Storytelling and Special Interests: Microstructure in the Fictional and Personal Narratives of Autistic Adults

By

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Abstract

Background and objectives: Past research has found that autistic individuals have pragmatic and morphosyntactic deficits in narrative language; however, the majority of these studies use fictional narrative prompts and are on children, not older autistic individuals. Furthermore, very few use interest-based prompts. Research has shown that incorporating autistic individuals' special interests into activities can increase their academic success, socialization, and mental health. Thus, this study investigates whether using a special interest-based prompt improves narrative language performance in autistic adults as compared to non-autistic adults.

Methods: There were 43 adult participants, including 23 self-identified autistic adults, who each narrated both a fictional story and an interest-based personal story. Participants also completed an IQ screener, a questionnaire which measures autistic traits, and a background questionnaire which included questions on diagnosis, language proficiency, and frequency of reading. Linear models were run with group and narrative type as fixed effects to examine the narrative microstructure elements of total number of words, number of different words, internal state terms, and mean length of utterance. Additionally, correlations were run between microstructure elements on both narratives and score on the autism questionnaire and frequency of reading.

Results: The autistic adults had a lower score than non-autistic controls on all microstructure elements except for mean length of utterance on the fictional narrative. However, the autistic adults had improved performance on the interest-based personal narrative such that they were similar to non-autistic participants for total number of words and number of different words and not equal to but closer to the non-autistic participants for internal state terms than they were on the fictional narrative. Score on the autism questionnaire was only correlated with microstructure elements on the fictional narrative and not the interest-based personal narrative. Frequency of reading was only found to have significant correlations when the two groups were split, indicating that frequency of reading may affect the two populations differently.

Conclusion: Autistic individuals appear to benefit from an interest-based prompt on narrative microstructure performance. This study contributes to the growing evidence for the benefits which

engaging autistic individuals' special interests has for their language performance, and supports a strength-based theory of special interests. It is suggested that special interests should be utilized in education, therapy, and general life in order to increase the success of autistic individuals. This study had limitations in group participant numbers and further research is needed to fully understand the extent of benefits that special interest have for this population.

Preface

This thesis is an original work by Natasha Daley. The research project, of which this thesis is a part, received research ethics approval from the University of Alberta Research Ethics Board, Project Name “Storying Telling and Special Interests – A Study on the Differences in Narrative Language of Autistic Individuals Depending on the Topic”, ID: Pro00113004, October 8, 2021.

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Chapter 1: Introduction

1.0. General Introduction

It has been found in the past that autistic individuals have pragmatic, lexical, and morphosyntactic deficits in narrative language; however, the majority of the studies in previous literature have been conducted with autistic children and used fictional narrative prompts. Fictional narrative prompts get the participant to tell a story they invent that is based upon a sentence, picture, or video prompt, while personal narrative prompts get the participant to tell a real story from their past. Furthermore, there are also interest-based prompts, which ask the speaker to tell a story involving something they personally have an interest in, and these have been used in very few studies for fictional narratives and no studies have used interest-based prompts for personal narratives. Research has shown that incorporating autistic individuals' special interests into activities can increase their academic success, socialization, and mental health. Thus, in this thesis, I investigate whether using a special interest-based prompt improves narrative language performance in autistic adults as compared to non-autistic adults.

1.1 What is autism?

Autism spectrum disorder (ASD) is a neurodevelopmental disability characterized by differences in communication, socialization, and cognitive and sensory processing throughout the lifespan (Autistic Self Advocacy Network, n.d.). The Diagnostic and Statistical Manual 5 (DSM-5) lists two main types of symptoms: deficits in social communication, and restricted, repetitive patterns of behaviour (RRBs) (American Psychiatric Association [APA], 2013). Regarding deficits in social communication, the DSM-5 includes difficulties making and maintaining relationships, social interactions, and non-verbal communication. Also, in the DSM-5, RRBs include repetitive and atypical speech and motor movements, adherence to routines and resistance to change, sensory processing differences, and special interests, also called circumscribed interests or narrow interests, which are unusually restricted and/or intense interests.

1.1.1. Terminology

In this thesis, autistic individuals will be referred to with identity-first language (autistic person) instead of person-first language (person with autism), and non-autistic individuals will be referred to using the term ‘allistic’ rather than ‘typical’ or ‘neurotypical’. The term allistic, meaning non-autistic, was first used in a parody of psychiatry written by Andrew Main (2003), but since then has become widely used in the autism and neurodiversity communities and been accepted by and added to dictionaries (Cambridge University Press, n.d.). This term’s popularity stems from its usefulness in more accurately describing people who are not autistic, as the term neurotypical does not accurately represent allistic people who have other conditions and neurotypes such as attention-deficit/hyperactivity disorder, anxiety or depression, personality disorders, and other cognitive disabilities. Neurotypical only refers to individuals who have no mental health conditions or mental disabilities. Since it is impractical to test participants for every possible condition, most studies likely do not have a fully neurotypical control group. Thus, I will be using the term allistic to most accurately refer to this population. Additionally, identity-first language will be used as it is the terminology preferred by the autistic community as a whole (Bottema-Beutel et al, 2021).

Regarding the topic of 1.1.3, Bottema-Beutel also states that the term ‘special interest’ is not preferred; however, in relation to this, Bottema-Beutel refers to Kim (2012), who states that she personally does not like the term, but that it is the most widespread and accepted term in the autistic community. Thus, Kim used ‘special interest’ herself and to follow community preference, ‘special interest’ will be used in this thesis as well for the same reason.

1.1.2 Autism and Social Communication and Language

Autistic people differ from allistic people in social communication and socialization in differences in body language and eye contact, conversational styles and understanding of nonverbal and indirect communication, and in understanding of, and participation in, social situations (Attwood, 2003). Previous literature has found that language abilities in autistic individuals has shown wide heterogeneity (Boucher, 2012; Anderson et al., 2007; Sigman & McGovern, 2005). Some autistic individuals are non-speaking or minimally speaking, some are speaking but additionally meet criteria to be diagnosed with language impairment, and some have clinically normal structural language abilities. Around 30% of diagnosed

autistic individuals are non-speaking or minimally speaking, though many in this group can communicate through sign language, written language, and alternative communication systems such as PECS (Picture Exchange Communication System) or VOCA (Voice Output Communication Aids) (Tager-Flusberg & Kasari, 2013). Within the remaining autistic population who uses spoken language, language abilities vary widely, with certain language areas, such as narrative language and pragmatics, more universally affected than others (Tager-Flusberg, 2000). Most but not all autistic children have a language delay; some who had a language delay will no longer have impaired structural language by later childhood and some will continue to meet criteria for language impairment throughout their life (Boucher, 2012). See section 1.2 for further description of autism and narrative language.

1.1.3 Autistic Special Interests

Special interests are included the DSM-5 (APA, 2013) diagnostic criteria for ASD under the category of restricted and repetitive patterns of behaviour and are characterized by often being very narrow and specific in focus and/or very intense. In this thesis, special interests are important to the study design, as one of the narratives elicited draws upon a story related to the participants' special interests.

Topics of special interests can be anything from more typical hobby topics such as certain sports or video games to unusual topics such as road signs and lawn mowers (Attwood, 2003).They have been reported to occur in over 90% of autistic individuals (Bashe, & Kirby, 2001; Nowell, et al., 2021; Turner-Brown, et al., 2011) and while they can also occur in people who are not autistic, it has been found that autistic individuals have more special interests, and that they are often more specific and in more systemizing domains (Jordan & Caidwell-Harris, 2012). The emergence of special interests has been found to be around 2-3 years old and as autistic people age, they often will develop more complex and stronger special interests and have multiple special interests at one time (Attwood, 2003).

In the past, special interests were primarily viewed through a focus on impairment such that studies researched how much a special interest impacted autistic individuals' lives by disrupting activities and conversation, distracting from work and school, and disturbing those around them. For example, both South and McMahon's (2005) study and Klin et al.'s (2007) study on special interests used a survey which asked parents about how much their autistic child's special interest interfered with activities and

bothered other people in the child's life, describing special interests as disruptive and debilitating, but had no questions which framed special interests positively. Attwood (1998; 2003) described how special interests could negatively impact an autistic individual's life by annoying people they have relationships with, stated that special interests may be caused by deficits in information processing and executive dysfunction, and suggested strategies to reduce special interests; however, Attwood also mentions possible positive benefits for special interests including facilitating conversation, relaxation, and enjoyment, and mentions how special interests can have benefits in the areas of learning, employment, and making friends.

More recently research has turned the focus away from deficit models to strength-based models and studying how special interests can benefit autistic individuals. Lawson (2011) presents a new theoretical approach, Single Attention and Associated Cognition in Autism, which differentiates the autistic spectrum from the allistic population with differences instead of deficits, stating that autistic individuals have *focused* attention, interest, and sensory systems while allistic individuals have *diffuse* systems. Winter-Messiers et al. (2007) propose a strength-based model of special interests, stating that engagement in special interests can potentially improve executive function, academics, communication, and social, emotional, sensory, and fine motor strengths. Furthermore, Caldwell-Harris and Jordan (2014) propose a strength-based continuum between regular hobbies of allistic people and autistic people's special interests based on *systemizing* and *mentalizing* abilities, in which allistic hobbies are broad, few, and low intensity due to mentalizing abilities on one hand, and autistic interests are numerous, specific, and intense due to systemizing abilities on the other hand.

Research on the practical effects of special interests in autistic individuals' lives on school, employment, mental health, and relationships supports a strength-based view of special interests. Patten Koenig and Hough Williams (2017) support strength-based models, finding that autistic adults viewed their special interests to be strengths, and that special interests had benefits in employment pursuits and in anxiety reduction. It has been found that special interests can help autistic individuals socially such as, improving autistic high schoolers' engagement with other students and enjoyment of activities (Koegel et al., 2013), and increasing social interaction in autistic children after incorporating special interests into

games with peers (Baker et al., 1998). Brown and Stanton-Chapman (2015), Winter-Messiers et al. (2007), and Wood (2021) all suggest that educators should incorporate special interests into school curriculum to increase success in school due to the increased interest, motivation, and focus which special interests foster and in turn raise academic success. Studies focused on special interests and employment suggest that special interest areas gave potential employment opportunities to autistic individuals due to the large amount of time they committed to their special interests, resulting in high knowledge and skill levels in those areas (Kirchner & Dziobek, 2014). Furthermore, obtaining employment related to their special interests can improve mental health and lower depression in autistic adults (Bross et al., 2022). Dachez and Ndobo (2018) also have found that autistic adults use special interests as a coping strategy and Grove et al. (2018) found that engagement with special interests is related to higher subjective wellbeing. Finally, concerning academic skills in autistic adults, Gillespie-Lynch et al. (2020) ran a study which compared the writing skills of autistic and allistic university students, using a prompt to write about a topic that interested them, and found that the autistic participants showed more advanced writing skills than the allistic group. Thus, special interests have been seen to be an area of strength and motivation to autistic individuals and can be used to benefit other aspects of their lives including socialization, mental health, and academics.

1.2 Autism and Language Use in Narrative Genres

Narratives are a type of pragmatic discourse in which the speaker describes an event with a beginning, middle, and end in temporal order. Narratives can be evaluated on several measures including macrostructure and microstructure. Macrostructure is the overall story structure, content, and organization, such as whether the speaker included all the story elements (characters, setting, etc.) and had a beginning, middle, and end to the story. Microstructure refers to language productivity, measured by examining the total number of words (TNW) and the number of different words (NDW), referring expressions, internal state terms (ISTs), and morphosyntactic complexity, which can be measured by examining errors in syntax or morphology or by measuring the mean length of utterance (MLU), which is the average number of morphemes used in an utterance. Referring expressions include content words, like nouns, as well as function words such as articles (the, a) and pronouns (he, she, it, they); adequate

use of referring expressions means choosing correctly among ones that refer back to someone or something mentioned earlier in the story (definite articles or pronouns) or are introducing a new character or object (indefinite articles or nouns). ISTs are words which refer to the current internal state of a character in a narrative such as, mental states, emotions, and senses (see section 2.4.3 for IST examples). These can be broken down into five categories of ISTs: cognitive, consciousness, emotional, perceptual, and physiological (Govindarajan, 2021). Furthermore, ISTs are an area of particular interest in autism research because of their relation to cognitive and emotional processing in autism and theories of autism such as the theory of mind deficit (Baron-Cohen, 1995) and newer opposing theories such as the double empathy problem (Milton, 2012). IST use in narratives by autistic individuals can give insight into how they process and understand mental states, both of their own and of others. See section 4.2.2 for more discussion of theories and ISTs. There are two narrative language genres, *fictional narratives*, which are narratives created by the speaker based upon a single picture or wordless picture book, a video, or a fictional prompt, and *personal narratives*, which are narratives where the speaker tells a story of an event that happened to them in the past, usually elicited using prompts such as, to tell a story "about a time that you had a problem or fight with another person" (Hilvert et al., 2020) or "about a visit to a hospital" (Goldman, 2008).

As mentioned in 1.1.2, language abilities in autistic individuals vary widely with some linguistic areas more likely to have differences with allistic individuals than others; narrative language is one of the linguistic areas that typically shows differences in ASD even for individuals who have no structural language impairment. Research on narrative language in ASD has shown that, in comparison to allistic children, autistic children's fictional narratives often have a smaller TNW, NDW, and MLU, more ambiguous referring expressions, and worse syntactic complexity, macrostructure, and ISTs (Baixauli et al., 2016; Banney et al., 2015; Kelley et al., 2006; Norbury et al., 2014). Govindarajan (2021) had bilingual autistic children ages 5-10 years old produce fictional narratives based on picture stories from a standardized narrative test and found that they told stories with shorter MLUs, less complex syntax, and less use of ISTs, as compared to bilingual allistic children. Furthermore, Govindarajan additionally found that when ISTs were broken down by category, autistic children were seen to use less emotional and cognitive ISTs than allistic children. There are fewer studies on personal narratives in autistic children

than fictional narratives, but the findings show similarity to findings for fictional stories because autistic children produce oral personal stories that contain fewer ISTs (Brown et al., 2012) and have worse microstructure in personal narrative writing (Hilvert et al., 2020) than allistic children.

Overall, there are fewer studies on the narrative skills of autistic adolescents than younger autistic children, although there are more studies on personal narratives with adolescents, and these studies show inconsistent results. King et al. (2013) conducted a study comparing *general* stories - which they elicited by use of prompts such as "what usually happens when someone goes on holiday" - and *personal* stories in autistic and allistic adolescents. They found that the autistic participants' narratives, of both types, had smaller TNW, NDW, and MLU than those of the allistic adolescents. In Canfield's 2016 study, picture-based fictional stories told by autistic adolescents were found to have worse macrostructure and were rated lower by undergraduate students on goodness, cohesiveness, accuracy, and oddness; however, at the same time, they were found to have the same TNW and IST usage as allistic adolescents. In personal narratives, Bang et al. (2013) found fewer ISTs were used by autistic than allistic adolescents and Goldman (2008) found that autistic adolescents told personal narratives with fewer conventional narrative elements than allistic adolescents. For example, their stories contained fewer characters and resolutions of conflicts/problems. However, Broc et al. (2021) found no differences between the personal narratives of autistic and allistic adolescents.

There are fewer studies on the narratives of autistic adults than there are on autistic children. For fictional narratives, as compared to allistic adults, Geelhand et al. (2020) found that autistic adults told narratives with worse microstructure, including TNW, syntactic complexity, and fewer ISTs, as well as macrostructure. Lee et al. (2018) found that autistic adults used less complex syntax in their narratives than allistic adults, and Colle (2008) found that autistic adults had worse pragmatics in their narratives in that they used fewer referring expressions and temporal expressions, but did not use fewer ISTs nor had shorter story lengths, than allistic adults. Both Klin (2000) and Beaumont and Newcombe (2006) also found no differences between autistic and allistic adults in use of ISTs in fictional narratives, although they noted that the autistic participants explained the characters' mental states less often. To the best of my knowledge, only one study has been done with autistic adults that was focused solely on personal

narratives (McCabe et al., 2012). This study found that they had worse macrostructure, but no differences were found in TNW, as compared to allistic adults. Rollins (2014) had autistic adults tell both a fictional and a personal story and did a within-group comparison of performance on both narrative genres, finding that autistic adults' personal narratives were worse than their fictional narratives in terms of macrostructure and IST usage.

Within the genre of personal narratives, it is possible to elicit an interest-based personal (IBP) narrative by formulating the prompt to elicit the participants to tell a story about something that interests them instead of a random event. There have been two studies, one with autistic children and one with autistic adults, which have compared fictional narratives to interested-based tasks, although both studies were on narrative writing rather than oral narrative telling. Sivertson (2010) conducted a study in which autistic children wrote two fictional narratives with prompts chosen by their teacher and two fictional narratives with prompts tailored to each child's special interests. In this study, Sivertson found that when the autistic children were given an interest-based prompt, they wrote stories with a higher word count and a higher score on a writing rubric which measured content, organization, voice, word choice, and sentence fluency. Barnes et al. (2009) ran a similar study with adults instead of children in which autistic and allistic adults were asked to write fictional narratives based on short films and to write about something that interested them; however, this interest-based task was not a narrative per se, so it was only comparable to the fictional narrative in length and writing quality and not for components such as story quality and IST usage. Barnes found that the autistic and allistic groups did not differ in TNW or writing quality of the interest-based writing task, but that the autistic group did produce shorter fictional narratives and used fewer ISTs than the allistic group in their fictional narratives. Thus, there is some evidence that involving special interests in narrative tasks can improve performance, but this has not yet been studied in oral language or in personal narratives and more research is needed in this area.

1.3 Narrative Language and Reading

In previous literature, it has been found that measures of reading were positively related to narrative production (Eme et al., 2010; Hamilton et al., 2021; Nevo et al., 2023; Sénéchal et al., 2018); because of these findings, I included measures of how often participants read for work and for pleasure in

my analysis of individual differences in narrative performance. It has been found in the past that, across childhood and adolescence, reading experience and comprehension predict vocabulary size (Cain & Oakhill, 2011), which is important for narrative language skills (Khan et al., 2021; Korecky-Kröll et al., 2019; Uccelli & Páez, 2007). In allistic children, reading fiction has been found to be correlated with TNW macrostructure in narratives (Hamilton et al., 2021) and that oral interactive storybook reading improves children's vocabulary, morphological awareness, and narrative language ability (Nevo et al., 2023). Sénéchal et al. (2018) found that grade four students who read more often also wrote stories that were more coherent and better followed writing conventions. In allistic adults, Eme et al., (2010) found that functionally illiterate adults, who have not mastered reading enough to read for pleasure or for work, produced oral narratives that were shorter, contained more morphosyntactic errors, and had worse narrative structure and cohesion than literate adult controls.

