure Between Groups

The autistic and non-autistic groups were not found to differ on total number of words, total number of different words, total number of utterances, or mean length of utterance in words. Additionally, no differences were found on efficiency, which investigated the proportion of total number of words over total number of story grammar elements per condition. This is in line with prior studies that have reported that autistic adults without language impairment show similar performance on structural language measures in comparison to non-autistic peers (Colle et al., 2008; McCabe et al., 2013). These data also confirm that language profiles between the two groups in this pilot sample are similar, which allows for comparison between groups by

condition on the study measures. It is important to note that highly verbal autistic individuals were purposefully recruited for this study. This should be considered when comparing findings presented here with other works.

Macrostructure Between Groups

Predictions about decreased complexity in story grammar and MST tied to story grammar elements in the autistic group relative to the non-autistic group were not supported by results from the pilot sample. The trends instead suggest that macrostructure skills are similar in autistic and non-autistic individuals when well-matched for structural language skills and not just language content. These findings contradict prior work, which has generally indicated decreased complexity in macrostructure in autistic individuals relative to non-autistic individuals (Barnes & Baron-Cohen, 2012; Colle, et al., 2008; Geelhand et al., 2020; McCabe et al., 2013). However, this general trend of decreased complexity in prior studies could be due to a number of methodological limitations, including: (1) underlying differences in structural language abilities between the diagnostic groups; (2) differences in elicitation or transcription methods; or (3) individual variability within the diagnostic groups.

Regarding the first point, these studies used verbal IQ measures to characterize language ability in their samples and reported similar language levels according to these measures. Ribeiro de Oliveria et al. (2020) reported that, in a sample of autistic and non-autistic children and adults, verbal IQ predicted language content in autistic and non-autistic children and adults but did not capture structural language ability. Therefore, it is possible then that differences in microstructure between groups in these studies could be due to underlying structural language differences between the autistic and non-autistic groups. Second, these studies all used different methodologies to elicit and transcribe the narratives. Differences in elicitation methodologies

could result in more or less rich narrative samples and differences in transcription methods could yield variability in utterance segmentation, impacting the language measures extracted from the narrative samples. Last, these studies did not report individual variability on study measures. As was discussed in Nadig et al. (2015), there are often important differences that occur at the individual level that should be taken into consideration in data interpretation.

It is difficult to interpret the findings from this study in context, given the limitations of prior work discussed earlier. However, the pilot sample presented here, while small, had a high degree of heterogeneity on measures of volubility, morphosyntax, and sentence repetition scores. These findings suggest that autistic and non-autistic adults with similarly high ability on structural language skills will perform similarly on narrative microstructure and macrostructure measures. These results will be investigated further given ongoing data coding and analysis of the full sample.

Partner Adaptation over Videoconference

Previous studies have reported a referential shortening effect associated with common ground whereby speakers produce less language when they share knowledge about the topic of the interaction with their communication partner (Holler & Wilkin, 2009; Horton & Gerrig, 2002; Isaacs & Clark, 1987; Krauss & Weinheimer, 1966; Nadig et al., 2015). The design of this experiment was based on de Marchena and Eigsti (2016), however a number of key differences were introduced: remote delivery using videoconferencing, different video stimuli, and a different package of measures to investigate partner adaptation. Therefore, I concentrate on trends in the non-autistic group to evaluate whether the common ground manipulation in this paradigm worked as intended, for the purposes of task validation.

In this study, referential shortening effects were not consistent across the study measures. On microstructure measures, both autistic and non-autistic participants did not show referential shortening effects and instead were more voluble in the shared compared to the private condition. Regarding microstructure, the non-autistic group showed referential shortening effects across measures in the shared versus the private condition. The autistic participants showed decreased story complexity as indicated by lower story grammar scores and less frequent usage of MST tied to story grammar elements in the shared versus private condition. The total number of MST used by non-autistic participants stayed relatively stable across conditions. I believe that the decreased complexity seen in the non-autistic participants on macrostructure measures suggests that the common ground manipulation was successful. I return to the differences in the autistic group on macrostructure measures below. Furthermore, I believe that the opposite trend across both groups on the microstructure measures can be explained by the online delivery of this study.

To my knowledge, no previous work has examined partner adaptation in autistic and non-autistic adults on tasks carried out over videoconference. Given participants were not in the same physical space and could not witness the research confederate experiencing the previews in the same way as in person, it is likely that participants felt the need to confirm that they had shared an experience by referring to it explicitly. This would lead to the increase in talk in the shared condition. de Marchena and Eigsti (2016) included analysis of explicit reference to common ground in their study, but this variable was not found to be meaningful and therefore this measure was not included in the present study. However, re-examining narratives for explicit reference would shed light on this phenomenon and will therefore be added to data analysis

procedures for the full study sample. The pilot sample presented here will be re-analyzed on this measure, as well.

Additionally, there are a number of factors that may have impacted the effectiveness of the common ground manipulation based on shared experience in this paradigm: (1) preview clips not functioning to create a shared experience; (2) reduced believability and effectiveness of the shared versus private manipulation in videoconferencing; and (3) social isolation effects during the COVID-19 pandemic.

First, it is possible that the previews shown in the experimental task were not informative enough to elicit a referential shortening effect in the expected way. The previews in this study were 20-seconds long and contained two scenes from the full clip, with scenes presented in the opposite order than they appeared in the full clips. Previews imitated those used in de Marchena and Eigsti (2016) as closely as possible but were reduced from 30-second to 20-second clips due to time constraints of the larger study protocol, perhaps reducing the effectiveness of these stimuli to bring about referential shortening effects by themselves. Instead, common ground effects may be attributable in part to the mechanics of the task, as the participant and the research confederate's videos were visible on the Webex screen when watching the previews in the shared condition. Moreover, the participant was told in each trial when the research confederate was being moved in and out of the breakout room to join the testing session. Perhaps these experiences produced an awareness that the conditions were supposed to be different instead of arising directly from the shared experience itself, resulting in a pattern of common ground effect that was different than anticipated.

