A Dissertation

entitled

The Effect of a 10-month Delay on Autobiographical Memory and Suggestibility in Children with Autism Spectrum Disorder

by

Kristina Todorovic

Submitted to the Graduate Faculty as partial fulfillment of the requirements for the

Doctor of Philosophy Degree in

Experimental Psychology

_____
Dr. Kamala London, Committee Chair

_____
Dr. Stephen Christman, Committee Member

_____
Dr. Sarah Francis, Committee Member

_____
Dr. Cin Cin Tan, Committee Member

_____
Dr. Elissar Andari, Committee Member

_____
Dr. Amy Thompson, Dean
College of Graduate Studies

The University of Toledo

May 2022

An Abstract of

The Effect of a 10-month Delay on Autobiographical Memory and Suggestibility in Children with Autism Spectrum Disorder

by

Kristina Todorovic

Submitted to the Graduate Faculty as partial fulfillment of the requirements for the Doctor of Philosophy Degree in
Experimental Psychology

The University of Toledo
May 2022

To date, evidence-based guidelines for interviewing children with Autism Spectrum Disorder (ASD) do not exist. Several different evidence-based interview protocols exist worldwide, but these were empirically derived based research with typically developing (TD) children. The present investigation is a follow-up study to an initial study that compared event memory and suggestibility among TD and ASD children. In the original study, 68 control (i.e., TD) and 30 ASD children participated in a three-session study. In session 1, children individually participated in an interactive magic show. Approximately 1-week later, in Session 2, children were given true reminders and false suggestions about the magic show. About 4-days later, in Session 3, children were given an initial memory test (i.e., two-weeks after the staged event). In the current follow-up study, we sought to examine whether autobiographical reports among ASD children differed from control children following a 10-month delay. Approximately 10-months after the staged event, we located and retested 41 control and 22 ASD children. In addition to retaking the initial memory test, children were given a lineup identification and object recognition task. The results revealed both ASD and control children's free recall was at the floor at

the 10-month delay. Compared to control children, more ASD children recalled *no details* about the magic show in the 10-month than the two-week delay interview. Control children recalled more correct utterances than ASD children regardless of the delay period. Children's recognition memory also worsened with the 10-month delay. Both groups showed memory facilitation effects at both the two-week and 10-month delayed interviews. Both groups showed memory misinformation effects at the two-week interview. At the 10-month interview, control children showed misinformation effects. In children with ASD, their false assent rate to non-suggested items was equally high as their false assent rate to suggested items. Similar patterns were found among control and ASD children in their performance on the lineup identification and object recognition tasks. In addition to the theoretical contribution, these results are important to professionals who interview ASD children by further understanding autobiographical memory in this vulnerable population. These results can be used to develop evidence-based guidelines for interviewing children with ASD and to guide early intervention programs.

Acknowledgements

I am immensely grateful for all the help I have received along this journey. I would like to thank my advisor, Dr. Kamala London, who has devoted countless hours helping me become a better researcher. Thank you for everything. I would also like to thank Dr. Maggie Bruck, Dr. Rebecca Landa, and Dr. June Goodman for allowing me to use their archival data as my dissertation. This project was supported by a grant from the National Institutes of Health (R01 HD39282) to Dr. Maggie Bruck. Thank you to the many children, parents, and school staff who took part in this study. I am also appreciative to my committee members for encouraging me to think critically about my analyses plan.

I would like to thank my family for their countless support and encouragement. To my parents, Cindy and Rudy, I thank you for your unwavering support through this journey. To my sister, Sofija, thank you for your encouragement as we took on becoming doctors together. To my fiancé, Eric, thank you for emotionally supporting me during this process. Lastly, to my daughter, Amelia, thank you for making me proud to be your mom. All your love and support mean everything to me. I could not have completed this journey without you by my side. Thank you for everything.

Table of Contents

List of Tables

List of Figures

Chapter One

Introduction

Children's forensic reports typically represent the primary or even sole evidence in child maltreatment investigations (London et al., 2008). A main concern in these cases is how to best communicate with children to gather the most accurate and complete reports while avoiding methods that elicit false information. To date, several evidence-based forensic interview protocols have been developed and refined based on developmental science (e.g., Lamb et al., 2008). Yet these protocols have been developed based on research with typically developing (TD) children. Forensic interview methods may need to be tailored to promote accurate and complete reports in children with Autism Spectrum Disorder (ASD) while avoiding methods that elicit false reports. However, evidence-based guidelines for interviewing children with ASD do not exist. Instead, investigative practices are based on intuition, and likely, the judgment of the individual interviewer who may have very little training on the cognitive and social functioning of children with ASD. Realizing this limitation, researchers have begun to investigate ASD children's autobiographical reports and susceptibility to suggestion.

Child maltreatment is a major public health issue associated with various lifelong consequences for victims, therefore, a failure to properly assist children with ASD in cases of suspected maltreatment is highly problematic. Maltreatment investigations also have high consequences for incorrect decisions such as wrongfully convicting an innocent person or taking a child away from a loving parent. Children with ASD are a particularly important population to examine because ASD is incredibly prevalent (1 in 44 children; Maenner et al., 2020) and children with intellectual and developmental

disabilities are at an increased risk of maltreatment relative to TD children (Mandell et al., 2005). Since children with ASD show impaired cognitive, social, and communication skills, these differences may have ramifications for best interview practices with ASD children.

Despite preliminary empirical investigations, researchers' understanding of autobiographical memory and suggestibility in children with ASD remains incomplete. Acknowledging there are myriad developmental differences in children with ASD (e.g., Bowler et al., 2004; Corbett et al., 2009; Williams et al., 2006), further research is needed to determine how these differences impact ASD children's autobiographical reports and susceptibility to different modes of suggestion in comparison to TD children. Thus, research on ASD children's eyewitness memory abilities is needed to understand how evidence-based guidelines may need to be modified when interviewing children on the autism spectrum.