Only a small number of studies have been done on how reading and narrative skills are connected in ASD. Similar to other language skills, reading skills have been seen to be heterogeneous in autistic individuals (McIntyre et al., 2017; Solari et al., 2019). In 2018, Kim et al. studied the effects of shared reading intervention on the narrative comprehension of autistic children and found that the participants all had improved narrative comprehension from shared reading. McIntyre et al. (2020) studied autistic individuals 8-16 years old and found that oral narrative retelling was a significant predictor of later reading comprehension. Zajic et al. (2020) studied 10 to 18-year-old autistic individuals and found that stronger readers also showed stronger narrative writing skills. More research is needed to examine if reading is connected to oral narrative skills, and how reading affects the narratives of autistic adults.

1.4 Thesis Overview and Research Questions

In the literature on narrative language in autism, there are still many gaps necessitating further studies. For example, there are fewer studies on autistic adults compared to children, as well as fewer studies on personal narratives compared to fictional narratives. To the best of my knowledge, there is only one study that compares a fictional narrative with an interest-based personal narrative (Sivertson 2010) with children and one with adults which compares a fictional narrative with an interest-based writing task (Barnes et al. 2009), however, both were on narrative writing rather than oral narrative telling and the

study on adults did not have a story for the interest-based task. Most research has found differences in narrative macrostructure and microstructure between autistic and allistic participants, namely, that autistic participants usually perform worse. However, it is possible that the heavy reliance on fictional, non-interest-based narratives might be skewing these results. Due to the benefits of engagement with special interests mentioned in 1.1.3, it is worth investigating whether autistic individuals would produce better quality narratives when the prompt involves their special interests. Doing so would indicate that autistic individuals are not inherently worse at telling stories and instead suggest that autistic people may simply not produce their best possible story when it is about something they have little interest in. This would also support strength-based theories of special interests in autistic individuals. Furthermore, to the best of my knowledge, there are no studies on how reading affects the narrative skills of autistic adults. Researching this would reveal insight into whether reading can be an effective predictor of autistic adult narrative language outcomes.

In this study, I investigated how incorporating special interests affects narrative language by having autistic and allistic adults tell a fictional narrative based on a picture and a personal narrative which involves a hobby or special interest. To do this, I elicited both a fictional narrative and an interest-based personal narrative from a group of autistic (*N*= 23) and allistic (*N*= 20) adults. Narratives were analyzed for different microstructure elements (see 2.4). Additionally, I examined the association between participants' reading habits and their narrative language skills as well as severity of autistic symptoms and their narrative language skills on both tasks. Below are my three broad research questions. More specific questions and hypotheses are in 2.5.

1. Are there differences between autistic and allistic adults in the microstructure of their fictional or IBP narratives?
2. Do autistic adults show superior microstructure in their IBP narratives as compared to their fictional narratives? Do autistic and allistic adults pattern the same in within-group comparison between fictional and IBP narratives?
3. What are the associations between severity of autism symptoms as measured by a self-report questionnaire and microstructure on the fictional and IBP narrative?

4. What are the associations between frequency of reading for pleasure and for work and microstructure on the fictional and IBP narrative?

Chapter 2: Methods

2.1 Participants

There was a total of 52 participants in the study at the outset, 27 within the allistic group and 25 in the autistic group; however, the final group numbers changed due to having to exclude some participants (see details below). There were two methods of recruitment used in this study, one for each group. First, the allistic group was recruited through the Linguistics Department's participant pool, which is consists of students in first year linguistics courses (LING 101 and LING 102). Students chose my study to participate in based on a short description of what was required, received a zoom link after signing up for a timeslot, and finally were granted credits for their course upon completion of the study. Second, the autistic group was mainly recruited through ads posted on Facebook autism groups (*N*=19), with a small number through a snowball effect from friends of members of the Bilingual Acquisition Lab of Alberta (*N*=5), and one participant in the autistic group was recruited via the linguistics participant pool. Participants for the autistic group who were recruited outside of the university participant pool contacted me via email to set up a time to participate and were compensated for their time with an online gift card worth 20$ to either Amazon, Walmart, or RedBubble. The recruitment ad can be found in Appendix A.

To be included in the study, participants in both groups were required to be within the ages of 18 and 30, have no intellectual disabilities, and speak English as their primary language. To test for intellectual impairment, the participants completed the TONI-3, an IQ screener (see materials). In the TONI-3, a deviation quotient or standard score of 70 or below indicates intellectual impairment; all participants in the study's scores fell within the normal standard deviation of 85-115 except for one participant from the autistic group who scored 74 and was thus excluded from the study. The autistic group had a mean standard score of 116.5 and range of 88 to 145 on the TONI-3 and the allistic group had a mean of 116.9 and range of 93 to 135. To be included in the autistic group, individuals self-identified as autistic and were additionally confirmed to be autistic by their scores on the SRS-2, a questionnaire which measures autistic traits (see materials). In this questionnaire, T-scores below 60 are within normal limits and do not indicate any autistic disorder, while T-scores 60 and above are associated with clinically significant autistic disorders, separated into range labels of mild, moderate, severe respectively for T-

scores 60-65, 65-75, and 75 and above. One participant from the autistic group was removed from the study due to scoring within the normal range on the SRS-2 while four participants from the allistic group were removed from the study due to scoring within the moderate range. I chose to keep all participants that scored within the mild range (4 allistics and 2 autistics) within their group in the study because the SRS-2 is not a diagnostic tool, and thus, was used in this study only to confirm self-identified groups. It was not used to differentiate between participants who scored in the mild range because allistic individuals can easily score in the mild category as many of the questions on the SRS-2 can be affected by other conditions such as ADHD, depression, anxiety, and personality. Additionally, three participants from the allistic group were excluded due to not completing all the questionnaires, audio issues, and low English language proficiency which resulted in them being unable to perform the narrative tasks.

Thus, the final autistic group included 23 participants and the final allistic group included 20 participants, resulting in the total number of included participants as 43. All participants were between the ages of 18 and 33; the mean age of the autistic group was 25.77 with a range of 21 to 32 while the mean age of the allistic group was younger at 22.7 with a range of 18 to 33. This is likely due to the allistic participants all being undergraduate university students, while only about half of the autistic participants, 12 out of 25, were currently in university. The autistic group had a mean T-score on the SRS of 75.50, while the allistics' mean score was 54.15. Frequency of reading for pleasure and for work were rated on a scale from 1-5 where 1 was never and 5 was daily; for reading for pleasure, the autistic group had a mean rating of 3.26 and the allistic group had mean rating of 3.25 and, for frequency of reading for work, the autistic group had a mean of 3.78 and the allistic group had a mean of 3.95. Wilcoxon tests between the autistic and allistic groups were run on these variables and Cohen's *d* was calculated for each. Significant results were found for the Wilcoxon tests for age (W= 416, p= 1.173e-05) and SRS T-score (W= 20, p= 6.434e-15). For Cohen's *d*, there was a large effect size for age (d= 0.92) and SRS T-score (d= 3.14). Non-significant results and small effect sizes were found for all other characteristics (see Table 2.1). The results for SRS T-scores and age were as expected since the two groups were intended to differ on the SRS and the autistic group was slightly older due to recruitment methods, as mentioned above.

Table 2.1

Participant Characteristics

Variables	**Autistic**	**Allistic**	**Wilcoxon**	**Cohen's *d***
Age (years)	25.77 (2.86)	22.7 (3.77)	*W*= 416, *p*= 1.173e-05	*d*= 0.92
SRS (T-Score)[a]	75.50 (7.54)	54.15 (5.97)	*W*= 20, *p*= 6.434e-15	*d*= 3.14
TONI (Standard scores)	116.5 (15.01)	116.9 (12.61)	*W*= 928, *p*= 0.95 n.s.	*d*= -0.03
Frequency of Reading for Pleasure	3.26 (1.41)	3.25 (1.06)	*W*= 932, *p*= 0.92 n.s.	*d*= 0.01
Frequency of Reading for Work	3.78 (1.30)	3.95 (0.86)	*W*= 928, *p*= 0.95 n.s.	*d*= -0.15

Note: Mean (SD). Frequency of reading was rated on a scale of 1-5 where 1 was never and 5 was daily.

[a]Range of SRS T-Scores = 61-90 (autistic), 43-65 (allistic)

Overall, there were 18 female participants, 15 male participants, and 9 participants who identified their gender as non-binary. The autistic group contained all 9 of the non-binary participants, 7 female participants, and 6 male participants, while the allistic group contained 11 female participants and 9 male participants. The majority of participants were bilingual, with 30 bilinguals and 21 monolinguals. There were more allistic bilinguals (*N*=17) than autistic bilinguals (*N*=7), and, by extension, more autistic monolinguals than allistic monolinguals. No participants were excluded due to co-occurring diagnoses (self-reported), as none of the participants had additional diagnoses that interfered with their ability to participate in the study. The autistic group also contained more participants with other co-occurring diagnoses, including ADHD (*N*=12), Obsessive CD (*N*=1), dyspraxia (*N*=2), dyscalculia (*N*=1), and bipolar disorder (*N*=1), whereas the allistic group only had two participants who reported a diagnosis, ADHD (*N*=1) and OCD (*N*=1). All except for one of the allistic participants currently resided in Canada, while the autistic group contained participants who currently resided in Canada (*N*=12), the United States (*N*=8),

Germany (*N*=1), and Australia (*N*=1). The autistic group also had a wider range of education levels, having 2 participants with their highest level of education being middle school, 9 with high school, 8 with an undergraduate degree or professional qualification, and 3 with a graduate degree. The allistic group had 10 whose highest level of education was high school and 10 with an undergraduate degree or professional qualification, and none with either middle school or a graduate degree as their highest level of education. This is most likely due to our different sampling methods for the two groups; the allistic group was entirely comprised of undergraduate university students, thus none could have only completed middle school and individuals from a sample such as this would be very unlikely to have already completed a graduate level degree, while the autistic group was not restricted to university students and thus was more likely to include a wider range of education levels. Participant characteristics for highest education level, bilingualism/monolingualism, and gender can be found in table 2.2.

Table 2.2

Participant Characteristics: Frequency distributions

Variables	**Autistic**	**Allistic**
Highest Education Level		
Middle school	2	0
High school	9	10
Undergraduate degree/professional qualification	8	10
Graduate degree	3	0
Bilingual	7	17
Monolingual	15	3
Gender		
Female	7	11
Male	6	9
Non-binary	9	0

2.2 Procedure

This study was conducted during the COVID-19 pandemic, so data collection was facilitated via online video calls. Participants joined a Zoom meeting and completed the consent form on Google Forms. Once the consent form was read and filled out, participants then filled out the language background questionnaire on another Google Form (see materials). Next, the TONI-3 version A was completed (see materials); to do the TONI-3 through Zoom, I shared my screen with the participant on a digital PowerPoint version of the TONI-3 with the possible answers numbered. Participants stated which number they thought was the right answer and then I moved to the next slide, until the end of the TONI-3 or until the participant had three wrong answers within five consecutive questions. Next, the participants completed the two narrative tasks; the order of the narrative tasks was counterbalanced between participants within each group. For the TNL-2 task (see materials), I shared my screen on the Zoom call to show the participants the 'Aliens' picture from task 6 of the TNL and asked the participants to tell a story based on the picture. For the IBP narrative task (see materials), I again shared my screen to show the participants a slide with the prompt and asked them to tell a personal story related to a hobby or interest of theirs. For both narratives, participants were given time to think of what story they wanted to tell and started orally telling their narratives when they were ready. Finally, the participants completed the SRS-2 on Google Forms (see materials) and then the zoom meeting ended and the participants were sent their credits or gift card.

2.3 Materials

2.3.1 Background Questionnaire

This questionnaire was created for this study and served to collect information about the participants' age, diagnoses, gender, education level, country of residence, and reading habits, as well as what languages the participants knew and what their proficiency in them was. Regarding the latter, all participants who were included in the study were proficient in English. The full questionnaire can be found in Appendix B.

2.3.2 TONI-3 (Brown, et al.,1997)

The Test of Nonverbal Intelligence 3 consists of 45 matrix problems which the participant solves by recognizing patterns. The test ends when either the participant has answered all 45 matrices or when the participant has made three wrong answers within five consecutive matrices. Participants score a 1 for correct answers and a 0 for incorrect answers; if the test ends early all matrices beyond the last question they completed are not included in scoring. The number of correct answers is then calculated to find the raw total score which is then converted into the deviation quotient based on the participant's age. Version A of the TONI-3 was used, which takes on average about fifteen minutes to complete.

2.3.3 SRS-2 (Constantino & Gruber, 2012)

The Social Responsiveness Scale is a questionnaire used to measure autistic traits and is comprised of 65 statements to which participants answer by choosing either 'Not true', 'Sometimes true', 'Often true', and 'Almost always true'. Participants scored between zero and three on each question; the scores were added up to find the total raw score, which is then converted into a T-score. T-scores are classified into four ranges of severity, normal (≤59T), mild (60T-65T), moderate (66T-75T), and severe (≥76T). The version of the SRS-2 that was used in this study was the adult self-report form.

2.3.4 TNL-2 (Gillam & Pearson, 2017)

The Test of Narrative Language 2 is a measure of narrative language production originally intended for and normed with children for clinical use. The section of the TNL used in this study was the *Aliens* story, which was used for the production of fictional stories based on a picture. Since I did not analyze story macrostructure, the TNL test scoring was not used in the study.

2.3.4 Interest-Based Personal Narrative

The IBP narrative task was constructed for this study. Participants were asked to tell a story which had happened to them in the past, had a beginning, middle, and end, and was related to a hobby or interest they had. Participants were given the prompt 'tell a story about the first time that you encountered your hobby or special interest' but were told they did not have to do this prompt exactly as it

was just an example, but to tell any story from their life that was related to one of their hobbies or special interests.

2.4 Narrative data

2.4.1 Transcription

Both narratives were transcribed using the CHAT/CLAN program (MacWhinney, 2000). Ten percent of the narratives were transcribed by a secondary transcriber and the original word count, reliability word count, and number of differences between transcriptions were calculated. The number of differences was divided by the original word count and the average was calculated to show a reliability of 94.41% with a standard deviation 3.925%.

2.4.2 Measuring TNW, NDW, and MLU

TNW and NDW were both found using the *freq* command in CLAN while MLU was found by adding a morphological tier with *mor*.cha* and then using *mlu*.cha* to calculate MLU.

2.4.3 Coding for Internal State Terms

The narratives were examined for usage of ISTs. Each use of an IST was counted and categorized into one of five types: cognitive, consciousness, emotional, perceptual, and physiological. Words were counted when they described a character's internal state and occurred within the story. Some general rules were made to decide which words would be accepted and which category they fit into, following the guidelines in Govindarajan (2019). Imperatives were not included (e.g., "calm down", "look at that"), nor were words included which were in general description and didn't refer to characters in the story or were in hypothetical uses (e.g., "it would be difficult to comprehend", "you learn about it in school", "without it being assumed", "who would have thought", "one should be wary", "if you (general) want to do X"). Furthermore, phrases such as "open minded" were not included as these were describing a character and not referring to a current internal state of the character. Any possible IST uses where the surrounding phrase was inaudible were not included due to this making it impossible to ascertain whether the usage should be included or not. Finally, the word "feel" could fall into multiple categories based on how it was used; for example, it was counted as cognitive when being used as a synonym for "think" such

as in “I feel like this is bad”, as physiological when referring to body health as in “I ended up feeling better after treatment”, or emotional such as when referring to feeling guilt “felt bad for doing it”. See Table 3 for examples of ISTs in each category.

Table 2.3

IST Categories and Examples

Category	**Cognitive**	**Consciousness**	**Emotional**	**Perceptual**	**Physiological**
Description	Mental states and intentions	States of consciousness	Labeling emotions	Perceptions	Physical sensations
Examples	Think	Alive	Happy	See*	Sore
	Know	Dead	Sad	Look*	Hungry
	Want	Awake	Mad	Hear*	Tired
	Assume	Asleep	Excited	Taste	
	Understand	Dream	Love	Watch	
	Believe	Subconsciously	Scared	Peek	
	Learn	Drunk	Enjoy	Notice	
	Decide	High (on drugs)	Proud	Overhear	
	Psychological	Lucid	Mood		
	Sympathy		Marvel		
	Choose		Empathy		
	Focus		Intrigued		
	Expect		Motivation		
	Figure out		Trust		
	Guess		Reluctant		
	Plan (verb)		Aggrieved		
	Intent		Comforting		
	Unaware				
	Devised				

Some words were counted as an IST in some uses and not counted in other uses, thus each instance of a possible IST was examined within the larger sentence context to ensure that it was being used to refer to a character's internal state. See Table 4 for examples of accepted and rejected uses of words.

Table 2.4

IST Decision Guidelines for Words with Multiple Uses

Word	**Accepted use**	**Rejected use**
look	Perceiving sight "looked at the sky"	Descriptions "she looked like" Expressions "looked at her as if to say", "looked on with excitement" Non-literal literal "look" to mean "learn about" Research: "look into other ways"
see	Perceiving sight "they see a"	Experiential "I've never seen X before", "see what happens" Visit: "I went to see my mom"
smell	Perceiving smell "she smelled"	Noun: "caught a smell"
hurt	Physiological/emotional hurt "felt hurt"	Verb: "to hurt"
hear	Perceiving audio "they heard a sound"	Non-literal: "heard the news"
Wish	Wanting "he wished to be a star"	Goodbye: "he wished them a nice picnic"
Caring	Emotion "he cared about it"	Action: "He took care of the apartment"
Distract	Felt distracted	Verb: To distract, "X distracted X"
Excitement	Felt excitement, their excitement	Adverbial: "In the excitement", ...
mind	Thinking "in my mind"	All other uses

2.5 Research Questions and Hypotheses

Below are my detailed research questions and hypotheses.

1. Are there differences in the TNW, NDW, use of ISTs, both of total ISTs and of specific IST categories, and MLU in the TNL or IBP narratives between autistic and allistic adults?

Since autistic individuals of all ages have performed worse on narrative language in previous literature on TNW and use of ISTs, I expect the autistic adults will have a lower TNW and use of ISTs on the TNL than the allistic adults. I expect MLU in both narratives will be similar across groups as it is included as a control variable; this is because, despite differences in MLU being found in autistic children's narratives, MLU measures morphosyntax and research on autistic language outcomes into adulthood have found no deficit in structural language in autistic adults without a concurrent language impairment. Thus, since all the participants are adults without a diagnosed, concurrent language impairment, MLU is unlikely to show differences between the groups. While differences for NDW have not been found yet for adults, this measure has not been used in studies with adults yet and it has been found that autistic children have worse NDW than allistic children. Furthermore, NDW is closely connected to TNW (as the more words you say, the more different words you say), so I believe that the results for NDW will be similar to TNW throughout and dissimilar to MLU. Additionally, for the IBP narrative, I expect autistic adults will have a similar TNW, NDW, use of ISTs, and MLU to allistic adults due to its interest-based prompt, as Siverston's 2010 study showed interest-based prompts improve performance for autistic individuals.