The way in which the study was delivered may have impacted the believability of the task, resulting in reduced effectiveness. Here, the research confederate was sent to a breakout

room on Webex to evoke the sense of leaving the room, as was done in de Marchena and Eigsti (2016). The research confederate's video and name were no longer visible to the participant when they were in the breakout room. When showing the videos, the experimenter turned off their video and microphone to give the sense that the participant was watching clips entirely alone. However, the experimenter's name was still visible to the participant and one participant even asked the experimenter if she was watching the video clips with her because of this. Therefore, it is possible that the awareness of the experimenter due to the limitations of conducting this study over videoconference may have impacted common ground effects.

Another factor to consider in interpreting these preliminary results is the likely increase in social isolation due to health measures put in place during the ongoing COVID-19 pandemic. Perhaps participants were inclined to speak more when they shared knowledge with the research confederate, as sharing experiences with new people during the pandemic has likely been less frequent and is therefore more novel. Additionally, conducting the study over videoconference introduces a new factor to consider, as some studies have found that using video to connect remotely has been shown to decrease conversational coordination, which could lead to a decrease in efficiency in collaborative social interactions (Tomprou et al., 2021). At the same time, videoconference has allowed individuals to stay connected across distance and a recent study reported that people actually socialized more and not less during the pandemic (Hacker et al., 2020). However, little is known to date about the effects of the pandemic on social communication skills in adults. Additionally, no data was collected on this topic in the present study due to oversight - the primary focus during development of study methodologies centered around adapting in-person study procedures to an online format to ensure data collection was

possible. Therefore, it is difficult to interpret the role that the ongoing COVID-19 pandemic has played in the findings of this study.

Partner Adaptation Differences Between Diagnostic Groups

Beyond task validation, there was a trend of interaction in the pilot sample between group and condition, where non-autistic participants showed referential shortening, or decreased story complexity, in the shared condition and autistic participants showed increased story complexity in the shared condition. This trend suggests a difference in how autistic and non-autistic individuals show sensitivity to common ground, especially in mixed neurotype designs (i.e., autistic & non-autistic pairs) as was the case in this present study. As discussed earlier, Nadig et al. (2015) reported that autistic individuals were sensitive to partner perspective when interacting with a non-autistic research confederate, but that this manifested in ways that differed relative to the non-autistic comparison group. Crompton et al. (2020a) investigated information transfer in same neurotype groups (e.g., autistic & autistic; non-autistic & non-autistic) and mixed neurotype groups (e.g., autistic & non-autistic) and found that story detail decreased significantly in a telephone game context, known as a *diffusion chain*, in the mixed groups in comparison to the same neurotype groups. Again, the data in the present study is too preliminary to draw firm conclusions, but the trends lend support to the idea of neurotype-specific profiles of social communication skills.

However, the interpretation of these findings is limited by two factors not taken into account in the autistic group: (1) prior speech-language therapy experience and (2) masking or camouflaging of autistic traits during the interaction. First, information was not collected from autistic participants on any prior history of speech-language therapy. If autistic participants had received speech therapy to target social communication skills or narrative discourse, it is possible

that they provided more story complexity in the shared condition given prior treatment experience and/or their increased awareness of potential difficulties with these skills. However, it is somewhat unlikely that autistic participants in this sample would have received extensive speech-language therapy services as the two participants with formal diagnoses received them within the past 1-2 years and availability and/or access to services tend to drop off once in the early adult years (Gotham et al., 2015). However, it is still an important potential confound that merits consideration.

The other point to consider is that of *masking*, also referred to as *camouflaging*, which is the process of hiding or suppressing autistic characteristics to appear more neurotypical (Corbett et al., 2021; Pearson & Rose; 2021). This behavior has been reported to be more prevalent among autistic females relative to males (Lai et al., 2017). This higher prevalence in females has been suggested to be due to greater societal pressure and messaging to "fit in" or by being more socially motivated and thus wanting to appear "less autistic" in order to be accepted by neurotypical peers (for further discussion on masking, see Hull et al., 2017; Hull et al., 2020; Lai et al., 2017 b; Pearson & Rose, 2020). Considering that all three autistic participants in this study identified as female, perhaps participants masked aspects of their autism when interacting with the research confederates, which resulted in overcompensation in story grammar complexity in the shared condition. Masking could also potentially explain the increase in microstructure measures.

Study Limitations

While some limitations have been mentioned in the context of alternative explanations above, this section will discuss limitations that may have impacted study results overall, such as

(1) small sample size; (2) technical issues related to remote study delivery; and (3) additional considerations regarding COVID-19.

The biggest limitation is the small sample size of the study. In pilot studies such as this one, 12 participants per group have been recommended to achieve adequate statistical power (Julious, 2005). A larger sample size would help to provide more certainty and insight into the findings reported here. However, a strength of this preliminary study is that the sample has a high degree of homogeneity in structural language ability and demographic characteristics such as gender, age, education, and NVIQ. This allows for easier interpretation, as findings are therefore likely to be due to diagnosis and not to other demographic factors. Further, the analysis of the full sample with adequate statistical power, as described in the *Results* section, is underway and will provide more insight into the trends noted in this thesis.

Second, this study occurred entirely over videoconference and it is difficult to determine just how different the experiences of the stimuli were across participants. Ratings were collected about the audio and video quality from the participant and the experimenter and a standardized script was used across all sessions, but it is likely the audio and video quality varied to a certain degree across participants. It is also not possible to determine at this point the ways in which the remote delivery of this study impacted findings, as no other studies using a paradigm such as the one used here or investigating perspective-taking skills in narratives have been conducted previously to my knowledge.