In the first section below, we provide a brief description of the social, behavioral, and communication profile of ASD. In the second section, we provide an overview of the literature on the development of best practice forensic interview guidelines in TD children. In the third section, we discuss the literature regarding autobiographical memory in children with ASD compared to TD children. Finally, in the fourth section, we discuss ASD children's susceptibility to different modes of suggestibility in comparison to TD children.

What is Autism Spectrum Disorder (ASD)?

ASD is a neurodevelopmental disorder that involves difficulties in communication, social interactions, and repetitive or restricted behaviors beginning early

in life (American Psychiatric Association, APA, 2013). Individuals with ASD may display a wide range of symptoms, skills, or levels of impairments across three diagnostic domains (i.e., Level 1 requiring support, Level 2 requiring substantial support, and Level 3 requiring very substantial support; APA, 2013). ASD is shown to be heavily based on the brain and genes (Abrahams & Geschwind, 2008; Koenig et al., 2001; Rutter, 2005), and affects individuals throughout their lifespan (Burack et al., 2001; Lord & Spence, 2006). Over the past 30 years, ASD has become an increasingly prevalent diagnosis (about 1 in 44 in the United States) and is more common in boys (1 in 37) than in girls (1 in 151; Baio et al., 2018).

A defining feature of ASD is exhibiting some degree of impairment in normative social behavior and communication (Volkmar, 2011). For example, individuals with ASD often exhibit difficulties initiating and engaging in social conversation (Lord, 2010; Shire et al., 2015), may have impairments with language (Eigsti et al., 2011), and are less sensitive in responding to their name (APA, 2013). Individuals with ASD often show deficits in emotional development including difficulty with emotional processing, conveying emotion, and expressing empathy towards others (Capps & Sigman, 1996; Carter et al., 2005). Finally, individuals with ASD may exhibit repetitive or stereotyped sensorimotor behaviors (e.g., hand flapping), insistence of sameness, and overly focused interests on specific objects (APA, 2013).

ASD includes a wide spectrum of symptoms and functioning across individuals and development (Charman et al., 2011; Geschwind & Levitt, 2007). This presents a challenge for diagnosing ASD and conducting generalizable research. The criteria used for diagnosing ASD has been updated regularly (APA, 1987, 1994, 2000, 2013), thus,

empirical research has used different criteria for selecting participants with ASD. This factor should be considered when interpreting the existing literature examining eyewitness memory and suggestibility among children with ASD.

Intellectual disability frequently occurs with ASD, although the co-occurrence has reduced from 75% to 50% over the past several decades (CDC, 2000). Individuals on the higher end of the autism spectrum generally have average to above-average intelligence quotient (IQ) and similar vocabulary skills to TD children. These individuals generally have difficulty with the pragmatics of language, understanding verbal and non-verbal cues, and language acquisition (Eigsti et al., 2011; Tager-Flusberg et al., 2005). Most eyewitness experiments focus on this subgroup of ASD individuals because an individual must be verbal in order to be interviewed. In contrast, individuals on the lower end of the autism spectrum are intellectually disabled and may have diminished or limited expressive language abilities.

Before comparing ASD and TD children we will discuss the evidence-based interview techniques used with TD children. Specifically, in the next section, we will review the literature on the reliability of children's reports during forensic interviews and how various factors may impede the veracity of children's reports.

Empirically Supported Forensic Interview Techniques

Spurred by multiple sexual abuse accusations in the 1980's, a growing body of literature has examined the reliability of children's reports and how to promote accurate and complete autobiographical reports while minimizing inaccurate information. For example, in 1985, 26-year-old Kelly Michaels was accused of sexually abusing 20 children who attended the Wee Care Nursery School (Ceci & Bruck, 1993; *State v.*

Michaels, 1988). In this case, the first disclosure was made by a boy while at the doctor's office. Specifically, during an examination where the boy was getting his temperature taken rectally, he reportedly disclosed, "That's how my teacher takes my temperature too." After the doctor appointment, the boy's mother informed child protective services about the allegation made against her son's teacher, Kelly Michaels. Child protective services launched an investigation. A state prosecutor interviewed the boy about the allegations. The interviewer used an anatomically detailed doll during the interview so the boy could physically show what type of abuse may have occurred. During the interview, the boy reportedly confirmed the allegations by inserting his finger into the doll's anus. Based on this allegation, the Wee Care Nursery School sent a letter home to parents reporting the investigation of a former employee. Interviewers then conducted repeated suggestive interviews with multiple children who disclosed abuse. After repeated interviews, children who initially denied the abuse changed their responses to be in line with the interviewers' suggestions. Concluding the investigation and trial in 1988, Ms. Michaels was convicted of 115 counts of child sexual abuse and sentenced to 47 years in prison. Five years into her sentence, the New Jersey Supreme Court ruled Ms. Michaels did not receive a fair trial and she was released from prison. The court reported that because the interviews with the children used highly suggestive methods Ms. Michael was denied a fair and impartial trial.

Following a rash of high-profile and highly dubious daycare cases, developmental psychologists began devoting much attention to developing empirically supported developmentally sensitive interview techniques. Numerous forensic interview protocols are available to forensic interviewers that offer principles for best practice guidelines for

interviewing children (e.g., National Institute of Child and Development, National Children's Advocacy Center). The vast majority of empirical studies examining eyewitness reports have used the National Institute Child Health and Development (NICHD) investigative interview protocol. The NICHD protocol is widely considered to be the gold-standard protocol.

The NICHD protocol was developed to guide interviewers away from using suggestive questions and towards a style of questioning that have been empirically shown to promote children's testimonial competence (Lamb & Fauchier, 2001; Lamb et al., 2007). The NICHD protocol has been shown to enhance the reliability of children (Hershkowitz et al., 2007), and improve the quality of information obtained (Lamb et al., 2007). The protocol also has been shown to culminate in a higher rate of successful prosecutions than cases involving non-protocol interviews.