2. Do autistic adults show superior TNW, NDW, use of ISTs, both of total ISTs and of specific IST categories, and MLU in their IBP narratives as compared to their TNL? Do autistic and allistic adults pattern the same in within group comparison of TNW, NDW, use of ISTs, and MLU between the TNL and the IBP narrative?

I expect that allistic adults will have small or no differences in TNW, NDW, and use of ISTs between their TNL and their IBP narratives, but that autistic adults will have higher TNW, NDW, and use of ISTs on their IBP narratives than their TNL, similarly to Siverston's results (2010). I expect both groups to have small or no differences in their MLU between narrative tasks as all participants are adults.

3. What are the associations between severity of autism symptoms as measured by score on the SRS-2 and TNW, NDW, and use of ISTs on the fictional and IBP narrative?

Since previous literature has shown autistic individuals perform worse on narrative tasks and the SRS-2 measures autistic traits, I expect that on the TNL, a higher SRS-2 score will be associated with lower TNW, NDW, and less use of ISTs, but not with lower MLU, nor on any of the measures for the IBP narrative.

4. What are the associations between reading for pleasure or for work and narrative TNW, NDW, use of ISTs, and MLU on the fictional and IBP narrative?

Previous literature has shown some evidence that individuals who read more often have higher narrative language skills, so I expect that a higher frequency of reading will predict higher TNW, NDW, use of ISTs, and MLU on both narrative tasks for all participants.

Chapter 3: Results

3.1 Descriptive Outcomes by Group and Narrative Type

In this section the descriptive outcomes including means, SDs, and ranges will be presented for TNW, NDW, ISTs, and MLU for each combination of narrative type and group (autistic IBP narratives, allistic IBP narratives, autistic fictional narratives, and allistic fictional narratives).

The descriptive outcomes for total number of words can be seen below in Table 3.1. For the IBP narrative, the autistic group used a mean of 602.2 total words with a range from 110-2006 and an SD of 534.54 while the allistic group used a mean total of 569.9 words with a range of 123-1562 and an SD of 357.76. For the TNL, the autistic group's mean total words was less than their IBP narratives, at only 234 words, with a range of 30-465 and an SD of 127.41. The allistic group had a mean total 413.5 words for their TNL with a range of 103-3184 and an SD of 653.05.

Table 3.1

TNW for each narrative type and group

	IBP			TNL		
Group	Mean	SD	Min-max	Mean	SD	Min-max
AUT	602.2	534.54	110-2006	234	127.41	30-465
ALL	569.9	357.76	123-1562	413.5	653.05	103-3184

The descriptive outcomes for number of different words for each combination of narrative type and group can be seen below in Table 3.2. The autistic group used a mean of 210.1 different words in their IBP narratives with a range of 73-531 and an SD of 122.63 and the allistic group used a mean of 206.2 different words with a range of 67-369 and an SD of 85.86. Similar to TNW outcomes, the autistic group had a larger difference than the allistic group in NDW between their IBP narrative and their TNL, in which the autistic group used a mean of 120.2 different words with a range of 28-199 and an SD of 54.03 and the allistic group used a mean of 186.2 different words with a range of 61-620 and a SD of 116.99.

Table 3.2

NDW for each narrative type and group

	IBP			TNL		
Group	Mean	SD	Min-max	Mean	SD	Min-max
AUT	210.1	122.63	73-531	120.2	54.03	28-199
ALL	206.2	85.86	67-369	186.2	116.99	61-620

The descriptive outcomes for total ISTs for each combination narrative type and group can be seen below in Table 3.3. In the IBP narrative, the autistic group used a mean total of 9.04 ISTs with a range of 0-39 and an SD of 10.17. The mean number of ISTs for allistic group in the IBP narrative was only slightly higher at 10.40, with a range of 0-43 and an SD of 9.83. The difference between groups was larger for the TNL, though, with the autistic group having mean of 7.22, a range of 1-23, and an SD of 5.69 and the allistic group having a mean of 15.20, a range of 4-51, and an SD of 11.69.

Table 3.3

ISTs for each narrative type and group

	IBP			TNL		
Group	Mean	SD	Min-max	Mean	SD	Min-max
AUT	9.04	10.17	0-39	7.22	5.69	1-23
ALL	10.40	9.83	0-43	15.20	11.69	4-51

The descriptive outcomes for mean length of utterance for each combination of narrative type and group can be seen below in Table 3.4. MLU was similar across both narrative type and group. The autistic group had a mean MLU of 12.80 for their IBP narrative, with a range of 9.55- 24.38 and an SD of 3.27, while the allistic group had a mean of 11.92 with a range of 8.75- 15.52 and an SD of 1.73. For the TNL, the autistic group had a mean MLU of 11.70 with a range of 7.96-19.38 and an SD of 2.71 and the allistic group had a mean of 11.56 with a range of 7.27- 17.76 and an SD of 2.34.

Table 3.4

MLU for each narrative type and group

	IBP			TNL		
Group	Mean	SD	Min-max	Mean	SD	Min-max
AUT	12.80	3.27	9.55- 24.38	11.70	2.71	7.96-19.36
ALL	11.92	1.73	8.75- 15.52	11.56	2.34	7.27- 17.76

3.2 Regression Analyses of Performance by Group and Narrative Type

Linear mixed modelling using the lmer package in R (version 4.2.2) was used to compare narrative microstructure measures between groups and between narrative type. The glmer function (poisson regression), included in the lmer package, was used for the analysis of TNW, ND and ISTs due to the non-normal distribution of the data (count data). The lmer function was used for MLU as this is a score, not count data. All models had group (autistic, allistic), narrative type (IBP narrative, TNL), and the interaction between group and narrative type as fixed effects and participant as a random effect. These fixed effects will address research questions one and two (section 2.5) on whether there are differences in narrative outcomes between autistic and allistic adults on the two narratives and whether there are differences in narrative outcomes for the autistic group between their fictional and IBP narratives and if this differs from allistics. Dependent variables were TNW, NDW, total ISTs, cognitive ISTs, emotional ISTs, perceptual ISTs, and MLU. The R script used and full model outputs for each analysis can be found in Appendix C.

3.2.1 Total Number of Words

This model showed a significant effect of narrative type (*B*= -0.07, *z*= -5.44, *p*= 5.26e-08) and the interaction between group and narrative type (*B*= -0.86, *z*= -40.99, *p*= < 2e-16). Model results can be found in Table 3.5 and the interaction plotted in Figure 3.1. This interaction showed that, while the allistic participants used a similar TNW in both of their stories, the autistic participants used fewer words for the

TNL than they did for the IBP narrative. Furthermore, the autistic adults used a similar number of words as the allistic adults for the IBP narrative, while they used fewer words than the allistic adults on the TNL.

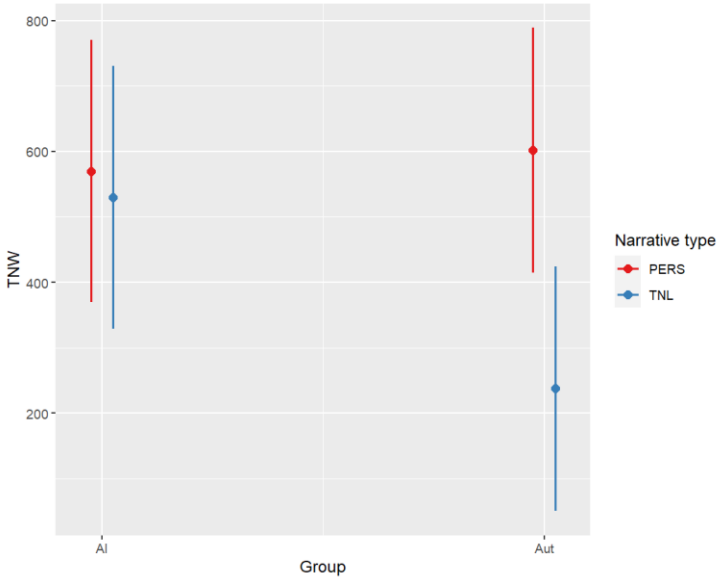
Table 3.5

Modeling outcomes for TNW

	Estimate	Stn error	z-value	p-value
Group	0.03	0.20	0.16	0.87
Narrative Type	-0.07	0.01	-5.44	5.26e-08 ***
Group X Narrative Type	-0.86	0.02	-40.99	< 2e-16 ***

Figure 3.1

Interaction of group and narrative type on total number of words



3.2.2 Number of Different Words

This model similarly showed a significant effect of narrative type (*B*= 0.10, *z*= -4.51, *p*= 6.65e-06 ***) and the interaction between narrative type and group (*B*=-0.46, *z*= -13.92, *p*= < 2e-16 ***). Model results can be found in Table 3.6 and the interaction plotted in Figure 3.2. Similar to TNW, this interaction

showed that for autistic individuals, the NDW used in their stories was far greater for the personal IBP narrative than the TNL, while the allistic participants had a much smaller difference in NDW between their stories. In addition, autistics had similar NDW to the allistic adults for the IBP narrative but less than the allistic adults on the TNL.

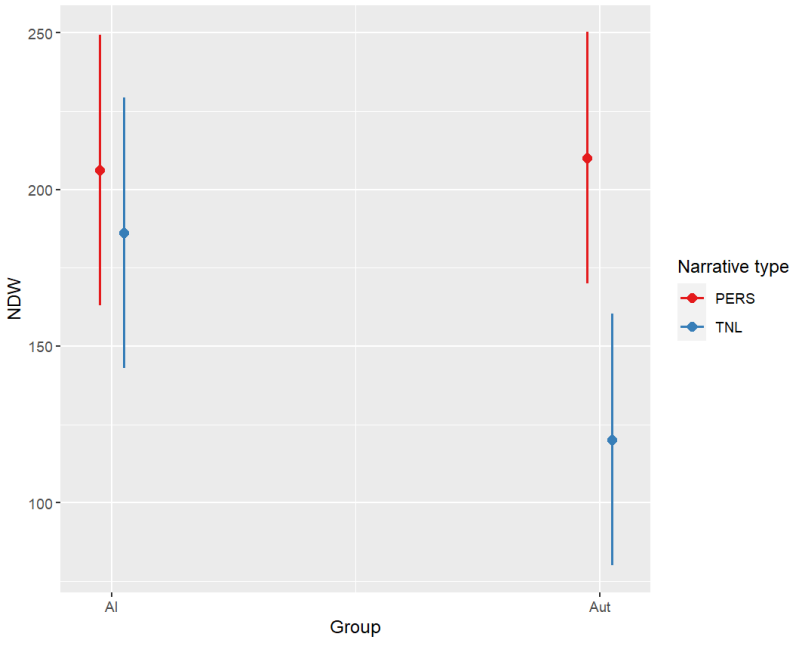
Table 3.6

Modeling outcomes for NDW

	Estimate	Stn error	z-value	p-value
Group	-0.00	0.14	0.03	0.98
Narrative Type	-0.10	0.02	-4.51	6.65e-06 ***
Group X Narrative Type	-0.46	0.03	-13.92	< 2e-16 ***

Figure 3.2:

Interaction of group and narrative type on number of different words



3.2.3 Internal State Terms

This model showed a significant effect of both narrative type (*B*=3.8, *z*= 4.25, *p*= 2.13e-05 ****) and the interaction between group and narrative type (*B*= -0.61, *z*= -4.44, *p*= 8.96e-06 ***). Model results can be found in Table 3.7 and the interaction plotted in Figure 3.3. This interaction showed that, on the TNL, the autistic participants used very few ISTs while the allistic group used many more. But, when doing the IBP narrative, the autistic participants used slightly more ISTs than they did on the TNL while the allistic participants used less than on the TNL, thus bringing the two groups much closer on IST usage in the IBP narrative than on the TNL. In contrast with the analyses for TNW and NDW, the difference in IST use between the two narratives for the autistic adults was narrower.

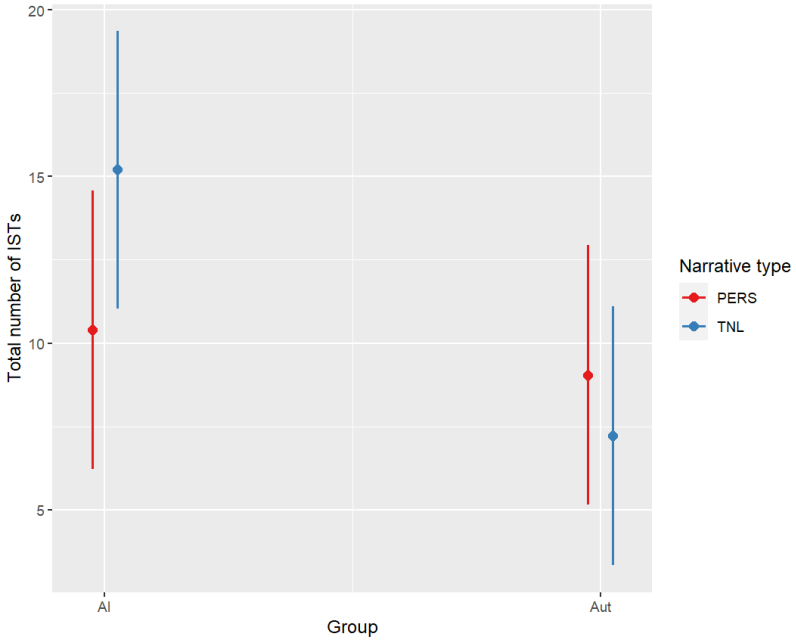
Table 3.7

Modeling outcomes for ISTs

	Estimate	Stn error	z-value	p-value
Group	-0.18	0.23	-0.73	0.48
Narrative Type	0.38	0.09	4.25	2.13e-05 ***
Group X Narrative Type	-0.61	0.14	-4.44	8.96e-06 ***

Figure 3.3

Interaction of group and narrative type on internal state terms



The IST analysis was further broken down by category, following Govindarajan (2021). ISTs within the consciousness and physiological categories were not analyzed due to low usage of these words within the narratives. However, cognitive, emotional, and perceptual ISTs were each individually analyzed.

The model for cognitive ISTs showed significance for the interaction between group and narrative type (*B*= -0.68, *z*= -3.63, *p*= 0.000279). Model results can be found in Table 3.8 and the interaction plotted in Figure 3.4. This interaction showed that the allistic participants used a similar number of cognitive ISTs on both the TNL and the IBP narrative (slightly more for the TNL); whereas, the autistic participants used a similar number of cognitive ISTs as the allistic adults for the IBP narrative and used fewer cognitive ISTs on the TNL than the IBP narrative.

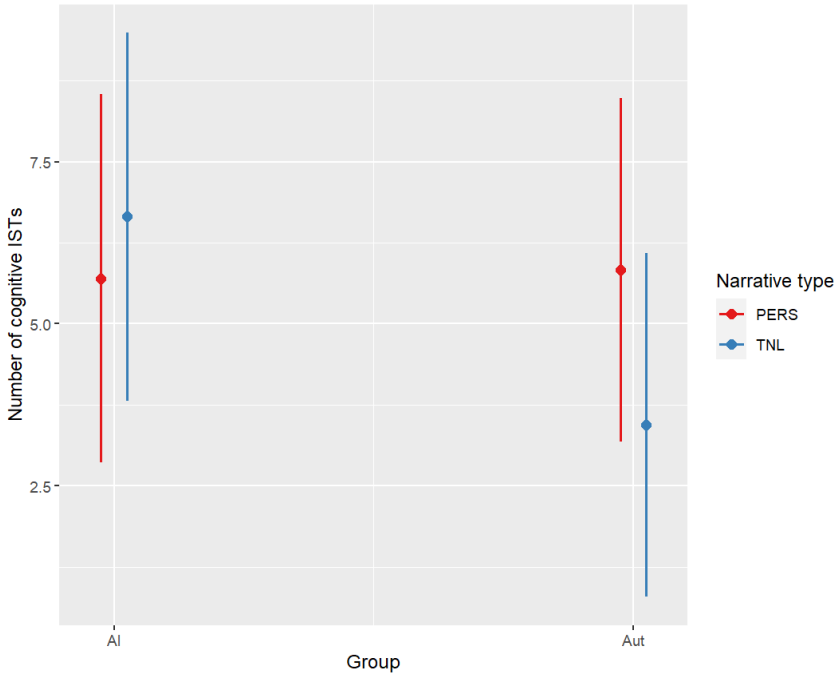
Table 3.8

Modeling outcomes for cognitive ISTs

	Estimate	Stn error	z-value	p-value
Group	-0.06	0.29	-0.22	0.826685
Narrative Type	0.15	0.13	1.23	0.220411
Group X Narrative Type	-0.68	0.19	-3.63	0.000279 ***

Figure 3.4

Interaction of group and narrative type on cognitive internal state terms



The model for emotional ISTs did not converge, possibly due to the distribution of the data across participants, thus no results are reported.

The model for perceptual ISTs showed significance for both group ((*B*= -0.98, *z*= -2.27, *p*= 0.0232 *) and narrative type (*B*= 1.26, *z*= 5.77, *p*= 8e-09 ***), but no significant interaction. Model results for

perceptual ISTs can be found in Table 3.9. These results showed that the allistic group used far more perceptual ISTs than the autistic group and that more perceptual ISTs were used for the TNL than for the IBP narrative, across groups.

Table 3.9

Modeling outcomes for perceptual ISTs

	Estimate	Stn error	z-value	p-value
Group	-0.98	0.43	-2.27	0.0232 *
Narrative Type	1.26	0.22	5.77	8e-09 ***
Group X Narrative Type	-0.46	0.40	-1.14	0.2531

3.2.4 Mean Length of Utterance

The analysis of MLU showed no significant effects from group, narrative type, nor their interaction. Model results for MLU can be found in Table 3.10.

Table 3.10

Modeling outcomes for MLU

	Estimate	Stn error	t-value	p-value
Group	0.88	0.58	1.10	0.27
Narrative Type	-0.34	0.80	-0.46	0.65
Group X Narrative Type	-0.74	0.78	-0.70	0.49

3.3 Factors Influencing Performance on Narrative Tasks

Other factors including SRS score and frequency of reading for pleasure and for work were analyzed to see whether they influenced narrative outcomes. Spearman correlations between SRS T-score and microstructure measures on both the TNL and the IBP narratives, and between frequency of reading and microstructure measures on both the TNL and the IBP narratives were run. For each variable

and narrative type, three spearman correlations were run, one with all of the participants, one with just the autistic participants, and one with just the allistic participants. Correlations with all participants were run to increase the power of the analysis and see if any correlations could be found with all participants. The separated autistic and allistic correlations were run to see if the two groups differed in these correlations. All analyses were completed in R (version 4.2.2). The R script used and full outputs for each correlation can be found in Appendix C.