Last, the COVID-19 pandemic may have also impacted the findings in this study beyond changes in socialization that were discussed previously. Recent studies have reported an increase in stress and anxiety and other mental health conditions in young adults due to the pandemic (Panchal et al., 2021; Son et al., 2020). Additionally, contracting COVID-19 has been reported to

adversely affect cognitive functioning with individuals experiencing chronic fatigue, difficulty with attention, short-term memory, and written language at a 6-month follow-up (Salamanna et al., 2021). As no information was collected about any of these aspects related to the COVID-19 pandemic in this study, it is not possible to know what effect this event had on the data presented here.

Future Directions

As the most robust finding from the limited pilot data presented here has to do with potential differences in the manifestation of partner adaptation over videoconference versus in person, future studies might directly compare partner adaptation in these two study delivery methods. This could be an interesting and fruitful avenue for future research, as more and more interactions occur over online platforms, given the increase in globalization and the shift to remote-working environments ushered in as a part of adjustments made during the COVID-19 pandemic that are likely to continue beyond the pandemic.

Additionally, research in social communication in autism is moving toward a paradigm that looks at social interaction between dyads of the same and mixed neurotypes. These studies are indicative of the research increasingly reflecting the lived experiences and desires of self-advocates from the autistic community, who have been arguing that social communication is not a deficit in autism but rather that autistic styles of communication are unique and different relative to neurotypical styles of communication (Williams et al., 2021; Heasman & Gillespie, 2019; Crompton et al., 2020a, b, c). Therefore, expanding this study to include autistic dyads and autistic and non-autistic dyads in the experimenter and participant roles would provide important insight into how common ground impacts partner adaptation across neurotypes.

Last, the narratives collected as a part of this study offer a wealth of information to analyze that could not be included in this study due to a lack of time. For example, explicit reference to common ground and disfluencies including filler words, reformulations, and restarts were coded as a part of the transcription process, following procedures from de Marchena and Eigsti (2016), but were not extracted from the transcripts. As noted earlier, explicit reference to common ground did not produce meaningful results in the de Marchena and Eigsti (2016) sample. However, examining this behavior in the present sample would provide additional insight into differences in partner adaptation over videoconference. Additionally, de Marchena and Eigsti (2016) found that autistic participants produced fewer disfluencies in the shared condition while non-autistic participants produced marginally more disfluencies in the shared condition. Analyzing this measure could provide additional insight into the differences in how both populations adapt to common ground in a slightly older age group.

Last, regarding methodology for future studies, I recommend drawing upon elicitation and transcription methods used in prior work with similar samples in order to standardize procedures across studies. This will allow for better comparison of results and, hopefully, a clearer understanding of language skills in highly verbal autistic adults. Similarly, I recommend the addition of expressive language measures that tap into structural language skills to provide a more well-rounded profile of language skills in future studies with similar participants.

Summary

This study set out to build on previous research by examining partner adaptation in autistic and non-autistic young adults in a narrative retell task with a common ground manipulation using a remote online study delivery method. Referential shortening effects, or decreased complexity due to the influence of common ground, in narrative microstructure and

macrostructure measures were predicted for both groups. In microstructure measures, referential shortening effects did not appear - instead an increase in volubility was seen in the shared condition relative to the private condition for both groups. For macrostructure measures, results from the non-autistic group showed referential shortening effects on both macrostructure measures and the autistic group showed increased story grammar complexity in the shared condition. The results from the non-autistic group suggest that it is possible to elicit common ground effects in remote online delivery format. Additionally, the increase in microstructure measures suggests that participants increase volubility in the presence of common ground when interacting over videoconference. Last, the possible interaction between group and condition supports evidence for neurotype-specific social communication skills.

Conclusion

Results from this thesis indicate that narrative macrostructure, in addition to microstructure measures, are sensitive to common ground established by shared prior experience in adults. This thesis additionally demonstrates that common ground effects can be elicited over videoconference, with preliminary pilot data suggesting that both autistic and non-autistic adults produce more language under conditions of common ground compared to no common ground over videoconference, likely as a way to confirm the presence of common ground with their communication partner. This finding would be interesting to expand on by comparing common ground effects in the same paradigm delivered in person. Last, these preliminary pilot results suggest divergent styles of partner adaptation in non-autistic and autistic individuals. These results contribute to the conversation about neurodiversity and autism that is currently taking place. My hope is that by tying the preliminary findings from this study into this movement, my

thesis will contribute to an increase in understanding and awareness of autistic ways of being and a reduction in stigma and bias often faced by autistic individuals.

References

Abbot-Smith, K., Williams, D., & Matthews, D. (2020). 'What's new for you?': Interlocutor-specific perspective-taking and language interpretation in autistic and neuro-typical children. *Research in Autism Spectrum Disorders, 70*.

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders (5th ed.)*. Doi: 10.1176/appi.books.9780890425596

Anderson, J. A. E., Mak, L., Keyvani Chahi, A., & Bialystok, E. (2018). The language and social background questionnaire: Assessing degree of bilingualism in a diverse population. *Behav Res, 50*, 250-263. Doi: 10.3758/s13428-017-0867-9

Argan, M., Hughes, C., Thoma, C. A., & LaRon, A. S. (2016). Employment social skills: What skills are really valued? *Career Development and Transition for Exceptional Individuals, 39*(2), 111-120. Doi: 10.1177/2165143414546741

Bal, V. H., Katz, T., Bishop, S. L., & Krasileva, K. (2016). Understanding definitions of minimally verbal across instruments: Evidence for subgroups within minimally verbal children and adolescents with autism spectrum disorder. *Journal of Child Psychology and Psychiatry*, *57*(12), 1424-1433.