The NICHD protocol guides interviewers through multiple phases and maximize the amount of information obtained from children via free-recall memory. One highly robust finding in basic cognitive developmental laboratory-based research is that children are more likely to provide accurate responses to open-ended questions versus when asked forced-choice questions (Lamb & Fauchier, 2001). In field studies, Michael Lamb and colleagues have demonstrated in dozens of studies with thousands of children from numerous countries that children who were interviewed with the NICHD protocol reported greater levels of details compared to children interviewed without the protocol (e.g., Orbach et al., 2000).

NICHD Protocol Phases. In the NICHD protocol, interviewers are instructed to move through three phases with the child witness (Hershkowitz et al., 2007; Lamb et al.,

2007). First the pre-substantive phase consists of explaining the ground rules, rapport building, and narrative practice. In this phase, an interviewer introduces themselves and emphasizes that the child should give descriptive details about the event and tell the truth. During this phase, the interviewer also explains the ground rules. This includes explaining that the child should only tell them what they really remember and that it is okay to say 'I don't know' or to correct the interviewer if they say something that is incorrect. In the rapport-building portion, the goal is to create a relaxed, supportive environment for the child and to establish rapport. To familiarize the child with the interviewing process, the interviewer may ask the child to describe a recent, non-threating event. In the second phase, the substantive phase, the interviewer will use open-ended prompts to assist the child in explaining the incident. Throughout the interview process interviewers are instructed to use open-ended prompts and avoid using suggestive questions. However, the protocol allows interviewers to use directive and limited option-posing questions as clarification if crucial details are still missing after children have made a disclosure (Lamb et al., 2007). Finally, in the closure phase the interviewer thanks the child for talking to them and asks if there's anything else the child want to tell them.

Guidelines for Forensic Interviews. Overall, forensic interview guidelines recommend avoiding suggestive and misleading questions when interviewing children. Over 30 years of research has delineated explicit leading techniques such as how asking questions that incorporate statements regarding events the child has not previously mentioned can influence the child's reports. Misleading questions incorporate inaccurate information about the incident. When children's reports are elicited by suggestive and misleading questions the information gathered is often viewed as unreliable because

children may incorporate information into their response that was suggested to them by the interviewer (Bruck & Ceci, 2013; Lamb et al., 2007). Importantly, suggestive methods go far beyond the obvious leading questions like 'Tell me what happened when he touched you.' Rather, children's reports can be affected by less explicit techniques (Eisen et al., 2019; Goldfarb et al., 2018).

One important implication of the suggestibility literature on TD children is that levels of suggestibility are dependent upon the interview context as well as social and cognitive characteristics that change with the child's development. Because children with ASD show several social and cognitive impairments, further research is needed to outline the strengths and weakness of their autobiographical reports. Thus, suggestibility does not show a linear decline, but rather certain modes of suggestibility affect children differently depending on their social and cognitive developmental skills (see Brainerd et al., 2008). Based on the general cognitive features of ASD deficits in eyewitness memory would be predicted. At the same time, since suggestibility is known to result from social influence, children with ASD may outperform TD children under certain interview contexts. However, the formulation of evidence-based interview protocols has been developed with TD children, thus a more extensive understanding is necessary to accurately gauge ASD children's autobiographical report abilities as well as their susceptibility to different types of suggestive information.

Autobiographical Memory in Children with ASD

Autobiographical memory refers to the recall of past personally experienced events. Children begin to develop autobiographical memories between 2- and 3-years of age (Fivush et al., 1987; Howe et al., 2003; Howe et al., 1994; Hudson, 1993). Research

demonstrates adults with ASD have deficits in their autobiographical memory (e.g., Crane & Goddard, 2008; Tanweer et al., 2010), including difficulties recalling personally experienced events. A common finding in the autobiographical literature is individuals with ASD who are verbally able with average intelligence tend to have intact recognition memory (e.g., Bowler et al., 2000) and cued recall (e.g., Bowler et al., 1997; Gardiner et al., 2003), but experience impairments in their free recall reports (e.g., Bowler et al., 2009; Bowler et al., 1997; Gaigg & Bowler, 2008). However, little research has examined memory among children with ASD in a context that allows inferences for forensic investigation techniques (e.g., memory for specific events, lineup performance). We will now review the limited studies examining ASD children's autobiographical memory for a staged event (see Table 1). Studies that stage events for children are important since it allows researchers to determine the accuracy in addition to the quantity of children's statements. The following studies control children (i.e., TD children) are matched to ASD children on several factors including chronological and mental age.

Table 1

Summary of reviewed studies examining autobiographical memory for a staged event in children with ASD

Study	**Group (*N*)**	**Mean CA**	**Sex (male:female)**	**Event**	**Main Findings**
Almeida et al. (2019)	ASD (27)	10.63	23:4	Autism Diagnostic Observation Schedule, Second Edition	Children with ASD recalled less information but the information recalled was as accurate as TD children.
	TD (32)	9.38	18:14		

Table 1 cont.

Study	Group (*N*)	Mean CA	Sex (male:female)	Event	Main Findings
Bruck et al. (2007)	ASD (30)	7.6	26:4	Magic Show	Children with ASD displayed deficits in their ability to recall personally experienced events in free recall and forced-choice questions.
	TD (38)	7.4	23:15		
Cornett et al. (2013)	ASD (42)	10.8	40:2	Encounter with a Stranger	Trend that children with ASD had better memory for witnessed than personally experienced events.
	TD (N/A)	N/A	N/A		
Henry, Crane et al. (2017)	ASD (71)	9.4	62:9	School Assembly Presentation with Minor Crime	Children with ASD showed no differences in information recalled among best-practice police interview, verbal labels, sketch reinstatement of context, or a registered intermediary investigative interview condition.
	TD (199)	8.7	98:101		
Henry, Messer et al. (2017)	ASD (71)	9.4	-[a]	School Assembly Presentation with Minor Crime	Children with ASD recalled fewer correct details but were as accurate as TD peers.
	TD (201)	8.7	-[a]		

Table 1 cont.