First, correlations between TNW, NDW, ISTs, and MLU in both the TNL and the IBP narrative with SRS T-score for all the participants together was run. A matrix for the correlations for the TNL can be found below in Table 3.11 and for the personal narrative in Table 3.12. Scatter plots for each narrative measure and SRS T-score can be found in Figure 3.5 to Figure 3.8 for the TNL and Figure 3.9 to Figure 3.12 for the IBP narrative. SRS T-score was found to be significantly and negatively correlated to NDW (r = -0.35*, p < 0.02) and with use of ISTs (r = -0.36***, p < 0.02) in the TNL, but no significant correlations with SRS T-score were found in the IBP narrative.

Table 3.11

Correlations between TNW, NDW, ISTs, MLU, and SRS T-score for the TNL for autistic and allistic participants collectively

	TNW	NDW	ISTs	MLU	SRS T-score
TNW	-	0.94***	0.55***	0.09	-0.26
NDW		-	0.63***	0.13	-0.35*
ISTs			-	0.09	-0.36***
MLU				-	0.04
SRS T-score					-

Figure 3.5

SRS T-score vs TNW for the TNL

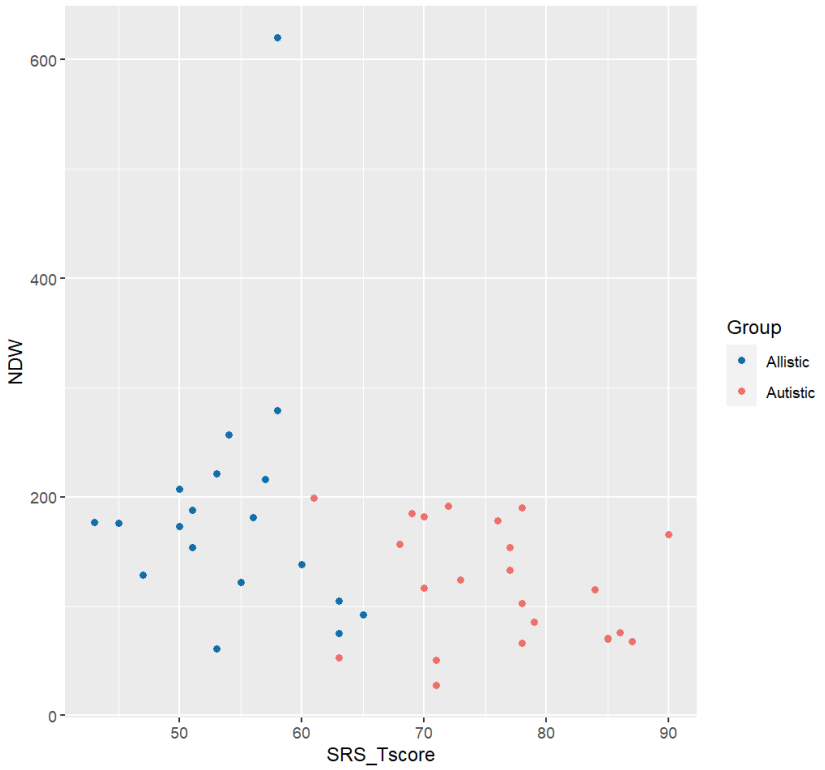


Figure 3.6

SRS T-score vs NDW for the TNL

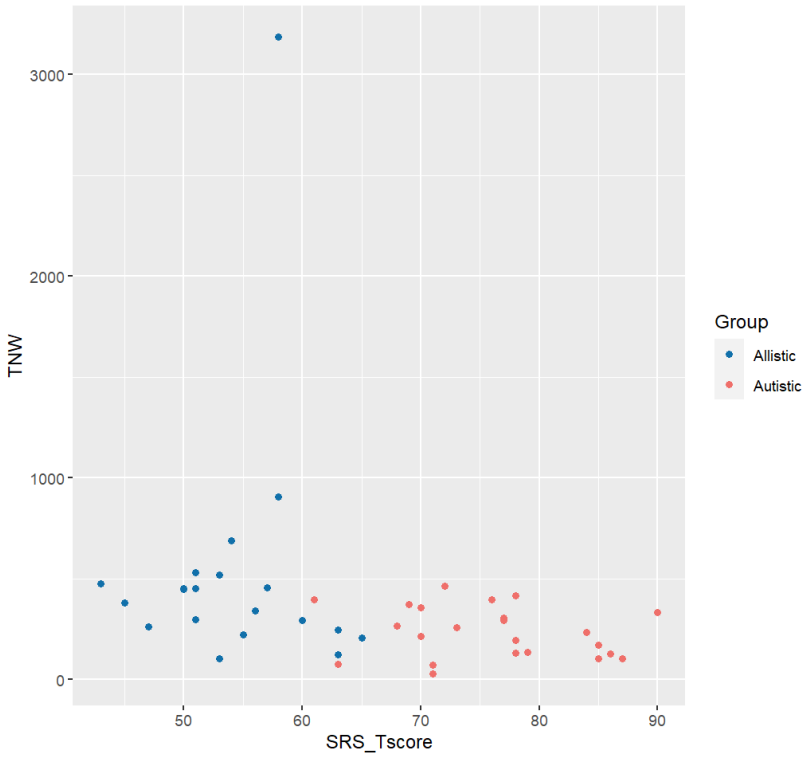


Figure 3.7

SRS T-score vs Total ISTs for the TNL

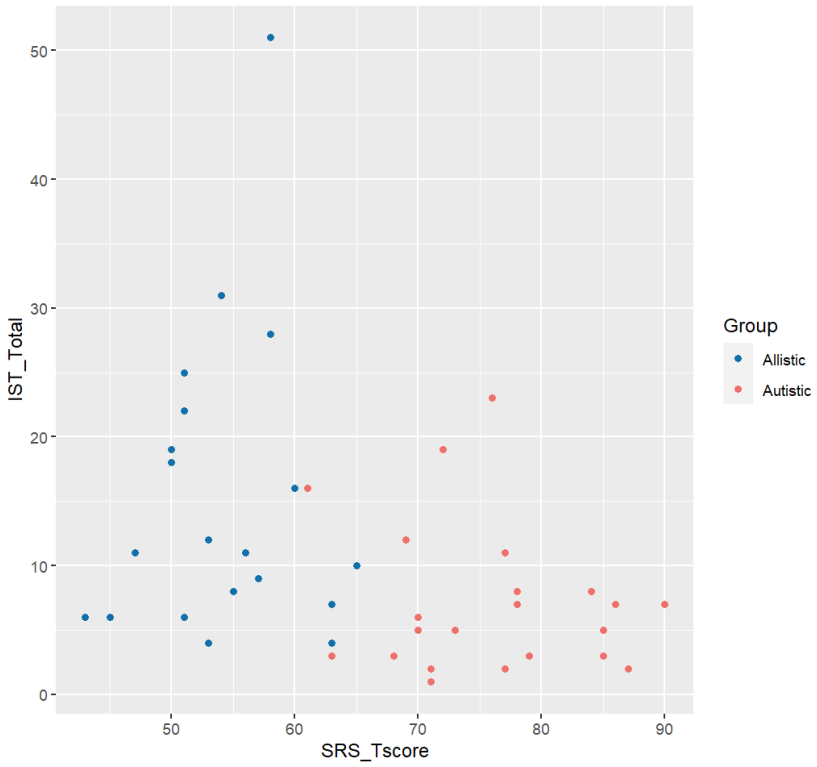


Figure 3.8

SRS T-score vs MLU for the TNL

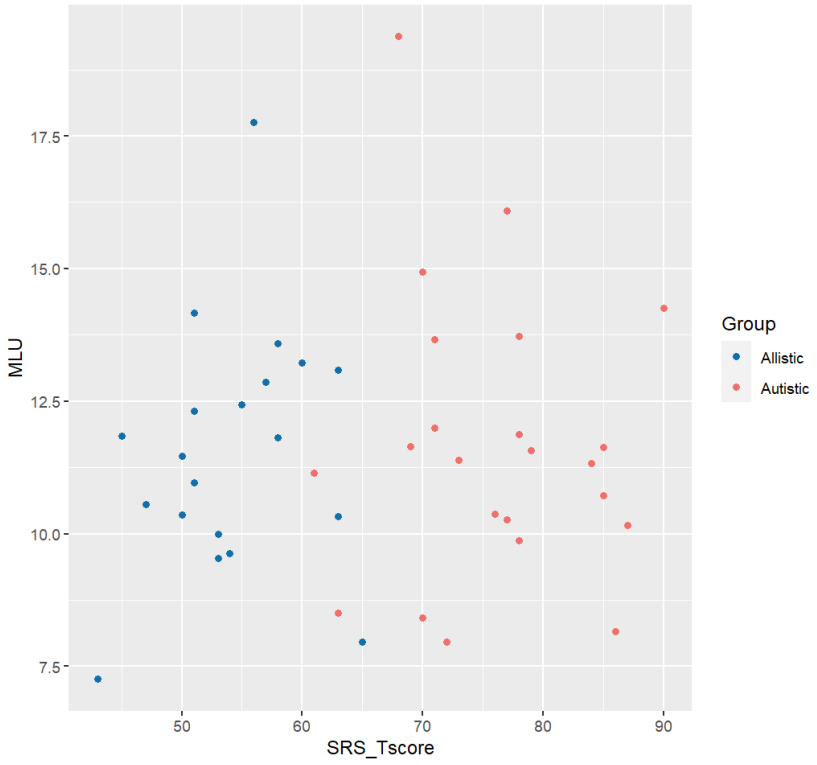


Table 3.12

Correlations between TNW, NDW, ISTs, MLU, and SRS T-score for the IBP narrative for autistic and allistic participants collectively

	TNW	NDW	ISTs	MLU	SRS T-score
TNW	-	0.96***	0.81***	-0.16	-0.01
NDW		-	0.76***	-0.17	-0.03
ISTs			-	-0.08	-0.07
MLU				-	0.17
SRS T-score					-

Figure 3.9

SRS T-score vs TNW for the IBP Narrative

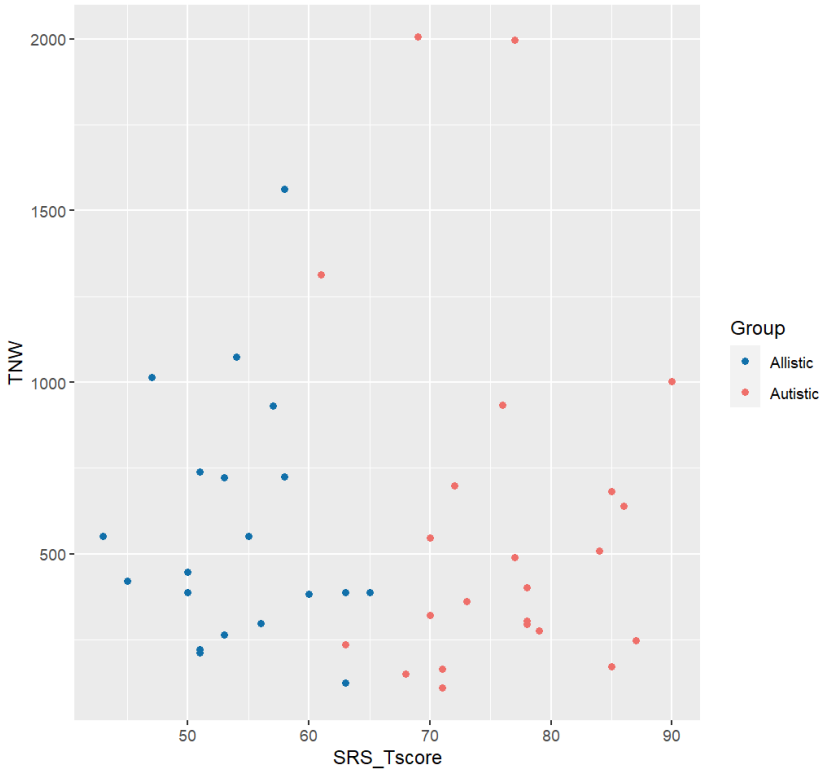


Figure 3.10

SRS T-score vs NDW for the IBP Narrative

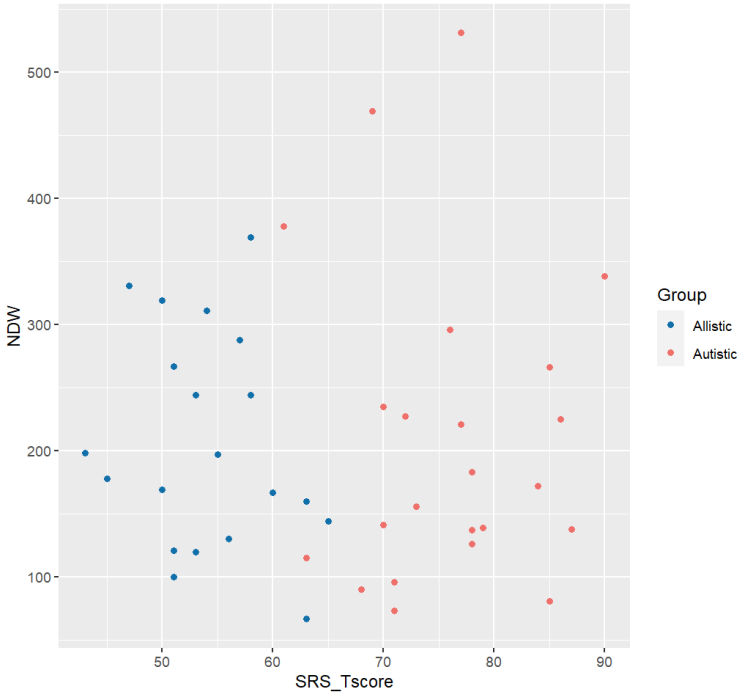


Figure 3.11

SRS T-score vs Total ISTs for the IBP Narrative

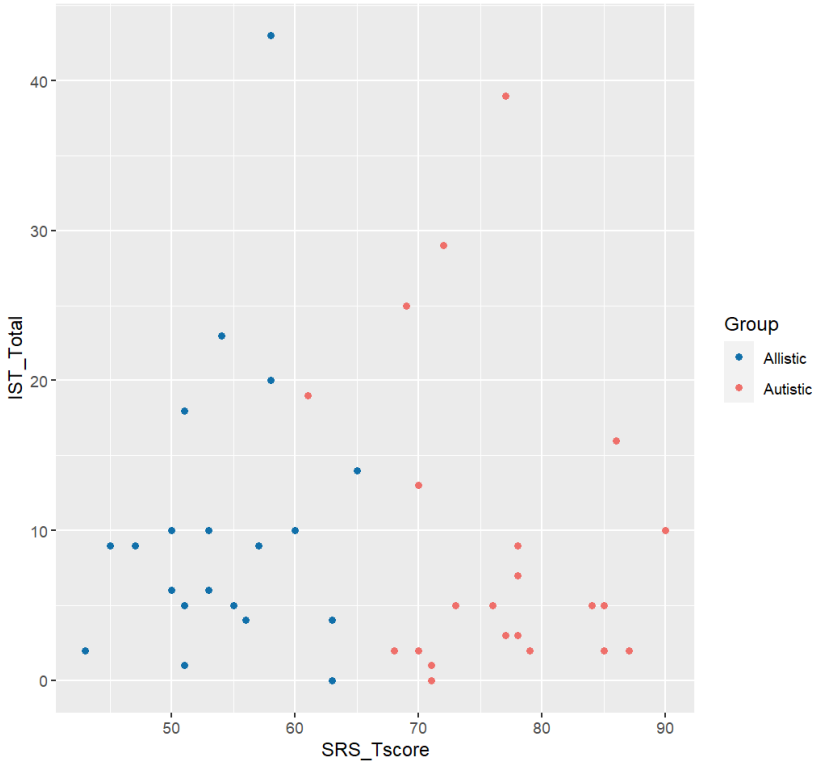
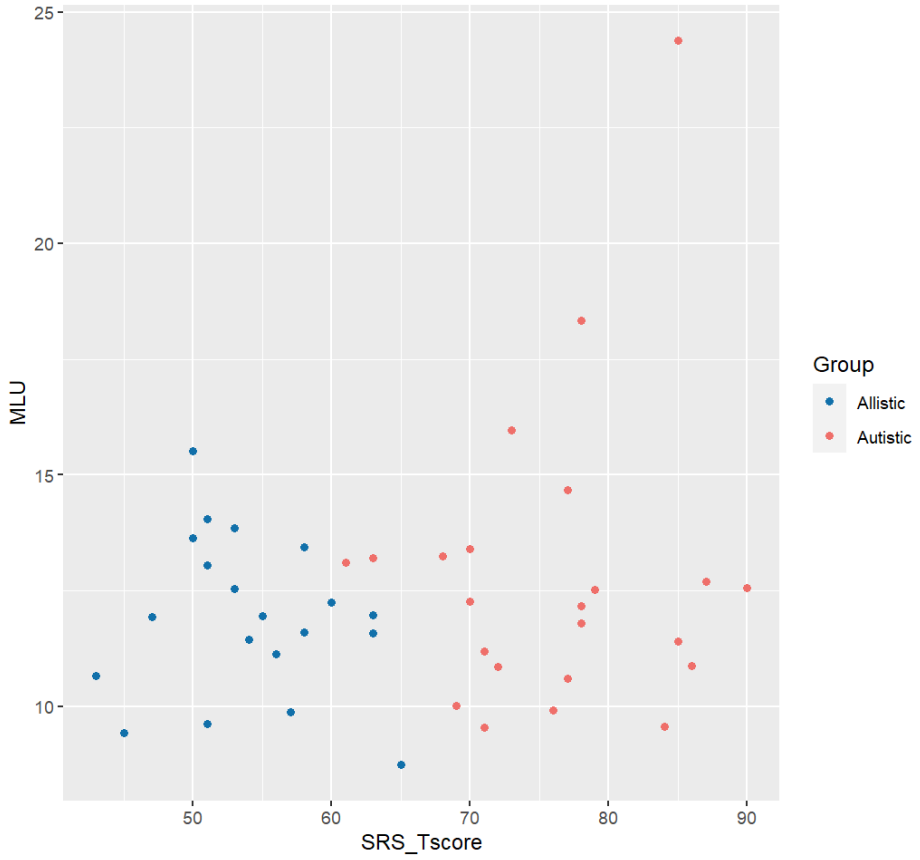


Figure 3.12

SRS T-score vs Total MLU for the IBP Narrative



Next, correlations between TNW, NDW, ISTs, and MLU in both the TNL and the IBP narrative with SRS T-score were run for the autistic participants and the allistic participants separately. The autistic group's correlation matrix for the TNL can be found below in Table 3.13 and for the personal narrative in Table 3.14, while the allistic group's correlation matrix can be found below in Table 3.15 and for the personal narrative in Table 3.16. When correlations were run separately, no significant correlations were found between SRS scores and the microstructure measures.