Ballou, E. P. (2018, February 6). What the neurodiversity movement does – and doesn't – offer [blog post]. Retrieved from: http://www.thinkingautismguide.com/2018/02/what-neurodiversity-movement-doesand.html

Bang, J., Burns, J., & Nadig, A. (2013). Brief report: Conveying subjective experience in conversation: Production of mental state terms and personal narratives in individuals with high functioning autism. *Journal of Autism and Developmental Disorders*, 43 *(7),* 1732-1740. Doi: 10.1007/s10803-012-1716-4

Barnes, J. L., & Baron-Cohen, S. (2012). The big picture: Storytelling ability in adults with autism spectrum conditions. *J Autism Dev Disord, 42*, 1557-1565. Doi: 10.1007/s10803-011-1388-5

Baron-Cohen, S., Wheelwright, S., Skinner, R., Martina, J., & Clubley, E. (2001). The Autism-Spectrum Quotient (AQ): Evidence from Asperger's Syndrome/High-Functioning Autism, males & females, scientists and mathematicians. *Journal of Autism and Developmental Disorders, 31*, 5-17. Doi: 10.1023/a:100563411471

Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the autistic child have a "theory of mind?". *Cognition, 21*, 37-46. Doi: 10.1016/0010-0277(85)90022-8

Baixauli, I., Colomer, C., Rosello, B., & Miranda, A. (2016). Narratives of children with high-functioning autism spectrum disorder: A meta-analysis. *Research in Developmental Disabilities, 59*, 234-254. Doi: 10.1016/j.ridd.2016.09.007

Beales, A., Whitworth, A., Cartwright, J., Panegyres, P. K., & Kane, R. T. (2018). Determining stability in connected speech in primary progressive aphasia and Alzheimer's disease. *International Journal of Speech-Language Pathology, 20*(3), 361-370. Doi: 10.1080/17549507.2018.1442498

Botha, M., Hanlon, J., & Williams, G. L. (2021). Does language matter? Identity-first versus person-first language use in autism research: A response to Vivanti. *Journal of Autism and Developmental Disorders*. Doi: 10.1007/s10803-020-04858-w

Bottema-Beutel, K., Kapp, S. K., Lester, J. N., Sasson, N. J., & Hand, B. N. (2021). Avoiding ableist language: Suggests for autism researchers. *Autism in Adulthood, 3*(1), 18-29. Doi: 10.1089/aut.2020.0014

Brennan, S. E., & Hanna, J. E. (2009). Partner-specific adaptation in dialog. *Topics in Cognitive Science, 1,* 274-291. Doi: 10.1111/j/1756-8765.2009.01019.x

Brennan, S. E., & Clark, H. H. (1996). Conceptual pacts and lexical choice in conversation. *J. Exp Psychol Learn. Mem. Cogn. 22,* 1482-1493. Doi: 10.1037//0278-7393.22.6.1482

Brignell, A., Morgan, A. T., Woolfenden, S., Klopper, F., May, T., Sarkozy, V., & Williams, K. (2018). A systematic review and meta-analysis of the prognosis of language outcomes for individuals with autism spectrum disorder. *Autism & Developmental Language Impairments, 3*, 1-19. Doi: 10.1177/2396941518767610

Brown, L. X. Z. (2011, August 4). The significance of semantics: First-person language: Why it matters [blog post]. Retrieved from: https://www.autistichoya.com/2011/08/significance-of-semantics-person-first.html

Brown-Schmidt, S., & Heller, D. (2018). Perspective-taking during conversation. In: Rueschemeyer S-A. & Gareth Gaskell M. (Eds). *The Oxford Handbook of Psycholinguistics, 2nd Edition*. Oxford University Press, England.

Bury, S. M., Jellett, R., Spoor, J. R., & Hedley, D. (2020). "It defines who I am" or "it's something I have": What language do [autistic] australian adults [on the autism spectrum] prefer? *Journal of Autism and Developmental Disorders.* Doi: 10.1007/s10803-020-04425-3

Cage, E., Di Monaco, J., & Newell, V. (2018). Experiences of autism acceptance and mental health in autistic adults. *J Autism Dev Disord, 48*, 473-484. Doi: 10.1007/s10803-017-3342-7

Capps, L., Losh, M., & Thurber, C. (2000). 'The frog ate the bug and made his mouth sad': Narrative competence in children with autism. *Journal of Abnormal Child Psychology, 28*(2), 193-204. Doi: 10.1023/A:1005126915631

Chiang, H-M., & Wineman, I. (2014). Factors associated with quality of life in individuals with autism spectrum disorders: A review of literature. *Research in Autism Spectrum Disorders, 8*, 974-986. Doi: 10.1016/j.rasd.2014.05.003

Cisco. (2021). *Cisco Webex Meetings* (Version 41.5.7.11) [Computer software]. https://www.Webex.com/fr/index.html

Colle, L., Baron-Cohen, S., Wheelwright, S., & van der Lely, H. K. J. (2008). Narrative discourse in adults with high-functioning autism or Asperger syndrome. *Journal of Autism and Developmental Disorders, 38*(1), 28-40. Doi: 10.1007/s10803-007-0357-5.

Constantino, J., & Gruber, C. (2005). *The Social Responsiveness Scale*. Los Angeles: Western Psychological Services.

Corbett, B. A., Schwartzman, J. M., Libsck, E. J., Muscatello, R. A., Lerner, M. D., Simmons, G. L., & White, S. W. (2021). Camouflaging in autism: Examining sex-based and compensatory models in socail cognition and communication. *Autism Research, 14*, 127-142. Doi: 10.1002/aur.2440

Crompton, C. J., Ropar, D., Evans-Williams, C. V. M., Flynn, E. G., & Fletcher-Watson, S. (2020a). Autistic peer-to-peer information transfer is highly effective. *Autism, 24*(7), 1704-1712. Doi: 10.1177/1362361320919286

Crompton, C. J., Sharp, M., Axbey, H., Fletcher-Watson, S., Flynn, E. G., & Ropar, D. (2020b). Neurotype-matching, but not being autistic, influences self and observer ratings of interpersonal rapport. *Frontiers in Psychology, 11*: 586171. Doi: 10.3389/fpsyg.2020.586171