Study	Group (*N*)	Mean CA	Sex (male:female)	Event	Main Findings
Mattison et al. (2015)	ASD (45)	14.6	-[b]	Crime Video	TD children recalled more details than children with ASD. ASD children's performance was enhanced when asked to draw what they witnessed.
	TD (45)	10.2	-[b]		
McCrory et al. (2007)	ASD (24)	13.02	22:2	Classroom Presentation	Children with ASD reported less information in free recall than TD children.
	TD (27)	12.55	24:3		
Millward et al. (2000)	ASD (12)	13.1	11:1	Outdoor Walk	Children with ASD recalled less information about events performed than witnessed. The opposite was found for TD children.
	TD (12)	5.8	10:2		

Note. CA = chronological age.
[a] The sample included 162 boys and 110 girls, but the authors did not report the sex breakdown for groups.
[b] The sample included 55 boys and 35 girls, however the authors did not report the sex breakdown within each diagnostic group.

Autobiographical Memory for a Staged Event. Millward et al. (2000) were the first to investigate autobiographical memory for a staged event among 11- to 15-year-old children with ASD and 5- to 6-year-old verbally and mentally age-matched TD children. Children in the Millward et al. (2000) experiment participated in two separate 25-minute walks with a researcher. In both walks, children were instructed to visit five locations. During the first walk, children individually participated in different events (e.g., buying a

sweat from a shop, playing on equipment in the park, posting a letter in the street) at each of the locations. On the second walk, children walked in pairs and participated in five different events (e.g., picking up straw, playing with a skipping rope) with their assigned pair. The results revealed that compared to TD children, children with ASD reported fewer event details that happened to themselves. However, children with ASD and TD children reported a comparable number of events experienced by their pair children (Millward et al., 2000). These findings suggest children with ASD may struggle to remember personally experienced events.

Additional research has been consistent with Millward et al. (2000) findings. Cornett et al. (2013) investigated 6- to 16-year-old ASD children's recognition memory for a witnessed or personally experienced event. Immediately after the event, children were asked a series of recognition questions. Although not statistically significant, the results revealed a trend that children with ASD had nominally *better* recognition memory for a witnessed than a personally experienced event. This finding had an effect size of 0.51 thus the non-significant result may be due to the small sample size used in the experiment. Moreover, Cornett et al. (2013) did not include a comparison group of TD children therefore no information can be gleaned regarding how children with ASD performed compared to TD children. A robust finding among TD children is that they recall personally experienced events better than witnessed events (Pipe et al., 2004). No age trends regarding ASD children's recognition memory were found (Cornett et al., 2013).

Other researchers have investigated how ASD children's autobiographical reports differ depending on the retrieval context. Mattison et al. (2015) and Henry, Crane et al.

(2017) examined whether the conditions under which children with ASD recall details of an event impacts the quantity and accuracy of the information gathered. Mattison et al. (2015) found regardless of retrieval condition, TD children recalled more correct details from a videoclip than children with ASD. However, when asked to draw during free recall (i.e., sketch condition) children with ASD showed enhanced performance compared to when given instructions to mentally reinstate both the environmental and personal context surrounding the event (i.e., mental reinstatement condition) and when simply asked to recount details from the videoclip (i.e., control condition; Mattison et al., 2015). Contrary to the Mattison et al. (2015) findings, Henry, Crane et al. (2017) reported drawing what happened before the free recall phase of the interview did not enhance performance in children with ASD. Specifically, when controlling for chronological and mental age, Henry, Crane et al. (2017) found no significant differences in the number of correct details, type of information recalled, or inaccurate details children with ASD provided between the four investigative interview conditions. However, TD children recalled a greater number of correct details when provided with four additional verbal prompts regarding the event (i.e., verbal labels condition) and when questioned by a trained professional who facilitated the interview between the witness and investigator (i.e., registered intermediaries condition; Henry, Crane et al., 2017). These findings are important because the sketch reinstatement approach may be modifiable to meet the needs of children with ASD.

Individual difference factors are also important to consider since ASD is on a wide spectrum. Henry, Messer et al. (2017) examined whether individual difference factors predicted 6- to 11-year-old ASD and TD children's autobiographical memory

immediately following a witnessed event. The authors examined the following individual difference factors: Age, group status, non-verbal IQ, memory, language, and attention. The results revealed children with ASD reported significantly less information, but the information provided was as accurate as those of TD children. Both groups had high levels of accuracy in their recall (TD children = 88.9%, ASD children = 86.8%). The authors also ran the analyses with children with ASD chronologically and mentally age-matched to TD children and found similar results (Henry, Messer et al., 2017). In short, these findings tell us that although children with ASD provide less information in their reports the information provided is as accurate as their TD peers.

Lastly, a small handful of studies have examined how suggestion can impact ASD children's event memory. Bruck et al. (2007) examined 5- to 10-year-old ASD children's autobiographical memory and their susceptibility to misinformation. The results demonstrated children with ASD had deficits in recalling memories from the staged event after a two-week delay. That is, children with ASD provided fewer details about the event and the information provided to open-ended, specific, and recognition questions were less accurate compared to chronologically age-matched TD children. Similarly, Henry, Messer et al. (2017) found children with ASD recalled fewer details in the interview immediately after the staged event compared to TD children. Further, Bruck et al. (2007) found children with ASD displayed no differences in their susceptibility to suggestive questioning when examined as a function of non-occurring items compared to TD children. Bruck et al. (2007) also found both ASD and TD children were suggestible, however, children with ASD assented to more of the non-suggested false items than TD children. Moreover, the results showed a facilitation effect of true reminded questions,

such that TD children provided more accurate responses to true reminded and true non-reminded questions in comparison to children with ASD (Bruck et al., 2007). Given children with ASD did not show the same memory facilitation effect, the findings indicate event memory in children with ASD may not equally benefit from rehearsal. In sum, these findings indicate children with ASD had poorer performance and incorporated inaccurate information from misleading questions to the same extent as TD children.