Table 3.13

Correlations between TNW, NDW, ISTs, MLU, and SRS T-score for the TNL for autistic participants

	TNW	NDW	ISTs	MLU	SRS T-score

TNW	-	0.98***	0.73***	-0.04	-0.20
NDW		-	0.65***	0.06	-0.25
ISTs			-	-0.37	-0.17
MLU				-	-0.07
SRS T-score					-

Table 3.14

Correlations between TNW, NDW, ISTs, MLU, and SRS T-score for the IBP narrative for autistic participants

	TNW	NDW	ISTs	MLU	SRS T-score
TNW	-	0.98***	0.83***	-0.19	-0.09
NDW		-	0.81***	-0.22	-0.03
ISTs			-	-0.09	-0.14
MLU				-	0.14
SRS T-score					-

Table 3.15

Correlations between TNW, NDW, ISTs, MLU, and SRS T-score for the TNL for allistic participants

	TNW	NDW	ISTs	MLU	SRS T-score
TNW	-	0.97***	0.49*	0.18	0.08
NDW		-	0.55*	0.22	0.01
ISTs			-	0.08	0.08
MLU				-	0.20
SRS T-score					-

Table 3.16

Correlations between TNW, NDW, ISTs, MLU, and SRS T-score for the IBP narrative for allistic participants

	TNW	NDW	ISTs	MLU	SRS T-score
TNW	-	0.90***	0.82***	-0.10	-0.06
NDW		-	0.70***	-0.05	-0.22
ISTs			-	-0.05	0.17
MLU				-	-0.15
SRS T-score					-

Relations between frequency of reading for pleasure and frequency of reading for work and TNW, NDW, ISTs, and MLU for all the participants together were analyzed. A matrix for the correlations for the TNL can be found below in Table 3.17 and for the IBP narrative in Table 3.18. No significant correlations were found for when participant groups were combined.

Table 3.17

Correlations between TNW, NDW, ISTs, MLU, as well as reading for pleasure and reading for work for the TNL narrative for autistic and allistic participants collectively

	TNW	NDW	ISTs	MLU	Reading for pleasure	Reading for work
TNW	-	0.94***	0.55***	0.56	-0.13	0.10
NDW		-	0.63***	0.13	-0.22	0.21
ISTs			-	-0.09	-0.28	0.04
MLU				-	-0.00	-0.01
Reading for pleasure					-	-0.09

Reading for work						-

Table 3.18

Correlations between TNW, NDW, ISTs, MLU, as well as reading for pleasure and reading for work for the IBP narrative for autistic and allistic participants collectively

	TNW	NDW	ISTs	MLU	Reading for pleasure	Reading for work
TNW	-	0.96***	0.81***	-0.16	-0.01	0.10
NDW		-	0.76***	-0.17	-0.01	0.17
ISTs			-	-0.08	-0.05	-0.01
MLU				-	-0.05	-0.07
Reading for pleasure					-	-0.09
Reading for work						-

Next, correlations between TNW, NDW, ISTs, and MLU in both the TNL and the IBP narrative with frequency of reading for pleasure and frequency of reading for work were run for the autistic participants and the allistic participants separately. The autistic group's correlation matrix for the TNL can be found below in Table 3.19 and for the personal narrative in Table 3.20, while the allistic group's correlation matrix can be found below in Table 3.21 and for the personal narrative in Table 3.22. With the groups separated, three significant correlations with reading were found: NDW and reading for work were positively correlated (r = 0.46*, p <0.03) on the TNL for the autistic group, MLU and reading for pleasure were negatively correlated (r = -0.54*, p < 0.01) on the TNL for the allistic group, and MLU and reading for work were positively correlated (r = 0.50*, p <0.03) on the IBP narrative for the allistic group.

Table 3.19

Correlations between TNW, NDW, ISTs, MLU, as well as reading for pleasure and reading for work for the TNL narrative for autistic participants

	TNW	NDW	ISTs	MLU	Reading for pleasure	Reading for work
TNW	-	0.98***	0.73***	-0.04	-0.36	0.39
NDW		-	0.65***	0.06	-0.34	0.46*
ISTs			-	-0.37	-0.38	0.06
MLU				-	0.30	0.11
Reading for pleasure					-	-0.11
Reading for work						-

Table 3.20

Correlations between TNW, NDW, ISTs, MLU, as well as reading for pleasure and reading for work for the IBP narrative for autistic participants

	TNW	NDW	ISTs	MLU	Reading for pleasure	Reading for work
TNW	-	0.98***	0.83***	-0.19	0.01	0.20
NDW		-	0.81***	-0.22	0.06	0.26
ISTs			-	-0.09	-0.02	0.08
MLU				-	-0.10	-0.22
Reading for pleasure					-	-0.11

Reading for work						-

Table 3.21

Correlations between TNW, NDW, ISTs, MLU, as well as reading for pleasure and reading for work for the TNL narrative for allistic participants

	TNW	NDW	ISTs	MLU	Reading for pleasure	Reading for work
TNW	-	0.97***	0.49*	0.18	-0.13	0.03
NDW		-	0.55*	0.22	-0.21	0.04
ISTs			-	0.08	-0.31	-0.02
MLU				-	-0.54*	-0.25
Reading for pleasure					-	-0.04
Reading for work						-

Table 3.22

Correlations between TNW, NDW, ISTs, MLU, as well as reading for pleasure and reading for work for the IBP narrative for allistic participants

	TNW	NDW	ISTs	MLU	Reading for pleasure	Reading for work
TNW	-	0.90***	0.82***	0.10	-0.06	-0.14
NDW		-	0.70***	-0.05	-0.14	-0.05
ISTs			-	-0.05	-0.11	-0.18

MLU				-	0.11	0.50*
Reading for pleasure					-	-0.04
Reading for work						-

Chapter 4: Discussion

4.1. Study Summary

In this study, I examined the effects on narrative microstructure of incorporating special interests into narrative tasks. Autistic and allistic adults told a fictional narrative based on a picture from the TNL and an interest-based personal narrative. These narratives were analyzed for the microstructure elements of TNW, NDW, IST usage, and MLU. TNW measures story length, which has been found in the past to be shorter in autistic children and adults' narratives than allistics' narratives, while NDW measures lexical diversity, which has been found to be lower in narratives of autistic children than allistic children and not yet studied in autistic adults' narrative language. MLU is a measure of morphosyntax which examines the number of morphemes per utterance and, while it has been found to be lower in the narratives of autistic children than of allistic children, autistic adults without language impairment typically do not show differences in structural language measures such as MLU (Boucher, 2012). ISTs are specific words which refer to the internal states of characters within a narrative; previous literature studying autism and ISTs has had inconsistent results, but the majority of studies has found that autistic individuals across all age groups use ISTs in narrative language less than allistic individuals.

4.2. Research Questions 1 and 2

Due to the interconnected nature of my first and second research questions, they will be discussed together, first for story length and lexical diversity and then for ISTs. Research question 1 was "Are there differences in the TNW, NDW, use of ISTs, both of total ISTs and of specific IST categories, and MLU in the TNL or IBP narratives between autistic and allistic adults?". Based on previous literature, it was hypothesized that the autistic adults would have a shorter story length, less lexical diversity, and use fewer ISTs on the fictional narrative than the allistic adults, but that the groups would be similar on these measures on the IBP narrative due to its interest-based nature and the evidence that special interests have benefits for autistic people. It was hypothesized that the groups would have a similar MLU regardless of narrative type because structural language differences have not been found between autistic adults without language impairment and allistic adults. Lexical diversity in narratives also has not been studied in autistic adults yet and due to its relation and dependence to TNW, I believed it would

pattern the same as story length throughout. Research question 2 was “Do autistic adults show superior TNW, NDW, use of ISTs, both of total ISTs and of specific IST categories, and MLU in their IBP narratives as compared to their fictional narrative? Do autistic and allistic adults pattern the same in within-group comparison of these measures between the fictional and the IBP narratives?”. Based on previous literature, I hypothesized that, while allistic adults would have little differences in story length, lexical diversity, and use of ISTs between their fictional and their IBP narratives, the autistic adults would have longer stories, more lexical diversity, and more use of ISTs on their IBP narratives than on their fictional narrative and that both groups would have little differences in their MLU between narrative types.

4.2.1. Story Length and Lexical Diversity

It was found that autistic adults told shorter stories on the fictional narrative than allistic adults, but that autistic and allistic adults had a similar story length in the IBP narrative, as was expected. The autistic participants’ story length on the fictional narrative appears to be in accordance with the majority of previous literature (Baixauli et al., 2016; King et al., 2013; Geelhand et al., 2020; Barnes et al., 2009) which has shown autistic individuals having shorter story lengths in fictional narratives than allistics, both for children and adults. King et al. (2013) also showed autistic participants had shorter story length on personal narratives than allistic participants. However, on the IBP narrative in the current study, the autistic adults performed similarly to the allistic adults, which suggests that an interest-based prompt can elevate autistic narrative skills. This is supported by Barnes et al. (2009) and Sivertson (2010), who also showed a longer length on their interest-based tasks than their non-interest-based tasks.

Lexical diversity showed a similar pattern of results as story length, with the autistic adults having less lexical diversity in the fictional narrative than allistic adults, but the two groups having similar lexical diversity in the IBP narrative. The autistic individuals’ lexical diversity on the fictional narrative is consistent with prior literature which has reported worse performance on lexical diversity in autistic children on fictional narratives and personal narratives than allistic children (Baixauli et al., 2016; King et al., 2013). Unlike previous literature on non-interest-based narratives, the autistic individuals in this study’s performance for lexical diversity on the IBP narrative was similar to that of the allistic participants.

These results are in line with my first and second hypotheses that the autistic adults would only show deficits in the fictional narrative and that they would have superior performance on the interest-based personal narrative. This benefit of an interest-based prompt is likely a result of the story being based on the autistic participants' special interests boosting motivation to tell the story and interest in and enjoyment of the task. Autistic individuals also tend to have specialized knowledge in the areas of their special interest such that when prompted to tell a story involving their special interest, they may use more specific vocabulary. For example, one participant in this study told a story about going to a plant nursery and mentioned many scientific plant names. Thus, this study suggests that a special interest-based prompt gives autistic individuals more motivation to tell a story, which may increase story length and allows them to tap into specialized knowledge about their special interests which may increase lexical diversity.

4.2.2. ISTs

ISTs are an area of particular interest in autism research as the use of ISTs connects to the larger area of cognitive and emotional processing in autism. In the past, ISTs and other differences in social communication in autistic people were approached through the viewpoint of a deficit in theory of mind. Baron-Cohen first suggested that autistic individuals have a deficit in theory of mind and have no understanding of anything mental including thoughts and emotions. As such, it has been proposed that differences in IST usage and causal explanations of ISTs in autistic individuals' narrative language is a result of a theory of mind deficit (Capps et al,. 2000). However, Chapple et al. (2021) ran a study where autistic and allistic individuals read and discussed a book together and found that autistic individuals can empathize with allistic individuals' perspectives and engage emotionally with literature. Additionally, Ben-David et al. (2020) found no differences in autistic and allistic undergraduate students in their ability to identify emotions from spoken sentences. These findings are inconsistent with a theory of mind deficit in autistic people. More recently, the double empathy problem, which states that while autistic individuals often lack understanding of allistic people, so do allistic individuals often lack understanding of autistic people (Milton, 2012), and relevance theory, which states people communicate with each other under the assumption that the speaker's utterance is relevant to the listener (Sperber & Wilson, 1995), have been suggested instead to explain the differences and communication difficulties between autistic and allistic

people. Williams (2021) suggests that the communication differences that have been labeled as impairments in autism are actually a result of autistic and allistic people having very different experiences which cause them to find different things more salient and relevant than each other, such that they say and interpret different things. For narratives, this may mean that autistic individuals find different things relevant to include when telling stories than allistic individuals, such as not finding internal states as important to relay, which could cause allistic people to find these stories strange.

For total ISTs in the current study, the autistic adults used fewer on the TNL than allistic adults; however, in the IBP narrative, the allistic participants used fewer ISTs than they did in the TNL, while the autistic participants used more than they did on the TNL, such that the two groups used a closer number of total ISTs on the IBP narrative, albeit the two groups were not as similar as they were for story length and lexical diversity on the IBP narrative. Again, this partially supports my hypotheses for research questions 1 and 2 as the autistic adults had lower scores than the allistics for ISTs on the fictional narrative but had improved performance on the interest-based narrative. However, it does not fully support my hypothesis because, despite using more ISTs on the IBP narrative than the fictional narrative, the autistic participants still used less than the allistic participants. In previous literature for fictional narratives, for the most part it has been found that autistic individuals of all ages use fewer ISTs (Baixauli et al., 2016; Barnes et al., 2009; Geelhand et al., 2020; Govindarajan, 2021); therefore, my results for the fictional narrative align with the majority of past studies. Thus far, for personal narratives in previous literature, it has also been found that autistic individuals perform worse on ISTs than allistic individuals (Bang et al., 2013; Brown et al., 2012) and Rollins (2014) found that autistic individuals did worse on ISTs on a personal narrative than fictional narrative. However, these studies did not use interest-based prompts. Thus, the results of my study suggest that using an interest-based prompt could improve autistic performance on IST usage in narrative language, but does not nullify the differences in IST usage between autistic people and allistic people.

When ISTs were broken down into categories, cognitive, emotional, and perceptual ISTs all showed different results. First, cognitive ISTs patterned very similarly to story length and lexical diversity with the autistic group performing alike to the allistic group on the IBP narrative but using fewer cognitive ISTs on

the fictional narrative. Thus, cognitive ISTs appear to benefit from an interest-based prompt, as was hypothesized. However, emotional and perceptual ISTs did not support my hypothesis. The analysis emotional ISTs did not converge; thus, results could not be reported. Perceptual ISTs patterned differently, with both the autistic and allistic group using more on the fictional narrative than the IBP narrative. This may have been caused by the nature of the TNL's Aliens task that was used to prompt the fictional narrative, since it may have prompted more uses of words such as 'see', 'look', and 'hear' to describe the humans discovering the aliens; thus, it is possible that if an interest-based prompt that additionally prompted for perceptual ISTs, similarly to the TNL, was used, the results may have been different. Overall, the number of IST uses in each category was low (see table 3.3 in section 3.1), since there was only one short story of each narrative type elicited from the participants. Thus, the results shown on the effect of an interest-based narrative on individual IST categories should be viewed as preliminary and further research should be completed to investigate how interest-based prompts affect different IST categories differently.

4.2.3. MLU

I found no significant results for MLU, with the autistic and allistic groups having similar MLUs in both narrative types. Thus, autistic and allistic adults performed similarly when it comes to MLU on both fictional and IBP narratives. This supports my hypotheses and lends further evidence that autistic adults without language impairment do not have worse morphosyntax and structural language as a whole than allistic adults, unlike the differences in narrative discourse, such as story length and IST use, which have been shown to persist into adulthood (Geelhand et al., 2020; Barnes et al., 2009). Since the autistic adults in this study were already within the normal allistic range on MLU for the fictional, non-interest-based narrative, the benefit of an interest-based prompt would likely not have applied to MLU.

4.3. Research Question 3

Research question 3 was about the associations between severity of autism symptoms, as measured by SRS-2 score, and TNW, NDW, total ISTs, and MLU on the fictional narrative and IBP narrative. Based on previous literature showing that autistic individuals perform worse on narrative measures, I hypothesized that a higher SRS-2 score would be associated with lower scores on the fictional narrative

on story length, lexical diversity, and use of ISTs. Since the autistic group had no diagnosed structural language impairment, I additionally hypothesized that SRS-2 score would not be associated with MLU. Because there is some previous evidence that interest-based prompts improve autistic narrative performance (Siverston, 2010), I also hypothesized that SRS-2 score would not be associated with the IBP narrative on any of the measures for the IBP narrative.

SRS-2 score was found to be correlated with lexical diversity and total ISTs in the fictional narrative when all of the participants were in one group together, but not on the IBP narrative, nor when the autistic and allistic groups were separated. Significant correlations being found for the fictional narrative but not the IBP narrative supports the results found in the linear models in that differences between groups were less pronounced with the IBP narrative, suggesting that autism affects narrative language skills less when using an interest-based prompt. No significant correlations were found for either the autistic group itself or allistic group itself with any of the narrative measures, which could be due to the smaller power when the groups were split.

4.4. Research Question 4

Research question 4 was on the associations between reading for pleasure and reading for work and TNW, NDW, total ISTs, and MLU on the fictional narrative and IBP narrative. It was hypothesized that a higher frequency of reading, both for pleasure and for work, would predict longer stories, more lexical diversity, more use of ISTs, and higher MLU on both narrative tasks for all participants. Differing from SRS-2 score, significant results were only found for reading when the autistic and allistic groups were split, rather than analyzed together. For the autistic group, reading for work was positively, moderately correlated with lexical diversity on the fictional narrative, while for the allistic group, reading for pleasure was negatively, moderately correlated with MLU on the fictional narrative and reading for work was positively, moderately correlated with MLU on the IBP narrative. The two positive correlations lend some support to my hypothesis, but, overall, few significant correlations emerged. Additionally, the negative correlation between reading for pleasure and MLU for the allistics' fictional narrative is in the opposite direction to what was predicted, and it is unclear why this correlation occurred. However, the analysis had low power due to small group numbers, thus these results are very preliminary and further research is

needed to bring more understanding to how reading affects narrative language in autistic and allistic adults. Furthermore, significant results only being found with the groups separated suggests that frequency of reading might affect narrative skills in autistic and allistic individuals differently; further research should be completed examining why and how reading affects narrative skills differently in these groups.

4.5. Conclusion

This study was the first to use an interest-based prompt in a personal narrative task with autistic adults. Performance on this narrative was compared to that of allistic adults, and to autistic and allistic adults' performance on a fictional narrative. It was found that autistic adults performed on par with allistic adults on story length, lexical diversity, and cognitive ISTs and improved performance on total ISTs on an interest-based personal narrative task than on a fictional narrative task. My study replicates the findings of Siverston (2010) that special interest-based prompts improve autistic narrative performance, but does so with adults and with oral narrative language rather than story writing. This supports strength-based theories of special interests, such as those of Caldwell-Harris and Jordan (2014), Lawson (2011), and Winter-Messiers et al. (2007).

4.6. Limitations, Future Research, and Implications

This study had several limitations, including low participant numbers and factors arising from my sampling methods. There were low numbers of participants in both the allistic and autistic groups, which limits power and generalizability. It would be beneficial for research with more participants to be done on interest-based narratives in autism as well as how reading affects autistic narrative skills. Additionally, due to sampling methods, there were some differences between groups in age and level of education, thus further research with both the allistic and autistic groups sampling from university students, or both groups sampled outside of the university population, would be beneficial. Due to the autistic group all having no intellectual impairment or language impairment, this study also cannot generalize to the autistic population as a whole, since a significant part of the autistic community also has intellectual and/or language impairment (Boucher, 2012). Further research with additional autistic groups with language

impairment and intellectual impairment would serve to show whether the beneficial effects of interest-based prompts extends to these groups as well.