Crompton, C. J., Hallet, S., Ropar, D., Flynn, E., & Fletcher-Watson, S. (2020c). 'I never realised everybody felt as happy as I do when I am around autistic people': A thematic analysis of autistc adults' relationships with autistic and neurotypical friends and family. *Autism, 24*(6), 1438-1448. Doi: 10.1177/1362361320908976

Crompton, C., Debrabander, K., Heasman, B., Milton, D., & Sasson, N. (2021). Double empathy: Why autistic people are often misunderstood. *Front. You Minds,* 9:554875. Doi: 10.3389/frym.2021.554875

Davis, R., & Crompton, C. J. (2021). What do new findings about social interaction in autistic adults mean for neurodevelopmental research? *Perspectives on Psychological Science*, 1-5. Doi: 10.1177/1745691620958010

de Marchena, A., & Eigsti, I-M. (2016). The art of common ground: Emergence of a complex pragmatic language skill in adolescents with autism. *J Child Lang*, *43*, 43-80. Doi: 10.1017/S0305000915000070

Dickter, C. L., Burk, J. A., Zeman, J. L., & Taylor, S. C. (2020). Implicit and explicit attitudes toward autistic adults. *Autism in Adulthood, 2*(2), 144-151. Doi: 10.1089/aut.2019.0023

Diehl, J. J., Bennetto, L., & Carter Young, E. (2006). Story recall and narrative coherence of high-functioning children with autism spectrum disorders. *Journal of Abnormal Child Psychology, 34*(1), 87-102. Doi: 10.1007/s10802-005-9003-x

Fukumura, K. (2016). Development of audience design in children with and without ASD. *Developmental Psychology, 52* (1), 71-87. Doi: 10.1037/dev0000064

Faul, F., Erdfelder, E., Lang, A-G., & Buchner, A. (2007). G*Power: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*, 175-191.

Frith, U. & Happé, F. (1994). Autism: Beyond "theory of mind". *Cognition, 50*, 115-132. Doi: 10.1016/0010-0277(94)90024-8

Garrod, S., & Anderson, A. (1987). Saying what you mean in dialogue: A study in conceptual and semantic co-ordination. *Cognition, 27*, 181-281. Doi: 10.1016/0010-0277(87)-90018-7.

Geelhand, P., Papastamou, F., Deliens, G., & Kissine, M. (2020). Narrative production in autistic adults: A systematic analysis of the microstructure, macrostructure and internal state language. *Journal of Pragmatics, 164*, 57-81. Doi: 10.1016/j.pragma.2020.04.014

Gernsbacher, M. A., & Yergeau, M. (2019). Empirical failures of the claim that autistic people lack a theory of mind. *Archives of Scientific Psychology, 7*(1), 102-118. Doi: 10.1037/arc0000067

Goldman, S. (2008). Brief Report: Narratives of personal events in children with autism and developmental language disorders: Unshared Memories. *J Autism Dev Disord*, 38(10), 1982-1988. Doi: 10.1007/s10803-008-0588-0

Gotham, K., Marvin, A. R., Lounds Taylor, J., Warren, Z., Anderson, C. M., Law, P. A., Law, J. K., & Lipkin, P. H. (2015). Characterizing the daily life, needs, and priorities of adults with autism spectrum disorder from Interactive Autism Network data. *Autism, 19*(7), 794-804. Doi: 10.1177/1362361315583818

Groening, M. (Creator). (1989). *The Simpsons* [Television series]. New York, NY: Fox Broadcasting Company.

Guajardo, N. R., & Watson, A. C. (2002). Narrative discourse and theory of mind development. *The Journal of Genetic Psychology, 163* (3), 305-325. Doi: 10.1080/00221320209598686

Hacker, J., vom Brocke, J., Handali, J., Otto, M., & Schneider, J. (2020). Virtually in this together - how web-conferencing systems enabled a new virtual togetherness during the COVID-19 crisis. *European Journal of Information Systems, 29*(5), 563-584. Doi: 10.1080/0960085X.2020.1814680

Heasman, B., & Gillespie, A. (2018). Perspective-taking is two-sided: Misunderstandings between people with Asperger's syndrome and their family members. *Autism, 22*(6), 740-750. Doi: 10.1177/1362361317708287

Heasman, B., & Gillespie, A. (2019). Neurodivergent intersubjectivity: Distinctive features of how autistic people create shared understanding. *Autism, 23*(4), 910-921. Doi: 10.1177/1362361318785172

Holler, J., & Wilkin, K. (2009). Communication common ground: How mutually shared knowledge influences speech and gesture in a narrative task. *Language and Cognitive Processes, 24*(2), 267-289. Doi: 10.1080/01690960802095545

Horton, W. S., & Gerrig, R. J. (2002). Speakers' experiences and audience design: Knowing *when* and knowing *how* to adjust utterances to addresses. *Journal of Memory and Language, 47*, 589-606. Doi: 10.1016/20749-596X(02)00019-0

Huang, Y., Arnold, S. RC., Foley, K-R., & Trollor, J. N. (2020). Diagnosis of autism in adulthood: A scoping review. *Autism, 24*(6), 1311-1327. Doi: 10.1177/1362361320903128

Hull, L., Petrides, K. V., Allison, C., Smith, P., Baron-Cohen, S., Lai, M-C., & Mandy, W. (2017). "Putting on my best normal": Social camouflaging in adults with autism spectrum conditions. *J Autism Dev Disord, 47*, 2519-2534. Doi: 10.1007/s10803-017-3166-5

Hull, L., Petrides, K. V., & Mandy, W. (2020). The female autism phenotype and camouflaging: A narrative review. *Review Journal of Autism and Developmental Disorders, 7*, 306-317. Doi: 0.1007/s40489-020-00197-9

Hyter, Y. D. (2017). Pragmatic assessment and intervention in children. In: Cummings L. (Eds.) *Research in Clinical Pragmatics.* Springer, Switzerland. Doi: 10.1007/978-3-319-47489-2_19

Hyter, Y. D., & Sloane, M. (2013). *Conceptual model of social communication*. Unpublished document.