McCrory et al. (2007) presented similar results, finding that children with Asperger syndrome (AS) were no less accurate and no more suggestible than TD children. In their study, McCrory et al. (2007) investigated autobiographical memory for a staged event and their responses to leading questions in 11- to 14-year-old TD children versus children with AS. The staged event included a neutral and socially salient sub-scene (i.e., minor exchange between two actors involving annoyance from an "injured" person and remorse from the other actor). McCrory et al. (2007) used the DSM-IV (APA, 1994) as their inclusion criteria which included autistic disorder, Asperger syndrome, childhood disintegrative disorder, and pervasive development disorders as separate diagnoses. The results revealed that in free recall children with AS recalled significantly less information compared to age-matched TD children. However, children with AS gave similar amounts of information to specific questions as TD children. Further, McCrory et al. (2007) found children with AS recalled less information from the socially salient sub-scene during free recall compared to TD children. However, when asked specific questions about the socially salient sub-scene no differences emerged between children with AS and TD children. Finally, both groups of children were equally suggestible to the interviewers misleading questions (McCrory et al., 2007). In short, these findings further

highlight the role of gist in autobiographical memory showing that children with AS provided significantly less gist-based information about salient aspects of the event compared to TD children.

To our knowledge, only one study has directly examined the effects of delay on ASD children's memory for a personally experienced event. Almeida et al. (2019) examined whether children with ASD continued to show poorer performance following two delay periods. Almeida et al. (2019) investigated 6- to 15-year-old ASD children's autobiographical memory for an experienced event and the impact of a supportive interviewer on the quantity and accuracy of information provided following a two-week and two-month delay. The interviewers employed the semi-structured NICHD interview protocol. The results revealed children with ASD were given a greater amount of directive prompts compared to age-matched TD children indicating that children with ASD may require more prompts than TD children to elicit the same amount of information. Regarding the information provided, like previous research (Bruck et al., 2007; Henry, Messer et al., 2017; McCrory et al., 2007), children with ASD recalled fewer details about the event, but the information provided was as accurate as those of TD children. Almeida et al. (2019) also found interviewers provided fewer supportive invitations to children with ASD compared to TD children. Finally, TD children were given more supportive prompts than children with ASD regardless of the delay period. However, interviewer-provided social support was only found to benefit children during the first interview (i.e., two-week delay) but not following a two-month delay. In sum, children with ASD recalled fewer correct details when questioned using open invitations, cued invitations, and directive questions compared to TD children. Nonetheless, children

with ASD were as accurate in their narratives to all types of prompts compared to TD children (Almeida et al., 2019).

Summary of Event Memory Experiments. Although limited studies have examined ASD children's autobiographical memory for a staged event, multiple findings emerged. First, children with ASD who have average intelligence tend to remember less information in free recall narratives, but the information recalled is as accurate as TD children (Bennetto et al., 1996; Henry, Messer et al., 2017; McCroy et al., 2007; Maras & Bowler, 2010; Mattison et al., 2015). This finding is further supported by literature demonstrating that event memory in children with ASD differ from TD children. For example, children with ASD show multiple deficits in their narratives such as coherence, action details, resolution (Goldman, 2008), temporal coherent, causal linkages (Diehl et al., 2006), usage of complex words, and frequency of words (King et al., 2013). The content provided during free recall narratives also differ between TD and ASD children. For example, children with ASD tend to focus on peripheral event details such as providing the description of a bystander instead of the perpetrator (McCrory et al., 2007). Additionally, children with ASD tend to lack coherence, organization around central themes, and mental state information (Capps et al., 2000; Diehl et al., 2006), and are likely to include bizarre or inappropriate information in their reports (Loveland et al., 1990). Taken together, children with ASD provide sparser and less organized eyewitness information when describing the events in their own words.

Taken together, extant memory research indicates children with ASD can give competent eyewitness accounts. However, best practice forensic interview guidelines may need to be tailored when interviewing children with ASD to overcome their recall

performance deficiencies. Some scholars have reported children with ASD may benefit from additional support throughout the interview to enhance the amount of accurate information obtained (Almeida et al., 2019; Malloy et al., 2018; Mattison et al., 2015; McCrory et al., 2007; Millward et al., 2000). For example, Malloy et al. (2018) suggested children with ASD may benefit from additional scaffolding and prompting as well as cued invitations. This claim is supported by Millward et al. (2000) and McCrory et al. (2007) experiments which found ASD children's memory improved when the interviewer switched from free to cued recall. However, the use of directed prompts should be cautioned because children tend to have lower accuracy on forced choice questions due to their tendency to provide a response to the interviewers' question. Mattison et al.'s (2015) finding further support Malloy et al.'s (2018) claims by demonstrating ASD children's free recall may be enhanced when children are allowed to draw what happened before and throughout the interview process. However, Mattison et al. (2015) did not ask questions that included false information, thus future research is needed to determine whether drawing enhances ASD children's performance when asked questions regarding false events.

Lastly, in direct contrast to TD children, children with ASD have better memory for *witnessed* than *personally experienced events* (Cornett et al., 2013; Millward et al., 2000). This finding is supported by the self-reference effect or the tendency for individuals to encode information differently depending on the level of previous experience (Rogers et al., 1997). One possibility is that children with ASD find social interactions to be confusing or cognitively taxing compared to TD children. Such extra cognitive effort in the social interactions may account for their poorer performance in

experienced versus witnessed events. A more comprehensive approach needs to be taken to determine what factors may impact ASD children's difficulties in recalling memories for experienced events.