This study compared a fictional narrative to an interest-based personal narrative, which could be less ideally comparable as a regular fictional narrative and an interest-based fictional narrative, such as those in Siverston (2010), or a regular personal narrative and an interest-based personal narrative. It would be beneficial to explore these comparisons in order to expand the existing research on how special interests affect narrative language in autism. Furthermore, since there is evidence that special interests increase language performance in autistic individuals, this prompts the question of whether incorporating special interests may increase performance on other areas of language as well, so it would be beneficial for future research on other areas of language to also investigate incorporating special interests.

The research on interest-based narratives and autism is still limited and preliminary, but is thus far promising of beneficial effects of special interests on narrative language in autism and supports strength-based models of special interests. These models suggest that engagement in special interests can improve many aspects of autistic individuals' lives, including mental health, academics, employment, socialization, and communication. This study shows some of the benefits to communication by demonstrating how an interest-based prompt improved microstructure in narrative language. This also indicates that it is possible that previous research which concluded autistic individuals have a deficit in narrative language may not be as accurate as previously thought, as the differences found in their narratives could be caused simply by a lack of interest in the task, rather than an inherent lack of skill in narrative language. Further possible benefits of special interests to language skills and other parts of life should continue to be examined as it could be very important to the life success of autistic people. For example, special interests could be incorporated into academics to improve school success, both in autistic children and in autistic adults who continue into post-secondary schooling, by increasing motivation and performance on assignments. Therapy plans could also utilize special interests to improve socialization and communication by using special interests to scaffold interactions or use special interests to hold interest and improve results in speech and language therapy. Thus, special interests continue to prove to be an area of strengths and benefits for autistic people and a better understanding of the

importance of special interests to autistic people is an essential pursuit for both practical and theoretical reasons.

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Appendix A: Recruitment Ad

Participants Needed for a Research Study!

(Pro00113004)

Study Name: Story Telling and Special Interests – A Study on the Differences in Narrative Language of Autistic Individuals Depending on the Topic

Autistic individuals are invited to participate in a study that aims to better understand the story-telling of autistic individuals. This study will be looking at the differences between autistic and neurotypical story-telling as well as the differences in how autistic people tell stories depending on the topic.

The study involves a 60-minute video call during which you will complete questionnaires, an IQ task, and two story telling activities and have the opportunity to info-dump about your special interests!

For the completion of these activities, participants will receive a $20 e-gift card of their choice. eGift card options include: RedBubble, Amazon, or WalMart.

I am seeking 18 to 30-year-old individuals who:
1. Have a diagnosis of Autism
2. Speak English as their primary language

For more information, please contact me at:
Natasha Daley, M.Sc. Student
Dept. of Linguistics
University of Alberta
ndaley@ualberta.ca

Appendix B: Language background questionnaire

Language Background Questionnaire

Thank you for participating in this experiment. In the following questionnaire, we will ask you questions pertaining to your general background and language history.

* Required

1. Date Completed *

_____

Example: January 7, 2019

2. Participant Number (provided by researcher) *

_____

General Background

3. Date of Birth

_____

Example: January 7, 2019

4. Age (in years) *

_____

5. Gender *

Check all that apply.

- ☐ Female
- ☐ Male
- Other: ☐ _____

6. Are you currently a college/university student? *

Mark only one oval.

- ◯ Yes
- ◯ No

7. If no, please tick your occupational status

Check all that apply.

- ☐ Secondary/high school student
- ☐ In full-time employment
- ☐ In part-time employment
- ☐ Self-empoyed
- ☐ Homemaker/Full-time parent
- ☐ Unemployed
- ☐ Retired

8. What is the highest educational qualification you have attained? *

Check all that apply.

- ☐ Did not complete any school qualification
- ☐ Completed first school qualification (e.g. Junior High School)
- ☐ Completed second school qualification (e.g. A levels / High School)
- ☐ Undergraduate degree or professional qualification
- ☐ Postgraduate degree

9. Are you autistic? *

Mark only one oval.

- ◯ No
- ◯ Yes, professionally diagnosed with a autism spectrum disorder
- ◯ Yes, self-diagnosed

10. If you answered 'yes', what age were you when you were diagnosed?

11. Do you have any other neurodevelopmental disorders/conditions? If so, please list all (with the age that you were when diagnosed with each)

12. Country of current residency *

13. Country of birth *

14. If you currently reside in Canada and were not born in Canada, when did you arrive here? *

Example: January 7, 2019

15. How often do you read for pleasure?

Mark only one oval.

- ◯ Daily
- ◯ A few times a week
- ◯ A few times a month
- ◯ Once every few months
- ◯ Never

16. How often do you read for work? (required readings for your job or your school)

Mark only one oval.

- ◯ Daily
- ◯ A few times a week
- ◯ A few times a month
- ◯ Once every few months
- ◯ Never

17. Please indicate what kinds of literature you read on a regular basis

Check all that apply.

- ☐ Full length novels
- ☐ Children's novels
- ☐ Scholarly articles
- ☐ News articles
- ☐ Manuals/textbooks
- ☐ Poetry
- ☐ Nonfiction books

Other: ☐ _____

18. Did you spend the same amount of time reading as a child as you do now?

Mark only one oval.

- ◯ Yes
- ◯ No, I read more as a child
- ◯ No, I read less as a child

Language Background

19. Primary / dominant language spoken currently *

_____

20. First language(s) learned

_____

21. Do you consider yourself bilingual?

Mark only one oval.

- ◯ Yes
- ◯ No

22. If yes, please provide the languages. Otherwise continue to next question.

_____

23. Language A:

_____

24. Overall proficiency in language A

Mark only one oval.

	1	2	3	4	5	
Little proficiency	◯	◯	◯	◯	◯	Excellent proficiency

25. Language B:

_____

26. Overall proficiency in language B

Mark only one oval.

	1	2	3	4	5	
Little proficiency	◯	◯	◯	◯	◯	Excellent proficiency

Appendix C: R Scripts and Output

```
> library(tidyverse)
── Attaching packages ─────────────────────────────────── tidyverse 1.3.2 ──
✓ ggplot2 3.4.0      ✓ purrr   1.0.1
✓ tibble  3.1.8      ✓ dplyr   1.0.10
✓ tidyr   1.3.0      ✓ stringr 1.5.0
✓ readr   2.1.3      ✓ forcats 0.5.2
── Conflicts ─────────────────────────────────────── tidyverse_conflicts() ──
✖ dplyr::filter() masks stats::filter()
✖ dplyr::lag()    masks stats::lag()
> library(readxl)
> library(tidyr)
> library(lme4)
Loading required package: Matrix

Attaching package: ‘Matrix’

The following objects are masked from ‘package:tidyr’:

    expand, pack, unpack

> library(ggplot2)
> library(emmeans)
> library(lmerTest)

Attaching package: ‘lmerTest’

The following object is masked from ‘package:lme4’:

    lmer

The following object is masked from ‘package:stats’:

    step

> library(sjPlot)
Learn more about sjPlot with 'browseVignettes("sjPlot")'.
> library(ggplot2)
> library(corrplot)
corrplot 0.92 loaded
Warning message:
package ‘corrplot’ was built under R version 4.2.3
> library(Hmisc)

Attaching package: ‘Hmisc’

The following objects are masked from ‘package:dplyr’:

    src, summarize

The following objects are masked from ‘package:base’:

    format.pval, units

Warning message:
package ‘Hmisc’ was built under R version 4.2.3
>
> Data2 <- read_excel("Data2.xlsx")
>
> Data2$Part<- as.factor(Data2$Part)
> Data2$Group<- as.factor(Data2$Group)
```

```
>
> TNL <- Data2 %>%
+   filter(Nar_type == "TNL")
> PERS <- Data2 %>%
+   filter(Nar_type == "PERS")
>
> allisticTNL <- Data2 %>%
+   filter(`Group` == "Al", Nar_type == "TNL")
> allisticPERS <- Data2 %>%
+   filter(`Group` == "Al", Nar_type == "PERS")
>
> autisticTNL <- Data2 %>%
+   filter(`Group` == "Aut", Nar_type == "TNL")
> autisticPERS <- Data2 %>%
+   filter(`Group` == "Aut", Nar_type == "PERS")
>
```

C1: Linear Models

C1.1 Total Number of Words

```
> ### Linear Models
> #Total Words
> gint_group.nar_TNW <- (glmer(TNW ~ Group * Nar_type + (1|Part), family = po
isson, data=Data2))
> summary(gint_group.nar_TNW)
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: poisson  ( log )
Formula: TNW ~ Group * Nar_type + (1 | Part)
   Data: Data2

     AIC      BIC   logLik deviance df.resid
  4239.2   4251.5  -2114.6   4229.2       81

Scaled residuals:
     Min       1Q   Median       3Q      Max
-18.0740  -3.3092  -0.0112   3.7073  18.8309

Random effects:
 Groups Name        Variance Std.Dev.
 Part   (Intercept) 0.4337   0.6586
Number of obs: 86, groups:  Part, 43

Fixed effects:
                    Estimate Std. Error z value Pr(>|z|)
(Intercept)          6.13198    0.14763  41.536  < 2e-16 ***
GroupAut             0.03263    0.20188   0.162    0.872
Nar_typeTNL         -0.07344    0.01349  -5.442 5.26e-08 ***
GroupAut:Nar_typeTNL -0.85710    0.02091 -40.991  < 2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) GropAt Nr_TNL
GroupAut    -0.731
Nar_typeTNL -0.044  0.032
GrpAt:N_TNL  0.028 -0.038 -0.645
> int_group.nar_TNW <- (lmer(TNW ~ Group * Nar_type + (1|Part), data=Data2))
> plot_model(int_group.nar_TNW, type = "int", legend.title = "Narrative type"
, title = "")
```

C1.2 Number of Different Words

```
> #NDW
> gint_group.nar_NDW <- (glmer(NDW ~ Group * Nar_type + (1|Part), family = po
isson, data=Data2))
> summary(gint_group.nar_NDW)
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: poisson  ( log )
Formula: NDW ~ Group * Nar_type + (1 | Part)
   Data: Data2

     AIC      BIC   logLik deviance df.resid
  1439.1   1451.3   -714.5   1429.1       81

Scaled residuals:
    Min      1Q  Median      3Q     Max
-6.5127 -1.7792  0.0325  1.8097  7.0764

Random effects:
 Groups Name        Variance Std.Dev.
 Part   (Intercept) 0.2089   0.457
Number of obs: 86, groups:  Part, 43

Fixed effects:
                     Estimate Std. Error z value Pr(>|z|)
(Intercept)          5.238320   0.103493  50.615  < 2e-16 ***
GroupAut            -0.004321   0.141535  -0.031    0.976
Nar_typeTNL         -0.101757   0.022590  -4.505 6.65e-06 ***
GroupAut:Nar_typeTNL -0.457032   0.032836 -13.919  < 2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) GropAt Nr_TNL
GroupAut    -0.731
Nar_typeTNL -0.104  0.076
GrpAt:N_TNL  0.071 -0.097 -0.688
> int_group.nar_NDW <- (lmer(NDW ~ Group * Nar_type + (1|Part),data=Data2))
> plot_model(int_group.nar_NDW, type = "int", legend.title = "Narrative type"
, title = "")
```

C1.3 Internal State Terms

```
> #ISTs
> gint_group.nar_IST <- (glmer(IST_Total ~ Group * Nar_type + (1|Part), famil
y = poisson, data=Data2))
> summary(gint_group.nar_IST)
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: poisson  ( log )
Formula: IST_Total ~ Group * Nar_type + (1 | Part)
   Data: Data2

     AIC      BIC   logLik deviance df.resid
   596.0    608.2   -293.0    586.0       81

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.6709 -0.8093 -0.0825  0.4176  3.7420
```

```
Random effects:
 Groups Name        Variance Std.Dev.
 Part   (Intercept) 0.5341   0.7309
Number of obs: 86, groups:  Part, 43

Fixed effects:
                    Estimate Std. Error z value Pr(>|z|)
(Intercept)          2.10529    0.18010  11.690  < 2e-16 ***
GroupAut            -0.18075    0.24838  -0.728    0.467
Nar_typeTNL          0.37949    0.08927   4.251 2.13e-05 ***
GroupAut:Nar_typeTNL -0.60503    0.13624  -4.441 8.96e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) GropAt Nr_TNL
GroupAut    -0.721
Nar_typeTNL -0.294  0.213
GrpAt:N_TNL  0.193 -0.279 -0.655
> int_group.nar_IST <- (lmer(IST_Total ~ Group * Nar_type + (1|Part),data=Dat
a2))
> plot_model(int_group.nar_IST, type = "int", legend.title = "Narrative type"
, title = "", axis.title = "Total number of ISTs")
```

C1.4 Internal State Terms: Cognitive

```
> #ISTs - Cognitive
> gint_group.nar_Cognitive <- (glmer(IST_Cognitive ~ Group * Nar_type + (1|Pa
rt), family = poisson, data=Data2))
> summary(gint_group.nar_Cognitive)
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: poisson  ( log )
Formula: IST_Cognitive ~ Group * Nar_type + (1 | Part)
   Data: Data2

     AIC      BIC   logLik deviance df.resid
   487.4    499.7   -238.7    477.4       81

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.2457 -0.7359 -0.1442  0.5041  3.5664

Random effects:
 Groups Name        Variance Std.Dev.
 Part   (Intercept) 0.6969   0.8348
Number of obs: 86, groups:  Part, 43

Fixed effects:
                    Estimate Std. Error z value Pr(>|z|)
(Intercept)          1.42734    0.21411   6.666 2.62e-11 ***
GroupAut            -0.06433    0.29382  -0.219 0.826685
Nar_typeTNL          0.15415    0.12579   1.225 0.220411
GroupAut:Nar_typeTNL -0.68255    0.18780  -3.634 0.000279 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) GropAt Nr_TNL
GroupAut    -0.720
Nar_typeTNL -0.316  0.231
```

```
GrpAt:N_TNL  0.212 -0.285 -0.670
> int_group.nar_Cognitive <- (lmer(IST_Cognitive ~ Group * Nar_type + (1|Part
), data=Data2))
> plot_model(int_group.nar_Cognitive, type = "int", legend.title = "Narrative
type", title = "", axis.title = "Number of cognitive ISTs")
```

C1.5 Internal State Terms: Emotional

```
> gint_group.nar_Emotional <- (glmer(IST_Emotional ~ Group * Nar_type + (1|Pa
rt), family = poisson,data=Data2))
Warning message:
In checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv,  :
  Model failed to converge with max|grad| = 0.0356541 (tol = 0.002, component
1)
> summary(gint_group.nar_Emotional)
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: poisson  ( log )
Formula: IST_Emotional ~ Group * Nar_type + (1 | Part)
   Data: Data2

     AIC      BIC   logLik deviance df.resid
   376.4    388.7   -183.2    366.4       81

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.1128 -0.8030 -0.1559  0.5500  2.7979

Random effects:
 Groups Name        Variance Std.Dev.
 Part   (Intercept) 0.4389   0.6625
Number of obs: 86, groups:  Part, 43

Fixed effects:
                           Estimate Std. Error z value Pr(>|z|)
(Intercept)                0.831034   0.001987  418.20   <2e-16 ***
GroupAutistic             -0.190353   0.001986  -95.84   <2e-16 ***
Nar_typeTNL                0.159058   0.001986   80.10   <2e-16 ***
GroupAutistic:Nar_typeTNL -0.086312   0.001985  -43.47   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) GrpAts Nr_TNL
GroupAutstc 0.001
Nar_typeTNL 0.001  0.001
GrpAt:N_TNL 0.000  0.000  0.000
optimizer (Nelder_Mead) convergence code: 0 (OK)
Model failed to converge with max|grad| = 0.0356541 (tol = 0.002, component 1
)
```

C1.6 Internal State Terms: Perceptual

```
> #ISTs - Perceptual
```

```
> gint_group.nar_Perceptual <- (glmer(IST_Perceptual ~ Group * Nar_type + (1|
Part), family = poisson, data=Data2))
> summary(gint_group.nar_Perceptual)
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: poisson  ( log )
Formula: IST_Perceptual ~ Group * Nar_type + (1 | Part)
   Data: Data2

     AIC      BIC   logLik deviance df.resid
   300.5    312.8   -145.3    290.5       81

Scaled residuals:
    Min      1Q  Median      3Q     Max
-1.8078 -0.7346 -0.4918  0.4672  3.1865

Random effects:
 Groups Name        Variance Std.Dev.
 Part   (Intercept) 0.628    0.7925
Number of obs: 86, groups:  Part, 43

Fixed effects:
                     Estimate Std. Error z value Pr(>|z|)
(Intercept)           0.05007    0.27074   0.185   0.8533
GroupAut             -0.97857    0.43121  -2.269   0.0232 *
Nar_typeTNL           1.25804    0.21809   5.768    8e-09 ***
GroupAut:Nar_typeTNL -0.45569    0.39871  -1.143   0.2531
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) GropAt Nr_TNL
GroupAut    -0.591
Nar_typeTNL -0.627  0.394
GrpAt:N_TNL  0.343 -0.663 -0.547
```

C1.7 Mean Length of Utterance

```
> #MLU
> int_group.nar_MLU <- (lmer(MLU ~ Group * Nar_type + (1|Part),data=Data2))
> summary(int_group.nar_MLU)
Linear mixed model fit by REML. t-tests use Satterthwaite's method [
lmerModLmerTest]
Formula: MLU ~ Group * Nar_type + (1 | Part)
   Data: Data2

REML criterion at convergence: 401.6

Scaled residuals:
    Min      1Q  Median      3Q     Max
-1.5252 -0.5647 -0.0953  0.4110  4.2862

Random effects:
 Groups   Name        Variance Std.Dev.
 Part     (Intercept) 0.7248   0.8513
 Residual             6.0647   2.4627
Number of obs: 86, groups:  Part, 43

Fixed effects:
                    Estimate Std. Error      df t value Pr(>|t|)
(Intercept)          11.9154     0.5826 81.0761  20.451   <2e-16 ***
GroupAut              0.8815     0.7967 81.0761   1.107    0.272
```

```
Nar_typeTNL           -0.3582     0.7788 41.0000  -0.460    0.648
GroupAut:Nar_typeTNL  -0.7400     1.0648 41.0000  -0.695    0.491
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) GropAt Nr_TNL
GroupAut    -0.731
Nar_typeTNL -0.668  0.489
GrpAt:N_TNL  0.489 -0.668 -0.731
>
```