Isaacs, E. A., & Clark. H. H. (1987). References in conversation between experts and novices. *Journal of Experimental Psychology: General*, *116*(1), 26-37. Doi: 10.1037/0096-3445.116.1.26

Ishii-Kuntz, M. (1990). Social interaction and psychological well-being: Comparison across stages of adulthood. *Int'l J. Aging and Human Development, 30*(1), 15-36. Doi: 10.2190/0WTY-XBXJ-GVV9-XWM9

JASP Team (2020). *JASP* (Version 0.14.1) [Computer software]. https://jasp-stats.org/

Kapp, S.K. (2020). Introduction. In: Kapp S. (Eds.) *Autistic Community and the Neurodiversity Movement*. Palgrave Macmillan, Singapore. Doi: 10.1007/978-981-13-8437-0_1

Kauschke, C., van der Beek, B., & Kamp-Becker, I. (2016). Narratives of Girls and Boys with Autism Spectrum Disorders: Gender Differences in Narrative Competence and Internal State Language. *Journal of Autism and Developmental Disorders, 46*(3), 840-852. Doi: 10.1007/s10803-015-2620-5

Kenny, L., Hattersley, C., Molins, B., Buckley, C., Povey, C., & Pellicano, E. (2016). Which terms should be used to describe autism? Perspectives from the UK autism community. *Autism, 20*(4), 442-462. Doi: 10.1177/1362361315588200

Kjelgaard, M. M., & Tager-Flusberg, H. (2001). An investigation of language impairment in autism: Implications for genetic subgroups. *Long Cog Prc, 16*, 287-308. Doi: 10.1080/01690960042000058

Krauss, R. M., & Weinheimer, S. (1966). Concurrent feedback, confirmation, and the encoding of referents in verbal communication. *Journal of Personality and Social Psychology, 4*(3), 343-346. Doi:10.1037/h0023705

Lai, M-C., Lombardo, M. V., Rugirok, A. NV., Chakrabarti, B., Auyeung, B., Szatmari, P., Happe, F., Baron-Cohen, S., & MRC AIMS Consortium. (2017). Quantifying and exploring camouflaging in men and women with autism. *Autism, 21*(6), 690-702. Doi: 10.1177/1362361316671012

Latif, N., Di Francesco, C., & Nadig, A. (2019). Using interpersonal movement coordination to investigate gender differences in adults with autism. *Proceedings of the Annual Meeting of the Cognitive Sciences Society,* p.3504.

Lewis, L. F. (2016). Exploring the experience of self-diagnosis of autism spectrum disorder in adults. *Archives of Psychiatric Nursing, 30*, 575-580. Doi: 10.1016/j.apnu.2016.03.009

LimeSurvey GmbH (2017). *LimeSurvey* (version 3) [Computer software]. https://www.limesurvey.org/

Lord, C., Elsabbagh, M., Baird, G., & Veenstra-Vanderweele, J. (2018). Autism spectrum disorder. *Lancet, 392*, 508-520. Doi: 10.1016/ S0140-6736(18)31129-2

MacWhinney, B. (2000). The CHILDES project: Tools for analyzing talk (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

Magiati, I., Tay, X., & Howlin, P. (2014). Cognitive, language, social and behavioural outcomes in adults with autism spectrum disorders: A systematic review of longitudinal follow-up studies in adulthood. *Clinical Psychology Review*, *34* (1), 78-86. Doi: 10.1016/j.cpr.2013.11.002.

Malkin, L., Abbot-Smith, K., & Williams, D. (2018). Is verbal reference impaired in autism spectrum disorder? A systematic review. *Autism & Developmental Language Impairments, 3*. Doi: 10.1177/2396941518763166

Marini, A., Andreetta, S., del Tin, S., & Carlomagno, S. (2011). A multi-level approach to the analysis of narrative language in aphasia. *Aphasiology, 25*(11), 1372-1392. Doi: 10.1080/02687038.2011.584690

McCabe, A., Hillier, A., & Shapiro, C. (2013). Brief report: Structure of personal narratives of adults with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 43*, 733-738. Doi: 10.1007/s10803-012-1585-x

McGill University (2021). *Cloud directive.* https://www.mcgill.ca/it/files/it/cloud_data_directive.pdf

Milton, D. E. M. (2012). On the ontological status of autism: the 'double empathy problem'. *Disability & Society, 27*(6), 883-887. Doi: 10.1080/09687599.2012.710008

Mitchell, P., Sheppard, E., & Cassidy, S. (2020). Autism and the double empathy problem: Implications for developmental and mental health. *British Journal of Developmental Psychology*, Doi: 10.1111/bjdp.12350

Mody, M., & Belliveau, J. W. (2013). Speech and language impairments in autism: Insights from Behavior and Neuroimaging. *N Am J Med Sci (Boston), 5*(3), 157-161. Doi: 10.7156/v5i3p157

Mottron, L., Dawson, M.m Soulières, I., Hubert, B., & Burack, J. (2006). Enhanced perceptual functioning in autism: An update, and eight principles of autistic perception. *Journal of Autism and Developmental Disorders, 36*(1), 27-43. Doi: 10.1007/s10803-005-0040-7

Nadig, A., Vivanti, G., & Ozonoff, S. (2009). Adaptation of object description to a partner under increasing communication demands: A comparison of children with and without autism. *Autism Research, 2*(6), 334-347. Doi: doi:10.1002/aur.102

Nadig, A., Seth, S., & Sasson, M. (2015). Global similarities and multifaceted differences in the production of partner-specific referential pacts by adults with autism spectrum disorders. *Frontiers in Psychology, 6*. Doi: 10.3389/ fpsyg.2015.01888

Nicholas, L. E., & Brookshire, R. H. (1993). A system for quantifying the informativeness and efficiency of the connected speech of adults with aphasia. *Journal of Speech and Hearing Research, 36*, 338-350.