Limitations of Research Methods in Extant Studies. Although these studies found children with ASD can be reliable witnesses, several methodological limitations exist. First, most of these studies had small or imbalanced sample sizes (see Table 1). That is, some of these studies may have been underpowered due to having sample sizes below 25 participants in each condition. For example, Mattison et al. (2015) had three retrieval conditions in their study but only 45 children in each group, therefore, each condition had less than 25 participants. Henry, Crane et al. (2017) and Henry, Messer et al. (2017) experiments had an imbalanced sample size; the ASD group may have been underpowered across the four conditions because there was a maximum of 18 children with ASD in each condition, whereas the TD group had between 38 and 75 children in each condition. This imbalanced sample size may explain why Henry, Crane et al. (2017) did not find enhanced performance for children with ASD when asked to draw a picture that would assist them in remembering the details of the event. Moreover, some studies did not report effect sizes thus it is unclear whether significant findings were robust or practically meaningful (e.g., Millward et al., 2000).

Second, the difference in the distribution of intelligence between the two groups is a limitation in several studies. To start, some studies did not administer an assessment to measure children's intelligence rather authors administered verbal mental age assessments (Cornett al., 2013; Mattison et al., 2015; Millward et al., 2000). Of the studies that measured children's intelligence, they did not report correlates of children's

IQ scores and their recall performance (e.g., Almeida et al., 2019; Bruck et al., 2007; McCrory et al., 2007). For example, in Bruck et al. (2007), TD children had significantly higher partial IQ scores (M = 105) than children with ASD (M = 96). However, the authors did report that controlling for partial IQ made no difference in their results (Bruck et al., 2007).

Lastly, extant studies used different diagnostic criteria for their inclusion of children with ASD. Thus, another limitation is generalizability. Due to the various criteria used to diagnose individuals with ASD over the years it is difficult to measure how useful these findings are for a broader group of children with ASD. Moreover, a wide spectrum of symptoms and functioning are associated with ASD. Therefore, these findings may only apply to children with ASD who show specific symptoms and functioning.

Impact of Delay on Autobiographical Memory. Similar to the normal process of forgetting children's autobiographical memory also changes with time (Otgaar et al., 2019). The present study focuses on the effects of a long delay period (i.e., 10-month delay) on children's reports because allegations of child sexual abuse often involve an element of delay between the incident and the forensic investigation (London et al., 2005). When considering whether a child's statement is reliable it is important to consider that memory naturally deteriorates and fades as the time between experiencing the event and recalling the event increases (Ebbinghaus, 1885/1964). In addition to the normal deterioration that happens over time, delayed memories are also problematic because of the increased effects of suggestion (Pezdek & Roe, 1995). Children's most accurate memory for an event are those made closest in time to the event in question

before opportunities for exposure to suggestion have taken place. As previously mentioned, forensic interviewers are recommended to avoid suggestive and misleading questions. Although best practice guidelines recommend forensic interviewers avoid suggestive questions, this type of questioning can also occur informally by a family member. Whether the suggestive questioning is done in a formal or informal context it can impact the reliability of the child's memory for the event (Principe & Schindewolf, 2012).

Research examining the effects of delay on TD children's memory for non-stressful or staged events have found variability in performance over time depending on the types of prompts used to elicit children's reports. Some studies have reported children's memories increase or stay the same over time when asked free recall and open-ended prompts (e.g., Fivush & Hamon, 1989; La Rooy et al., 2005 [Experiment 1 and 2]; Pipe et al., 2004). Other studies have found the amount of information provided and accuracy of children's reports decreases after longer delay periods when asked free recall and recognition prompts (e.g., Baker-Ward et al., 1990; Hudson & Fivush, 1991; La Rooy et al., 2005; Pipe et al., 1999 [Experiment 1 and 2]; Salmon & Pipe, 1997). This variability may be related to the differences in how children's accounts were scored (Peterson, 2011). To our knowledge, only Almeida et al. (2019) has investigated the effects of delay on responses to recall and recognition prompts among children with ASD. Specifically, Almeida et al. (2019) examined how children with ASD respond to different types of prompts and the effects of interviewer supportiveness on children's reports following a two-week and two-month delay. Their results revealed ASD children's accounts were no less accurate in response to contaminating prompts following

a two-month delay than after a two-week delay. ASD children's accounts were also no less accurate than accounts provided by TD children (Almeida et al., 2019).

Eyewitness Identification. One important aspect of eyewitness testimony is children's abilities to be an eyewitness when asked to identify a target person (i.e., perpetrator) from a lineup. Although some research has examined ASD children's memory for a staged event, studies investigating ASD children's lineup identification are almost non-existent. Lineup identification requires witnesses/victims to correctly identify a perpetrator when the perpetrator is truly present in the lineup or to correctly reject innocent persons if the perpetrator is not present in the lineup. In child maltreatment cases, children are typically the only witnesses of the crime. Therefore, it is important to understand children's capacities as eyewitnesses because mistaken identification is a growing problem in the criminal justice system. For instance, the Innocence Project reports that mistaken identification is the leading cause for erroneous convictions accounting for 259 (69%) of the 377 cases (www.innocenceproject.org).

Research examining lineup identification has been extensively studied in TD populations. The studies reveal children over age 5 perform as well as adults in correctly recognizing previously seen people when presented a target-present lineup (Fitzgerald et al., 2015; Pozzulo & Lindsay, 1998). However, numerous studies have found that when the target person is not present in the lineup (i.e., target-absent lineup) children tend to perform worse compared to adults in correctly rejecting the filler persons (Lindsay et al., 1997; Parker & Carranza, 1989). For instance, 5- to 12-years-old TD children were more likely to make an incorrect identification when presented a target-absent lineup than a target-present lineup (Pozzulo, 2007).