C2: SRS-2

```
> ###Correlations
> #SRS score
```

C2.1 SRS-2 + TNL with all participants

```
> cor(TNL[,c('TNW','NDW','SRS_Tscore', 'IST_Total', 'MLU')])
                  TNW        NDW SRS_Tscore   IST_Total         MLU
TNW         1.00000000  0.9440309 -0.2586845  0.55345334  0.09114119
NDW         0.94403093  1.0000000 -0.3469277  0.63487242  0.12510232
SRS_Tscore -0.25868449 -0.3469277  1.0000000 -0.36040544  0.03862590
IST_Total   0.55345334  0.6348724 -0.3604054  1.00000000 -0.09073648
MLU         0.09114119  0.1251023  0.0386259 -0.09073648  1.00000000
> cor.mtest(TNL[,c('TNW','NDW','SRS_Tscore', 'IST_Total', 'MLU')], conf.level
= 0.95)
$p
                   TNW          NDW SRS_Tscore    IST_Total       MLU
TNW        0.000000e+00 2.333673e-21 0.09394051 1.183501e-04 0.5610696
NDW        2.333673e-21 0.000000e+00 0.02265390 4.817855e-06 0.4241020
SRS_Tscore 9.394051e-02 2.265390e-02 0.00000000 1.759204e-02 0.8057480
IST_Total  1.183501e-04 4.817855e-06 0.01759204 0.000000e+00 0.5628174
MLU        5.610696e-01 4.241020e-01 0.80574801 5.628174e-01 0.0000000

$lowCI
                  TNW        NDW SRS_Tscore  IST_Total        MLU
TNW         1.0000000  0.8984194 -0.5187263  0.3035710 -0.2150905
NDW         0.8984194  1.0000000 -0.5861918  0.4133452 -0.1820831
SRS_Tscore -0.5187263 -0.5861918  1.0000000 -0.5962120 -0.2647898
IST_Total   0.3035710  0.4133452 -0.5962120  1.0000000 -0.3807053
MLU        -0.2150905 -0.1820831 -0.2647898 -0.3807053  1.0000000

$uppCI
                  TNW        NDW  SRS_Tscore   IST_Total       MLU
TNW        1.00000000  0.9694912  0.04516872  0.73210250 0.3810542
NDW        0.96949118  1.0000000 -0.05200240  0.78544719 0.4100395
SRS_Tscore 0.04516872 -0.0520024  1.00000000 -0.06735215 0.3350825
IST_Total  0.73210250  0.7854472 -0.06735215  1.00000000 0.2154797
MLU        0.38105419  0.4100395  0.33508245  0.21547966 1.0000000
```

C2.2 SRS-2 + IBP narrative with all participants

```
>
> cor(PERS[,c('TNW','NDW','SRS_Tscore', 'IST_Total', 'MLU')])
                  TNW        NDW  SRS_Tscore   IST_Total         MLU
TNW         1.00000000  0.9560744 -0.01175761  0.81016562 -0.15657431
NDW         0.95607435  1.0000000 -0.03042370  0.75826725 -0.17428287
SRS_Tscore -0.01175761 -0.0304237  1.00000000 -0.06777867  0.17418545
IST_Total   0.81016562  0.7582673 -0.06777867  1.00000000 -0.08243565
MLU        -0.15657431 -0.1742829  0.17418545 -0.08243565  1.00000000
```

```
> cor.mtest(PERS[,c('TNW','NDW','SRS_Tscore', 'IST_Total', 'MLU')], conf.leve
l = 0.95)
$p
                   TNW          NDW SRS_Tscore    IST_Total       MLU
TNW        0.000000e+00 1.822162e-23  0.9403497 4.667600e-11 0.3160185
NDW        1.822162e-23 0.000000e+00  0.8464362 3.877146e-09 0.2636723
SRS_Tscore 9.403497e-01 8.464362e-01  0.0000000 6.658469e-01 0.2639435
IST_Total  4.667600e-11 3.877146e-09  0.6658469 0.000000e+00 0.5992122
MLU        3.160185e-01 2.636723e-01  0.2639435 5.992122e-01 0.0000000

$lowCI
                TNW        NDW SRS_Tscore  IST_Total        MLU
TNW         1.0000000  0.9198730 -0.3110032  0.6737687 -0.4363961
NDW         0.9198730  1.0000000 -0.3277725  0.5929660 -0.4510183
SRS_Tscore -0.3110032 -0.3277725  1.0000000 -0.3607782 -0.1331228
IST_Total   0.6737687  0.5929660 -0.3607782  1.0000000 -0.3735312
MLU        -0.4363961 -0.4510183 -0.1331228 -0.3735312  1.0000000

$uppCI
               TNW       NDW SRS_Tscore IST_Total       MLU
TNW        1.0000000 0.9761234  0.2896090 0.8931748 0.1508641
NDW        0.9761234 1.0000000  0.2724093 0.8622431 0.1330241
SRS_Tscore 0.2896090 0.2724093  1.0000000 0.2373979 0.4509382
IST_Total  0.8931748 0.8622431  0.2373979 1.0000000 0.2234404
MLU        0.1508641 0.1330241  0.4509382 0.2234404 1.0000000
```

C2.3 SRS-2 + IBP narrative with allistic participants

```
>
> cor(allisticPERS[,c('TNW','NDW','SRS_Tscore', 'IST_Total', 'MLU')])
                TNW         NDW  SRS_Tscore   IST_Total        MLU
TNW         1.00000000  0.89592480 -0.05600223  0.82477687 -0.09814405
NDW         0.89592480  1.00000000 -0.21507862  0.69838492 -0.04887642
SRS_Tscore -0.05600223 -0.21507862  1.00000000  0.17295222 -0.14791646
IST_Total   0.82477687  0.69838492  0.17295222  1.00000000 -0.04699861
MLU        -0.09814405 -0.04887642 -0.14791646 -0.04699861  1.00000000
> cor.mtest(allisticPERS[,c('TNW','NDW','SRS_Tscore', 'IST_Total', 'MLU')], c
onf.level = 0.95)
$p
                   TNW          NDW SRS_Tscore    IST_Total       MLU
TNW        0.000000e+00 9.275135e-08  0.8145916 7.681252e-06 0.6805971
NDW        9.275135e-08 0.000000e+00  0.3624801 6.151775e-04 0.8378618
SRS_Tscore 8.145916e-01 3.624801e-01  0.0000000 4.658880e-01 0.5337135
IST_Total  7.681252e-06 6.151775e-04  0.4658880 0.000000e+00 0.8440165
MLU        6.805971e-01 8.378618e-01  0.5337135 8.440165e-01 0.0000000

$lowCI
                TNW        NDW SRS_Tscore  IST_Total        MLU
TNW         1.0000000  0.7512477 -0.4864673  0.6019600 -0.5181607
NDW         0.7512477  1.0000000 -0.6004505  0.3703077 -0.4809939
SRS_Tscore -0.4864673 -0.6004505  1.0000000 -0.2919099 -0.5541638
IST_Total   0.6019600  0.3703077 -0.2919099  1.0000000 -0.4795459
MLU        -0.5181607 -0.4809939 -0.5541638 -0.4795459  1.0000000

$uppCI
               TNW       NDW SRS_Tscore IST_Total       MLU
TNW        1.0000000 0.9584524  0.3963407 0.9284362 0.3600124
NDW        0.9584524 1.0000000  0.2513664 0.8715525 0.4023467
SRS_Tscore 0.3963407 0.2513664  1.0000000 0.5717167 0.3152386
IST_Total  0.9284362 0.8715525  0.5717167 1.0000000 0.4039229
MLU        0.3600124 0.4023467  0.3152386 0.4039229 1.0000000
```

C2.4 SRS-2 + TNL with allistic participants

```
>
> cor(allisticTNL[,c('TNW','NDW','SRS_Tscore', 'IST_Total', 'MLU')])
                TNW         NDW  SRS_Tscore  IST_Total        MLU
TNW        1.00000000  0.96844432  0.07944888 0.48549827 0.18238910
NDW        0.96844432  1.00000000 -0.00714361 0.55432639 0.21959993
SRS_Tscore 0.07944888 -0.00714361  1.00000000 0.08482638 0.19574068
IST_Total  0.48549827  0.55432639  0.08482638 1.00000000 0.08338551
MLU        0.18238910  0.21959993  0.19574068 0.08338551 1.00000000
> cor.mtest(allisticTNL[,c('TNW','NDW','SRS_Tscore', 'IST_Total', 'MLU')], co
nf.level = 0.95)
$p
                  TNW          NDW SRS_Tscore  IST_Total       MLU
TNW        0.000000e+00 2.627716e-12  0.7391682 0.03000466 0.4415145
NDW        2.627716e-12 0.000000e+00  0.9761545 0.01120243 0.3522309
SRS_Tscore 7.391682e-01 9.761545e-01  0.0000000 0.72216223 0.4082035
IST_Total  3.000466e-02 1.120243e-02  0.7221622 0.00000000 0.7267070
MLU        4.415145e-01 3.522309e-01  0.4082035 0.72670695 0.0000000

$lowCI
                 TNW        NDW SRS_Tscore   IST_Total        MLU
TNW         1.00000000  0.9203425 -0.3763018  0.05473745 -0.2829705
NDW         0.92034254  1.0000000 -0.4482474  0.14814595 -0.2469155
SRS_Tscore -0.37630184 -0.4482474  1.0000000 -0.37164500 -0.2701832
IST_Total   0.05473745  0.1481460 -0.3716450  1.00000000 -0.3728950
MLU        -0.28297051 -0.2469155 -0.2701832 -0.37289503  1.0000000

$uppCI
               TNW       NDW SRS_Tscore IST_Total       MLU
TNW        1.0000000 0.9876857  0.5042416 0.7639004 0.5782396
NDW        0.9876857 1.0000000  0.4367578 0.8004870 0.6034764
SRS_Tscore 0.5042416 0.4367578  1.0000000 0.5082681 0.5873828
IST_Total  0.7639004 0.8004870  0.5082681 1.0000000 0.5071910
MLU        0.5782396 0.6034764  0.5873828 0.5071910 1.0000000
```

C2.5 SRS-2 + IBP narrative with autistic participants

```
>
> cor(autisticPERS[,c('TNW','NDW','SRS_Tscore', 'IST_Total', 'MLU')])
                TNW         NDW  SRS_Tscore   IST_Total        MLU
TNW         1.00000000  0.98085206 -0.09026137  0.82948993 -0.18643792
NDW         0.98085206  1.00000000 -0.02799483  0.81302986 -0.22355502
SRS_Tscore -0.09026137 -0.02799483  1.00000000 -0.14016576  0.13827960
IST_Total   0.82948993  0.81302986 -0.14016576  1.00000000 -0.08726082
MLU        -0.18643792 -0.22355502  0.13827960 -0.08726082  1.00000000
> cor.mtest(autisticPERS[,c('TNW','NDW','SRS_Tscore', 'IST_Total', 'MLU')], c
onf.level = 0.95)
$p
                  TNW          NDW SRS_Tscore    IST_Total       MLU
TNW        0.000000e+00 2.101580e-16  0.6821170 9.919376e-07 0.3943432
NDW        2.101580e-16 0.000000e+00  0.8991020 2.416469e-06 0.3051769
SRS_Tscore 6.821170e-01 8.991020e-01  0.0000000 5.235481e-01 0.5292066
IST_Total  9.919376e-07 2.416469e-06  0.5235481 0.000000e+00 0.6921735
MLU        3.943432e-01 3.051769e-01  0.5292066 6.921735e-01 0.0000000

$lowCI
                TNW        NDW SRS_Tscore  IST_Total        MLU
TNW         1.0000000  0.9546060 -0.4844395  0.6340965 -0.5559178
NDW         0.9546060  1.0000000 -0.4351753  0.6028687 -0.5821153
SRS_Tscore -0.4844395 -0.4351753  1.0000000 -0.5221971 -0.2904797
IST_Total   0.6340965  0.6028687 -0.5221971  1.0000000 -0.4821215
MLU        -0.5559178 -0.5821153 -0.2904797 -0.4821215  1.0000000
```

```
$uppCI
                TNW       NDW SRS_Tscore IST_Total       MLU
TNW        1.0000000 0.9919853  0.3343818 0.9253118 0.2445586
NDW        0.9919853 1.0000000  0.3886927 0.9176856 0.2077955
SRS_Tscore 0.3343818 0.3886927  1.0000000 0.2887175 0.5207968
IST_Total  0.9253118 0.9176856  0.2887175 1.0000000 0.3370653
MLU        0.2445586 0.2077955  0.5207968 0.3370653 1.0000000
```

C2.6 SRS-2 + TNL with autistic participants

```
>
> cor(autisticTNL[,c('TNW','NDW','SRS_Tscore', 'IST_Total', 'MLU')])
                  TNW         NDW  SRS_Tscore  IST_Total         MLU
TNW         1.00000000  0.97785101 -0.20140873  0.7318610 -0.03874611
NDW         0.97785101  1.00000000 -0.24652375  0.6475813  0.06270248
SRS_Tscore -0.20140873 -0.24652375  1.00000000 -0.1702094 -0.06885097
IST_Total   0.73186098  0.64758126 -0.17020939  1.0000000 -0.36694770
MLU        -0.03874611  0.06270248 -0.06885097 -0.3669477  1.00000000
> cor.mtest(autisticTNL[,c('TNW','NDW','SRS_Tscore', 'IST_Total', 'MLU')], co
nf.level = 0.95)
$p
                  TNW          NDW SRS_Tscore    IST_Total        MLU
TNW        0.000000e+00 9.567047e-16  0.3567637 7.215127e-05 0.86066893
NDW        9.567047e-16 0.000000e+00  0.2568092 8.358379e-04 0.77624137
SRS_Tscore 3.567637e-01 2.568092e-01  0.0000000 4.374743e-01 0.75492328
IST_Total  7.215127e-05 8.358379e-04  0.4374743 0.000000e+00 0.08500556
MLU        8.606689e-01 7.762414e-01  0.7549233 8.500556e-02 0.00000000

$lowCI
                 TNW        NDW SRS_Tscore  IST_Total        MLU
TNW         1.0000000  0.9476003 -0.5665734  0.4577506 -0.4438593
NDW         0.9476003  1.0000000 -0.5979624  0.3210887 -0.3587726
SRS_Tscore -0.5665734 -0.5979624  1.0000000 -0.5442281 -0.4677774
IST_Total   0.4577506  0.3210887 -0.5442281  1.0000000 -0.6767821
MLU        -0.4438593 -0.3587726 -0.4677774 -0.6767821  1.0000000

$uppCI
                TNW       NDW SRS_Tscore  IST_Total        MLU
TNW        1.0000000 0.9907210  0.2298782 0.87891634 0.37951743
NDW        0.9907210 1.0000000  0.1844186 0.83649432 0.46293948
SRS_Tscore 0.2298782 0.1844186  1.0000000 0.26025227 0.35338032
IST_Total  0.8789163 0.8364943  0.2602523 1.00000000 0.05331939
MLU        0.3795174 0.4629395  0.3533803 0.05331939 1.00000000
```

C2.7 SRS-2 scatter plots

```
> cols <- c("#1170AA", "#EF6F6A")
> ggplot(TNL) + geom_point(mapping = aes(x=SRS_Tscore, y=TNW, color = Group))
+ scale_color_manual(values = cols)
> ggplot(TNL) + geom_point(mapping = aes(x=SRS_Tscore, y=NDW, color = Group))
+ scale_color_manual(values = cols)
> ggplot(TNL) + geom_point(mapping = aes(x=SRS_Tscore, y=IST_Total, color = G
roup)) + scale_color_manual(values = cols)
> ggplot(TNL) + geom_point(mapping = aes(x=SRS_Tscore, y=MLU, color = Group))
+ scale_color_manual(values = cols)
>
> ggplot(PERS) + geom_point(mapping = aes(x=SRS_Tscore, y=TNW, color = Group)
) + scale_color_manual(values = cols)
> ggplot(PERS) + geom_point(mapping = aes(x=SRS_Tscore, y=NDW, color = Group)
) + scale_color_manual(values = cols)
> ggplot(PERS) + geom_point(mapping = aes(x=SRS_Tscore, y=IST_Total, color =
Group)) + scale_color_manual(values = cols)
```

```
> ggplot(PERS) + geom_point(mapping = aes(x=SRS_Tscore, y=MLU, color = Group)
) + scale_color_manual(values = cols)
```

C3: Reading

```
>
> #Reading
```

C3.1 Reading + TNL with all participants

```
> cor(TNL[,c('TNW','NDW','Reading.pleasure', 'reading.work', 'IST_Total', 'ML
U')])
                         TNW        NDW Reading.pleasure reading.work
TNW               1.00000000  0.9440309     -0.129980066  0.101237729
NDW               0.94403093  1.0000000     -0.218759825  0.205462297
Reading.pleasure -0.12998007 -0.2187598      1.000000000 -0.092132382
reading.work      0.10123773  0.2054623     -0.092132382  1.000000000
IST_Total         0.55345334  0.6348724     -0.276818542  0.042522533
MLU               0.09114119  0.1251023     -0.002636822 -0.009158954
                   IST_Total          MLU
TNW               0.55345334  0.091141186
NDW               0.63487242  0.125102318
Reading.pleasure -0.27681854 -0.002636822
reading.work      0.04252253 -0.009158954
IST_Total         1.00000000 -0.090736480
MLU              -0.09073648  1.000000000
> cor.mtest(TNL[,c('TNW','NDW','Reading.pleasure', 'reading.work', 'IST_Total
', 'MLU')], conf.level = 0.95)
$p
                          TNW          NDW Reading.pleasure reading.work
TNW               0.000000e+00 2.333673e-21        0.4061131    0.5183046
NDW               2.333673e-21 0.000000e+00        0.1587257    0.1862487
Reading.pleasure  4.061131e-01 1.587257e-01        0.0000000    0.5567996
reading.work      5.183046e-01 1.862487e-01        0.5567996    0.0000000
IST_Total         1.183501e-04 4.817855e-06        0.0723308    0.7865874
MLU               5.610696e-01 4.241020e-01        0.9866111    0.9535171
                     IST_Total       MLU
TNW               1.183501e-04 0.5610696
NDW               4.817855e-06 0.4241020
Reading.pleasure  7.233080e-02 0.9866111
reading.work      7.865874e-01 0.9535171
IST_Total         0.000000e+00 0.5628174
MLU               5.628174e-01 0.0000000

$lowCI
                         TNW        NDW Reading.pleasure reading.work
TNW               1.0000000  0.8984194       -0.4141558   -0.2053500
NDW               0.8984194  1.0000000       -0.4870997   -0.1011217
Reading.pleasure -0.4141558 -0.4870997        1.0000000   -0.3819083
reading.work     -0.2053500 -0.1011217       -0.3819083    1.0000000
IST_Total         0.3035710  0.4133452       -0.5328600   -0.2611567
MLU              -0.2150905 -0.1820831       -0.3027409   -0.3086538
                  IST_Total        MLU
TNW               0.3035710 -0.2150905
NDW               0.4133452 -0.1820831
Reading.pleasure -0.5328600 -0.3027409
reading.work     -0.2611567 -0.3086538
IST_Total         1.0000000 -0.3807053
MLU              -0.3807053  1.0000000
```

```
$uppCI
                      TNW        NDW Reading.pleasure reading.work
TNW              1.0000000 0.96949118       0.17728476    0.3897314
NDW              0.9694912 1.00000000       0.08732132    0.4764074
Reading.pleasure 0.1772848 0.08732132       1.00000000    0.2141369
reading.work     0.3897314 0.47640737       0.21413695    1.0000000
IST_Total        0.7321025 0.78544719       0.02565859    0.3385427
MLU              0.3810542 0.41003947       0.29794300    0.2919881
                  IST_Total       MLU
TNW              0.73210250 0.3810542
NDW              0.78544719 0.4100395
Reading.pleasure 0.02565859 0.2979430
reading.work     0.33854274 0.2919881
IST_Total        1.00000000 0.2154797
MLU              0.21547966 1.0000000
```