Nippold, M.A. (2016). Later language development: School-aged children, adolescents, and young adults, 4th Edition. Pro-Ed.

Nippold, M.A., Fantz-Kaspar, M.A., & Vigeland, M. W. (2017). Adults: Examining Syntactic Complexity. *Journal of Speech, Language, and Hearing Research, 60*, 1339-1347. Doi: 10.1044/2016_JSLHR-L-16-0124

Norbury, C. F. (2014). Practitioner Review: Social (pragmatic) communication disorder conceptualization, evidence and clinical implications. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 55*(3), 204-216. Doi: 10.1111/jcpp.12154

Norrelgen, F., Fernell, E., Eriksson, M., Hedvall, Å, Persson, C., Sjölin, M., & Kjellmer, L. (2015). Children with autism spectrum disorder who do not develop phrase speech in the preschool years. *Autism, 19*(8), 934-943. Doi: 10.1177/1362361314556782

Oakley, B. F. M., Tillman, J., Ahmad, J., Crawley, D., Caceres, A. S. J., Holt, R., Charman, T., Banaschewski, T., Buitelaar, J., Simonoff, E., Murphy, D., Loth, E., & The EU-AIMS Group. (2021). How do core autism traits and associated symptoms relate to quality of life? Findings from the Longitudinal European Autism Project. *Autism, 25*(2), 389-404. Doi: 10.1177/1362361320959959

Oelschlaeger, M. L., & Thorne, J. C. (1999). Application of the correct information unit analysis to the naturally occurring conversation of a person with aphasia. *Journal of Speech, Language, and Hearing Research, 42*, 636-648. Doi: 10.1044/jshlr.4203.636

Panchal, N., Kamal, R., Cox, C., & Garfield, R. (2021, Feb 10). The implications of COVD-19 for mental health and substance use. https://www.kff.org/coronavirus-covid-19/issue-brief/the-implications-of-covid-19-for-mental-health-and-substance-use/

Paynter, J. M., Keen, D., & Rose, V. J. (Commentary authors) (2016). Systematic review documents limited empirical support for the practical application of the Theory of Mind model of ASD. *Evidence-Based Communication Assessment and Intervention, 10*, 131-139. Doi: 10.1080/17489539.2016.1265698

Pearson, A., & Rose, K. (2021). A conceptual analysis of autism masking: Understanding the narrative of stigma and the illusion of choice. *Autism in Adulthood, 3*(1), 52-60. Doi: 10.1089/aut.2020.0043

Pellicano, E., Dinsmore, A., & Charman, T. (2014). What should autism research focus upon? Community views and priorities from the United Kingdom. *Autism, 18*(7), 756-770. Doi: 10.1177/1362361314529627

Paul, R., & Fahim, D. (2014). Assessing communication in autism spectrum disorders. In F. Volkmar, R. Paul, A., Klin & D. Cohen (Eds.). *Handbook of Autism and Pervasive Developmental Disorders, Fourth Edition* (Chapter 27, pp. 673-694). Hoboken, New Jersey: John Wiley & Sons. Doi: 10.1002/9781118911389.hautc27

Paul, R., Norbury, C., & Gosse, C. (2018). Language Disorders: From Infancy Through Adolescence, 5th Edition. Elsevier.

Pennington, B. F., Rogers, S. J., Bennetto, L., McMahon Griffith, E., Reed, D. T., & Shyu, V. (1997). Validity tests of the executive dysfunction hypothesis of autism. In Russell J (Eds.) Autism as an Executive Disorder. Oxford University Press. Doi: 10.1093/med:psych/9780198523499.001.0001

Peristeri, E., Andreou, M., & Timspli, I. M. (2017). Syntactic and story structure complexity in the narrative of high- and low-language ability children with autism spectrum disorder. *Frontiers in Psychology, 8*: 2027. Doi: 10.3389/fpsyg.2017.02027

Pettit, G., S., Erath, S. A., Lansford, J. E., Dodge, K. A., & Bates, J. E. (2011). Dimensions of social capital and life adjustment in the transition to early adulthood. *International Journal of Behavioral Development, 35*(6), 482-489. Doi: 10.1177/0165025411422995

Pickles, A., Anderson, D., K., & Lord, C. (2014). Heterogeneity and plasticity in the development of language: A 17-year follow-up of children referred early for possible autism. *Journal of Child Psychology and Psychiatry*, *55*(12), 1354-1362. Doi: 10.1111/jcpp.12269

Ploudre, E. (2003). Doublage: uniformisation linguistique et manipulation du discours. *Post-scriptum*. Retrieved November 8, 2020, from https://post-scriptum.org/03-11-doublage-uniformisation-linguistique-et-manipulation-du-discours/

R Core Team (2020). *R Project* (version 4.0.2) [Computer software]. https://www.r-project.org/

Raven, J., Raven, J. C., & Court, J. H. (2003). *Manual for Raven's Progressive Matrices and Vocabulary Scales.* San Antonio, TX: Pearson Assessment.