Little is known about lineup identification abilities among children with ASD. Research on facial recognition in ASD populations has focused on face memory tasks and found ASD children and adults perform worse on recognizing faces in comparison to TD children and adults (see Weigelt et al., 2012). In theory, children with ASD may show difficulties in eyewitness identification because of diminished social motivation (Chevallier et al., 2012), as well as the increased task demands due to the complexity of facial stimuli (Williams et al., 2015). On the other hand, children with ASD may perform better than TD children because they rely heavily on verbatim traces (Miller et al., 2018), and may not succumb to social pressures of the investigator.

We only identified one study that investigated ASD children's lineup identification (Wilcock et al., 2019). As part of a larger study (see Henry, Crane et al., 2017; Henry, Messer et al., 2017) children viewed two lineups and were asked to identify two people who gave presentations one-week earlier. Each child viewed one target-present and one target-absent lineup. Overall, children with ASD performed similar in lineup identification compared to TD children (Wilcock et al., 2019). However, Wilcock et al. (2019) reported similarities between the first target person and foil persons may have impacted children's abilities to correctly identify the target person where the second target person had fewer similarities with the foil persons making it easier for children to identify the target person. Therefore, although children with ASD show similar performance in correctly identifying the target person, the similarities between the target and foil persons may play an important factor (Wilcock et al., 2019).

Suggestibility in Children with ASD

For numerous reasons children with ASD may exhibit differences in their susceptibility to suggestion in comparison to TD children. For example, evidence indicates children with ASD may be less suggestible than TD children due to a reduced desire to please the interviewer resulting in less compliance with the interviewers' suggestions. However, children with ASD may be more prone to suggestion because of their limited source monitoring abilities and deficits in memory trace strength. Additionally, depending on the context, verbatim memory may lead to less or more suggestibility. We will now review the literature on different modes of suggestibility that are included in the present study.

Interrogative Suggestibility. Of the limited studies on ASD children's autobiographical memory of a staged event only a sparse number of these studies examined suggestibility (see Almeida et al., 2019; Bruck et al., 2007; McCrory et al., 2007). More specifically, the estimate of suggestibility focused solely on *interrogative suggestibility,* defined as how readily a person answers misleading questions or agrees with misinformation. Overall, children with ASD display similar levels of interrogative suggestibility to leading questions compared to TD children (Almeida et al., 2019; Bruck et al., 2007; McCrory et al., 2007). This finding implies children with ASD can act as competent witnesses, offering accurate, albeit incomplete, autobiographical reports. However, children with ASD are just as vulnerable to suggestive interrogation techniques as TD children, thus warranting caution when trying to elicit further information beyond reports given in free recall. As displayed by McCrory et al. (2007) and Henry, Messer et al. (2017), children with ASD can report similar amounts of information when given

increasingly directive prompts, but such prompts adversely affect accuracy rates. These studies offer a good indication of ASD children's autobiographical abilities and vulnerability to suggestive information but are limited in the types of suggestion presented. Nonetheless, children with ASD may display differences in susceptibility to other types of misinformation, such as information incorporated into schemas. Thus, future research is needed to determine how other suggestive elements such as source monitoring, misinformation effects, and the DRM paradigm impact ASD children's event memory.

Source Misattribution. The process of knowing when, where, and how something was encoded in their memory is known as *source monitoring* (Bowler et al., 2004; Johnson et al., 1993; Lind & Bowler, 2009). Source monitoring consists of an individuals' ability to distinguish between to-be-remembered information and external sources of misinformation. The main finding in the source monitoring literature is that with age, individuals' ability to distinguish among sources of event information (e.g., imagined, watched, heard) improves considerably (Foley & Johnson, 1985; Lindsay et al., 1991; Roberts & Blades, 1998). Some research has examined how source monitoring abilities differ among diagnostic group and found children with ASD show impairments in source monitoring abilities compared to TD children (Bowler et al., 2004; Hala et al., 2005; Lind & Bowler, 2009).

Source monitoring skills are an important component of children's ability to resist suggestive questions. Of the studies that have examined source monitoring in children with ASD, none have examined this skill within the context of suggestibility. Therefore, research is needed to understand how source monitoring abilities differ among ASD and

TD children. When children arrive at forensic interviews' they may have already experienced misinformation from a non-professional. Therefore, children may have difficulty distinguishing between sources of information they heard versus aspects they experienced.

Some research has indicated that acceptance of misinformation is sometimes driven by social mechanisms (Zaragoza et al., 2001; Ceci et al., 1987). Zaragoza and colleagues (2001) argued that children may accept misinformation initially due to compliance, but later come to believe that the false information was experienced. Hence, the concept of compliance may explain suggestibility in children. This line of research becomes important to the development of source monitoring skills because children are often questioned by familiar adults before the structured forensic interview and may accept misleading information to please the familiar adult or forensic interviewer (Goodman et al., 1995; McCloskey & Zaragoza, 1985).

Compliance with Authority Figures. Few studies have examined whether children with ASD have an increased likelihood to comply with requests from authority figures. Compliance refers to "the tendency of an individual to go along with propositions, requests or instructions while not necessarily accepting that they are true or right" (Gudjonsson, 2003, p. 370). Individuals with ASD may be more compliant towards an authority figure because of their fear of negative evaluation (North et al., 2008), increased anxiety, and deficits in social skills (Kuusikko et al., 2008). However, other research suggests individuals with ASD may be less compliant because of their deficits in theory of mind (e.g., Baron-Cohen, 2000).

In the limited eyewitness memory studies that have examined compliance the results revealed individuals with ASD are no more or less suggestible to leading questions and negative feedback than TD individuals (Bruck et al., 2007; Maras & Bowler, 2011; McCrory et al., 2007). For example, Bruck et al. (2007) found children with ASD assented to yes/no questions about "silly events" more than TD children (e.g., whether they ever saw the tooth fairy come into their room at night), but group differences were not found with the "plausible events." The authors concluded that since children with ASD did not assent more to plausible events that they are no more suggestible to comply with an authority figure than TD children (Bruck et al., 2007).