C3.2 Reading + IBP narrative with all participants

```
>
> cor(PERS[,c('TNW','NDW','Reading.pleasure', 'reading.work', 'IST_Total', 'M
LU')])
                          TNW          NDW Reading.pleasure reading.work
TNW               1.000000000  0.956074350     -0.009352136  0.104352689
NDW               0.956074350  1.000000000     -0.007043154  0.168223807
Reading.pleasure -0.009352136 -0.007043154      1.000000000 -0.092132382
reading.work      0.104352689  0.168223807     -0.092132382  1.000000000
IST_Total         0.810165620  0.758267254     -0.052421110 -0.008433749
MLU              -0.156574311 -0.174282874     -0.045500102 -0.066028675
                   IST_Total          MLU
TNW               0.810165620 -0.15657431
NDW               0.758267254 -0.17428287
Reading.pleasure -0.052421110 -0.04550010
reading.work     -0.008433749 -0.06602867
IST_Total         1.000000000 -0.08243565
MLU              -0.082435649  1.00000000
> cor.mtest(PERS[,c('TNW','NDW','Reading.pleasure', 'reading.work', 'IST_Tota
l', 'MLU')], conf.level = 0.95)
$p
                          TNW          NDW Reading.pleasure reading.work
TNW              0.000000e+00 1.822162e-23        0.9525378    0.5054468
NDW              1.822162e-23 0.000000e+00        0.9642471    0.2808913
Reading.pleasure 9.525378e-01 9.642471e-01        0.0000000    0.5567996
reading.work     5.054468e-01 2.808913e-01        0.5567996    0.0000000
IST_Total        4.667600e-11 3.877146e-09        0.7384938    0.9571941
MLU              3.160185e-01 2.636723e-01        0.7720287    0.6739888
                   IST_Total       MLU
TNW              4.667600e-11 0.3160185
NDW              3.877146e-09 0.2636723
Reading.pleasure 7.384938e-01 0.7720287
reading.work     9.571941e-01 0.6739888
IST_Total        0.000000e+00 0.5992122
MLU              5.992122e-01 0.0000000

$lowCI
                       TNW        NDW Reading.pleasure reading.work
TNW               1.0000000  0.9198730       -0.3088285   -0.2023326
NDW               0.9198730  1.0000000       -0.3067382   -0.1391506
Reading.pleasure -0.3088285 -0.3067382        1.0000000   -0.3819083
reading.work     -0.2023326 -0.1391506       -0.3819083    1.0000000
IST_Total         0.6737687  0.5929660       -0.3472970   -0.3079974
MLU              -0.4363961 -0.4510183       -0.3411815   -0.3592482
                  IST_Total        MLU
TNW               0.6737687 -0.4363961
NDW               0.5929660 -0.4510183
```

```
Reading.pleasure -0.3472970 -0.3411815
reading.work     -0.3079974 -0.3592482
IST_Total         1.0000000 -0.3735312
MLU              -0.3735312  1.0000000

$uppCI
                      TNW       NDW Reading.pleasure reading.work
TNW               1.0000000 0.9761234        0.2918114    0.3923981
NDW               0.9761234 1.0000000        0.2939225    0.4460319
Reading.pleasure  0.2918114 0.2939225        1.0000000    0.2141369
reading.work      0.3923981 0.4460319        0.2141369    1.0000000
IST_Total         0.8931748 0.8622431        0.2518886    0.2926514
MLU               0.1508641 0.1330241        0.2583746    0.2390560
                  IST_Total       MLU
TNW               0.8931748 0.1508641
NDW               0.8622431 0.1330241
Reading.pleasure  0.2518886 0.2583746
reading.work      0.2926514 0.2390560
IST_Total         1.0000000 0.2234404
MLU               0.2234404 1.0000000
```

C3.3 Reading + TNL with allistic participants

```
>
> cor(allisticTNL[,c('TNW','NDW','Reading.pleasure', 'reading.work', 'IST_Tot
al', 'MLU')])
                          TNW          NDW Reading.pleasure reading.work
TNW                1.00000000  0.96844432      -0.13298843   0.02648462
NDW                0.96844432  1.00000000      -0.21035166   0.03918018
Reading.pleasure -0.13298843 -0.21035166       1.00000000  -0.04159212
reading.work       0.02648462  0.03918018      -0.04159212   1.00000000
IST_Total          0.48549827  0.55432639      -0.30726126  -0.02436886
MLU                0.18238910  0.21959993      -0.54027239  -0.24964888
                    IST_Total         MLU
TNW                0.48549827  0.18238910
NDW                0.55432639  0.21959993
Reading.pleasure -0.30726126 -0.54027239
reading.work     -0.02436886 -0.24964888
IST_Total          1.00000000  0.08338551
MLU                0.08338551  1.00000000
> cor.mtest(allisticTNL[,c('TNW','NDW','Reading.pleasure', 'reading.work', 'I
ST_Total', 'MLU')], conf.level = 0.95)
$p
                           TNW          NDW Reading.pleasure reading.work
TNW               0.000000e+00 2.627716e-12       0.57620278    0.9117470
NDW               2.627716e-12 0.000000e+00       0.37337575    0.8697319
Reading.pleasure  5.762028e-01 3.733757e-01       0.00000000    0.8617842
reading.work      9.117470e-01 8.697319e-01       0.86178417    0.0000000
IST_Total         3.000466e-02 1.120243e-02       0.18757569    0.9187739
MLU               4.415145e-01 3.522309e-01       0.01392411    0.2884631
                   IST_Total        MLU
TNW               0.03000466 0.44151447
NDW               0.01120243 0.35223088
Reading.pleasure  0.18757569 0.01392411
reading.work      0.91877395 0.28846307
IST_Total         0.00000000 0.72670695
MLU               0.72670695 0.00000000

$lowCI
                          TNW         NDW Reading.pleasure reading.work
TNW                1.00000000  0.9203425       -0.5435228   -0.4209699
NDW                0.92034254  1.0000000       -0.5972751   -0.4104571
Reading.pleasure -0.54352282 -0.5972751        1.0000000   -0.4753637
reading.work     -0.42096993 -0.4104571       -0.4753637    1.0000000
```

```
IST_Total          0.05473745  0.1481460       -0.6600371   -0.4619085
MLU               -0.28297051 -0.2469155       -0.7931625   -0.6233096
                   IST_Total        MLU
TNW                0.05473745 -0.2829705
NDW                0.14814595 -0.2469155
Reading.pleasure -0.66003713 -0.7931625
reading.work     -0.46190855 -0.6233096
IST_Total          1.00000000 -0.3728950
MLU               -0.37289503  1.0000000

$uppCI
                        TNW       NDW Reading.pleasure reading.work
TNW               1.0000000 0.9876857        0.3288874    0.4635723
NDW               0.9876857 1.0000000        0.2559988    0.4734915
Reading.pleasure 0.3288874 0.2559988        1.0000000    0.4084463
reading.work     0.4635723 0.4734915        0.4084463    1.0000000
IST_Total         0.7639004 0.8004870        0.1565448    0.4227103
MLU               0.5782396 0.6034764       -0.1284653    0.2168257
                  IST_Total        MLU
TNW               0.7639004  0.5782396
NDW               0.8004870  0.6034764
Reading.pleasure 0.1565448 -0.1284653
reading.work     0.4227103  0.2168257
IST_Total         1.0000000  0.5071910
MLU               0.5071910  1.0000000
```

C3.4 Reading + TNL with autistic participants

```
>
> cor(autisticTNL[,c('TNW','NDW','Reading.pleasure', 'reading.work', 'IST_Tot
al', 'MLU')])
                          TNW         NDW Reading.pleasure reading.work
TNW                1.00000000  0.97785101       -0.3609472   0.39280489
NDW                0.97785101  1.00000000       -0.3409680   0.45937323
Reading.pleasure -0.36094725 -0.34096798        1.0000000  -0.11440370
reading.work       0.39280489  0.45937323       -0.1144037   1.00000000
IST_Total          0.73186098  0.64758126       -0.3840372   0.06139773
MLU               -0.03874611  0.06270248        0.2980885   0.11475814
                   IST_Total         MLU
TNW                0.73186098 -0.03874611
NDW                0.64758126  0.06270248
Reading.pleasure -0.38403724  0.29808847
reading.work       0.06139773  0.11475814
IST_Total          1.00000000 -0.36694770
MLU               -0.36694770  1.00000000
> cor.mtest(autisticTNL[,c('TNW','NDW','Reading.pleasure', 'reading.work', 'I
ST_Total', 'MLU')], conf.level = 0.95)
$p
                           TNW          NDW Reading.pleasure reading.work
TNW               0.000000e+00 9.567047e-16       0.09062702   0.06372469
NDW               9.567047e-16 0.000000e+00       0.11134601   0.02744383
Reading.pleasure 9.062702e-02 1.113460e-01       0.00000000   0.60321978
reading.work     6.372469e-02 2.744383e-02       0.60321978   0.00000000
IST_Total         7.215127e-05 8.358379e-04       0.07042473   0.78078593
MLU               8.606689e-01 7.762414e-01       0.16712362   0.60209023
                     IST_Total        MLU
TNW               7.215127e-05 0.86066893
NDW               8.358379e-04 0.77624137
Reading.pleasure 7.042473e-02 0.16712362
reading.work     7.807859e-01 0.60209023
IST_Total         0.000000e+00 0.08500556
MLU               8.500556e-02 0.00000000

$lowCI
```

```
                         TNW         NDW Reading.pleasure reading.work
TNW                1.00000000  0.94760026       -0.6730159  -0.02314477
NDW                0.94760026  1.00000000       -0.6603583   0.05818951
Reading.pleasure -0.67301593 -0.66035829        1.0000000  -0.50289082
reading.work     -0.02314477  0.05818951       -0.5028908   1.00000000
IST_Total         0.45775057  0.32108871       -0.6874201  -0.35991323
MLU              -0.44385931 -0.35877257       -0.1300994  -0.31221281
                  IST_Total         MLU
TNW                0.4577506 -0.4438593
NDW                0.3210887 -0.3587726
Reading.pleasure -0.6874201 -0.1300994
reading.work     -0.3599132 -0.3122128
IST_Total          1.0000000 -0.6767821
MLU               -0.6767821  1.0000000

$uppCI
                        TNW        NDW Reading.pleasure reading.work
TNW               1.00000000 0.99072098       0.06021372    0.6928278
NDW               0.99072098 1.00000000       0.08288325    0.7328137
Reading.pleasure 0.06021372 0.08288325       1.00000000    0.3125369
reading.work     0.69282783 0.73281373       0.31253692    1.0000000
IST_Total        0.87891634 0.83649432       0.03346200    0.4619098
MLU              0.37951743 0.46293948       0.63256559    0.5031591
                  IST_Total        MLU
TNW               0.87891634 0.37951743
NDW               0.83649432 0.46293948
Reading.pleasure 0.03346200 0.63256559
reading.work     0.46190977 0.50315910
IST_Total        1.00000000 0.05331939
MLU              0.05331939 1.00000000
```

C3.5 Reading + IBP narrative with allistic participants

```
>
> cor(allisticPERS[,c('TNW','NDW','Reading.pleasure', 'reading.work', 'IST_To
tal', 'MLU')])
                         TNW         NDW Reading.pleasure reading.work
TNW                1.00000000  0.89592480      -0.05613446  -0.14199147
NDW                0.89592480  1.00000000      -0.14495873  -0.04892898
Reading.pleasure -0.05613446 -0.14495873       1.00000000  -0.04159212
reading.work     -0.14199147 -0.04892898      -0.04159212   1.00000000
IST_Total         0.82477687  0.69838492      -0.10506516  -0.17862415
MLU              -0.09814405 -0.04887642       0.10640621   0.49726128
                  IST_Total         MLU
TNW                0.82477687 -0.09814405
NDW                0.69838492 -0.04887642
Reading.pleasure -0.10506516  0.10640621
reading.work     -0.17862415  0.49726128
IST_Total          1.00000000 -0.04699861
MLU               -0.04699861  1.00000000
> cor.mtest(allisticPERS[,c('TNW','NDW','Reading.pleasure', 'reading.work', '
IST_Total', 'MLU')], conf.level = 0.95)
$p
                          TNW          NDW Reading.pleasure reading.work
TNW               0.000000e+00 9.275135e-08        0.8141611   0.55040317
NDW               9.275135e-08 0.000000e+00        0.5420156   0.83768966
Reading.pleasure 8.141611e-01 5.420156e-01        0.0000000   0.86178417
reading.work     5.504032e-01 8.376897e-01        0.8617842   0.00000000
IST_Total        7.681252e-06 6.151775e-04        0.6593325   0.45115754
MLU              6.805971e-01 8.378618e-01        0.6552406   0.02569837
                   IST_Total         MLU
TNW               7.681252e-06 0.68059713
NDW               6.151775e-04 0.83786181
Reading.pleasure 6.593325e-01 0.65524057
```

```
reading.work     4.511575e-01 0.02569837
IST_Total        0.000000e+00 0.84401645
MLU              8.440165e-01 0.00000000

$lowCI
                         TNW        NDW Reading.pleasure reading.work
TNW                1.0000000  0.7512477       -0.4865686  -0.54995621
NDW                0.7512477  1.0000000       -0.5520660  -0.48103436
Reading.pleasure -0.4865686 -0.5520660        1.0000000  -0.47536365
reading.work     -0.5499562 -0.4810344       -0.4753637   1.00000000
IST_Total         0.6019600  0.3703077       -0.5232578  -0.57564327
MLU              -0.5181607 -0.4809939       -0.3527232   0.07018448
                  IST_Total         MLU
TNW                0.6019600 -0.51816070
NDW                0.3703077 -0.48099386
Reading.pleasure -0.5232578 -0.35272324
reading.work     -0.5756433  0.07018448
IST_Total         1.0000000 -0.47954587
MLU              -0.4795459  1.00000000

$uppCI
                       TNW       NDW Reading.pleasure reading.work
TNW               1.0000000 0.9584524        0.3962289    0.3206789
NDW               0.9584524 1.0000000        0.3179582    0.4023025
Reading.pleasure  0.3962289 0.3179582        1.0000000    0.4084463
reading.work      0.3206789 0.4023025        0.4084463    1.0000000
IST_Total         0.9284362 0.8715525        0.3539101    0.2865467
MLU               0.3600124 0.4023467        0.5242420    0.7702826
                  IST_Total       MLU
TNW               0.9284362 0.3600124
NDW               0.8715525 0.4023467
Reading.pleasure  0.3539101 0.5242420
reading.work      0.2865467 0.7702826
IST_Total         1.0000000 0.4039229
MLU               0.4039229 1.0000000
```

C3.6 Reading + IBP narrative with autistic participants

```
>
> cor(autisticPERS[,c('TNW','NDW','Reading.pleasure', 'reading.work', 'IST_To
tal', 'MLU')])
                          TNW        NDW Reading.pleasure reading.work
TNW                1.00000000  0.9808521       0.01075196   0.20482875
NDW                0.98085206  1.0000000       0.05561220   0.25967985
Reading.pleasure   0.01075196  0.0556122       1.00000000  -0.11440370
reading.work       0.20482875  0.2596798      -0.11440370   1.00000000
IST_Total          0.82948993  0.8130299      -0.01968320   0.07902086
MLU               -0.18643792 -0.2235550      -0.10029476  -0.22491360
                   IST_Total         MLU
TNW                0.82948993 -0.18643792
NDW                0.81302986 -0.22355502
Reading.pleasure  -0.01968320 -0.10029476
reading.work       0.07902086 -0.22491360
IST_Total          1.00000000 -0.08726082
MLU               -0.08726082  1.00000000
> cor.mtest(autisticPERS[,c('TNW','NDW','Reading.pleasure', 'reading.work', '
IST_Total', 'MLU')], conf.level = 0.95)
$p
                          TNW          NDW Reading.pleasure reading.work
TNW               0.000000e+00 2.101580e-16        0.9611662    0.3484827
NDW               2.101580e-16 0.000000e+00        0.8010193    0.2314653
Reading.pleasure  9.611662e-01 8.010193e-01        0.0000000    0.6032198
reading.work      3.484827e-01 2.314653e-01        0.6032198    0.0000000
IST_Total         9.919376e-07 2.416469e-06        0.9289695    0.7200454
```

```
MLU               3.943432e-01 3.051769e-01        0.6488759    0.3021700
                     IST_Total       MLU
TNW               9.919376e-07 0.3943432
NDW               2.416469e-06 0.3051769
Reading.pleasure  9.289695e-01 0.6488759
reading.work      7.200454e-01 0.3021700
IST_Total         0.000000e+00 0.6921735
MLU               6.921735e-01 0.0000000

$lowCI
                          TNW        NDW Reading.pleasure reading.work
TNW                1.0000000  0.9546060       -0.4032374   -0.2264967
NDW                0.9546060  1.0000000       -0.3649560   -0.1708054
Reading.pleasure -0.4032374 -0.3649560        1.0000000   -0.5028908
reading.work     -0.2264967 -0.1708054       -0.5028908    1.0000000
IST_Total         0.6340965  0.6028687       -0.4284095   -0.3443993
MLU              -0.5559178 -0.5821153       -0.4921506   -0.5830603
                  IST_Total        MLU
TNW               0.6340965 -0.5559178
NDW               0.6028687 -0.5821153
Reading.pleasure -0.4284095 -0.4921506
reading.work     -0.3443993 -0.5830603
IST_Total         1.0000000 -0.4821215
MLU              -0.4821215  1.0000000

$uppCI
                        TNW       NDW Reading.pleasure reading.work
TNW               1.0000000 0.9919853        0.4210879    0.5689906
NDW               0.9919853 1.0000000        0.4573308    0.6069172
Reading.pleasure  0.4210879 0.4573308        1.0000000    0.3125369
reading.work      0.5689906 0.6069172        0.3125369    1.0000000
IST_Total         0.9253118 0.9176856        0.3957297    0.4757274
MLU               0.2445586 0.2077955        0.3253583    0.2064263
                  IST_Total       MLU
TNW               0.9253118 0.2445586
NDW               0.9176856 0.2077955
Reading.pleasure  0.3957297 0.3253583
reading.work      0.4757274 0.2064263
IST_Total         1.0000000 0.3370653
MLU               0.3370653 1.0000000
```