Raymaker, D. M., Teo, A. R., Steckler, N. A., Lentz, B., Scharer, M., Delos Santos, A., Kapp, S. K., Hunter, M., Joyce, A., & Nicolaidis, C. (2020). "Having all of your internal resources exhausted beyond measure and being left with no clean-up crew": Defining autistic burnout. *Autism in Adulthood, 2*(2), 132-143. Doi: 10.1089/aut.2019.0079

Rumpf, A-L., Kamp-Becker, I., Becker, K., & Kauschke, C. (2012). Narrative competence and internal state language of children with Asperger Syndrome and ADHD. *Research in Developmental Disabilities, 33*(5), 1395-1407. Doi: 10.1016/j.ridd.2012.03.007

Russell, J. (1997). How executive disorders can bring about an inadequate 'theory of mind'. In Russell J (Eds.) Autism as an Executive Disorder. Oxford University Press. Doi: 10.1093/med:psych/9780198523499.001.0001

Ribeiro de Oliveria, L., Brian, J., Kelley, E., Beal, D., Nicolson, R., Georgiades, S., Iaboni, A., Day Fragiadakis, S., Ristic, L., Anagnostou, E., & Sanjeevan, T. (2020). Exploring the use of the verbal intelligence quotient as a proxy for language ability in autism spectrum disorder. *Research in Autism Spectrum Disorders, 73*: 101548. Doi: 10.1016/j.rasd.2020.101548

Salamanna, F., Veronesi, F., Martini, L., Landini, M. P., & Fini, M. (2021). Post-COVID-19 Symptoms: The persistent symptoms at the post-viral stage of the disease. A systematic review of the current data. *Frontiers in Medicine, 8,* 653516. Doi: 10.3389/fmed.2021.653516

Sasson, N. J., Faso, D., J., Nugent, J., Lovell, S., Kennedy, D. P., & Grossman, R. B. (2017). Neurotypical peers are less willing to interact with those with autism based on thin slice judgments. *Scientific Reports, 7*, 40700. Doi: 10.1038/srep40700

Siller, M., Swanson, M. R., Serlin, G., & Teachworth, A. G. (2014). Internal state language in the storybook narratives of children with and without autism spectrum disorder: Investigating

relations to theory of mind abilities. *Research in Autism Spectrum Disorders, 8*(5), 589-596. Doi: 10.1016/j.rasd.2014.02.002

Son, C., Hedge, S., Smith, A., Wang, X., & Sasangohar, F. (2020). Effects of COVID-19 on college students' mental health in the United States: Interview survey study. *J Med Internet Res, 22*(9):e21279. Doi: 10.2196/21279

Spreen, O., & Benton, A. L. (1969). Neurosensory Center Comprehensive Examination for Aphasia. Victoria: Neuropsychology Laboratory, University of Victoria.

Stirling, L., Douglas, S., Leekam, S., & Carey, L. (2014). The use of narrative in studying communication in Autism Spectrum Disorders: A review of methodologies and findings. In J. Arciuli & J. Brock (Eds.), *Communication in Autism: Trends in Language Acquisition Research 11.* (171-215). John Benjamins. Doi: 10.1075/tilar.11.09sti

Sullivan, G. M., & Feinn, R. (2012). Using effect size – or why the *p* value is not enough. *Journal of Graduate Medical Education,* 279-282. Doi: 10.4300/JGME-D-12-00156.1

Tager-Flusberg, H. (2004). Strategies for conducting research on language in autism. *Journal of Autism and Developmental Disorders, 34*, 75-80.

Tager-Flusberg, H., & Kasari, C. (2013). Minimally verbal school-aged children with autism spectrum disorder: The neglected end of the spectrum. *Autism research*, *6*(6), 468-478.

Thordardottir, E. (2018). SCSD 637: *Developmental language disorders I: Abbreviated SALT conventions [Lecture handout]*.

Tomprou, M., Kim, Y. J., Chikersal, P., Williams Woolley, A., & Dabbish, L. A. (2021). Speaking out of turn: How video conferencing reduces vocal synchrony and collective intelligence. *PLoS One, 16*(3): e0247655. Doi: 10.1371/journal.pone.0247655

Umberson, D. & Karas Montez, J. (2010). Social relationships and health: A flashpoint for health policy. *J Health Soc Behav, 51*(Suppl), S54-S66. Doi: 10.1177/0022146510383501

Waite, M. (2013). Executive Functions and Social Interactions: Developing Social Scenarios (Publication No. 154). [Master's thesis, Western Michigan University]. Scholarworks.

Walker, N. (2014, September 27). Neurodiversity: Some basic terms and definitions [blog post]. Retrieved from: https://neurocosmopolitanism.com/neurodiversity-some-basic-terms-definitions/

Weinberger, C. J. (2014). The increasing complementarity between cognitive and social skills. *The Review of Economics and Statistics, 96*(5), 849-861. Doi: 10.1162/REST_a_00449

Williams, G. L., Wharton, T., & Jagoe, C. (2021). Mutual (mis)understanding: Reframing autistic pragmatic "impairments" using relevance theory. *Frontiers in Psychology, 12*: 616664. Doi: 10.3389/fpsyg.2021.616664.

Appendix A
Example Quiz for Experimental Task

Quiz A - Eng

* Obligatoire

1. Participant ID *

2. Where does Homer go? *

- ◯ On a cruise
- ◯ To space
- ◯ To France
- ◯ On a safari

3. What object keeps the door closed? *

- ◯ A sandwich
- ◯ Duct tape
- ◯ A rod
- ◯ Super glue

4. Does Homer bring potato chips on board? *

- ◯ Yes
- ◯ No

6/7/2021

Appendix B

Survey on Prior Familiarity with *The Simpsons* and Audio and Video Quality of Study Tasks

Simpsons & AV Quality - ENG

* Obligatoire

1. Participant ID: *

2. Before watching the clips in the study today, how familiar were you with The Simpsons? *

- ◯ I had never heard of it before
- ◯ I knew about the show (i.e., what the show was about, character names, etc.), but had never watched it
- ◯ I had watched a few episodes
- ◯ I had watched many episodes

3. Had you previously watched any of the episodes the clips came from? *

- ◯ Yes
- ◯ No

4. If you answered yes above, which episodes? (Check all that apply)

- ☐ Otto the bus driver gets his job back
- ☐ Homer goes to space
- ☐ Marge has a fear of flying
- ☐ Bart passes his test
- ☐ Lisa becomes a trouble-maker