Autobiographical Memory and Suggestibility Summary

To summarize, three major findings emerge from the literature examining ASD children's autobiographical memory for a staged event. First, children with ASD report fewer details during free recall, but the information provided is as accurate as TD children. Second, certain retrieval conditions may bolster ASD children's memory performance. Last, children with ASD report greater details for witnessed than personally experienced events.

Additionally, the literature on ASD children's susceptibility to suggestion reveals multiple key findings. For example, children with ASD tend to show similar levels of suggestibility to interviewers' misleading questions and have impairments in their source monitoring abilities. Based on these key findings, the present study aimed to explore ASD children's event memory and suggestibility effects following a 10-month delay compared to TD children.

Chapter Two

The Present Study

The overarching goal of this work is to identify factors influencing the quality of autobiographical memory in children with ASD to develop evidence-based practices for interviewing this vulnerable population. Specifically, this research aims to explore the event memory and susceptibility to suggestion of children with ASD in comparison to chronologically age-matched control (i.e., TD) children following a 10-month delay. Our study focuses on children's reports following a 10-month delay because the extended delays between the incident and the legal adjudication can hamper children's memory of the incident in question.

In the present study, 5- to 10-year-old ASD and control children individually participated in a staged magic show with a research assistant. Following a 1-week delay a suggestive interview took place where children were given ten reminders about the magic show. Half of these reminders described events that actually occurred (i.e., true reminders) and the remaining five reminders consisted of false information (i.e., suggestions) about the magic show. All reminders were embedded in statement form followed by a forced-choice question. Next, approximately 4-days after the suggestive interview, children were given an initial memory test (i.e., two-week delay interview). Children were asked to provide free recall of the magic show and answer yes/no recognition questions. Following an approximate 10-month delay children participated in a follow-up study. The follow-up study included a memory test as well as a lineup identification task and an object recognition task. The memory test (i.e., 10-month delay interview) consisted of children reporting what happened in the magic show and

answering yes/no recognition questions. As part of the lineup identification and object recognition tasks children were asked questions about the target persons actions, which target person used the object, and what they did with the object to assess children's source monitoring abilities.

Research Questions and Hypotheses

Research Question 1. Do ASD and control children differ in their 10-month recall reports?

Hypothesis 1. Previous research indicated children with ASD provide fewer event details (Bruck et al., 2007; Mattison et al., 2015; McCrory et al., 2007; Millward et al., 2000), but the information provided is as accurate as control children (Almeida et al., 2019; Henry, Crane et al., 2017; McCrory et al., 2007). Expanding on this finding, the present study will examine whether differences exist in free recall reports following a 10-month delay. We expect children with ASD will recall fewer correct details from the staged event than control children following a 10-month delay. However, we expect both groups will provide fewer correct details at the 10-month delay interview than the two-week delay interview. We expect regardless of group, children will provide a greater number of incorrect details at the 10-month delay interview than at the two-week delay interview.

Research Question 2. Are ASD and control children's recognition accounts differentially affected by a 10-month delay?

Hypothesis 1. We will examine true and false recognition items separately. For true recognition items, we anticipate control children will provide more accurate responses than children with ASD following a 10-month delay. We expect older children

will be more accurate than younger children in their responses to the true recognition items. We expect children will have higher accuracy during the two-week delay interview than at the 10-month delay interview. Based on London et al.'s (2009) finding that TD children showed facilitation effects at the two-week delay and 10-month delay interview, we predict both groups will show facilitation effects at both delay intervals. That is, we expect regardless of group children will perform better on the true reminded than true non-reminded questions at the two-week and the 10-month delay interview.

We will also test whether differences exist in misinformation effects by examining the false recognition items. We anticipate children with ASD will be more suggestible than control children. Moreover, consistent with London et al. (2009), we expect children will assent to false reminded items similarly but their assents to the non-reminded false items will increase at the 10-month delay interview compared to the two-week delay interview. Thus, we anticipate misinformation effects will decrease from the two-week delay to the 10-month delay memory interview due to increases in children's false assents to the non-reminded items from the two-week delay interview to the 10-month delay interview.

Research Question 3. Do group differences exist for children's ability to recognize people and identify what that person did and said following a 10-month delay?

Hypothesis 1. We will test the exploratory hypothesis that children with ASD differ in correctly identifying the target persons from Session 1, Session 2, and Session 3 compared to control children. Based on Bruck et al.'s (2007) finding that children with ASD commit more false assents on non-reminded items, we predict children with ASD will commit more errors in rejecting the foil persons compared to control children.

Consistent with Wilcock et al. (2019) we expect children with ASD will perform similarly in recognizing the target persons compared to control children.

Hypothesis 2. We will examine children's source monitoring abilities by investigating whether age category and group differences exist for children's responses regarding what the target person in Session 2 and Session 3 did and said. Children were not asked these questions about the target person in Session 1 because they were asked free recall questions about the magic show. We anticipate children in the older age category will provide more correct details about what the target person did and said in Session 2 and Session 3 compared to children in the younger age category. We further expect control children will provide more details regarding the target persons actions than children with ASD.

Research Question 4. Do group differences exist for children's identification of previously seen objects following a 10-month delay?

Hypothesis 1. We will test the hypothesis that children with ASD differ in correctly identifying previously seen objects and correctly rejecting previously unseen objects compared to control children. We anticipate regardless of age category children will perform above chance in correctly recognizing previously seen objects from the magic show after a 10-month delay.

Hypothesis 2. We will examine whether children with ASD differ in correctly identifying previously seen and unseen objects following a 10-month delay in comparison to control children.

Hypothesis 3. We will investigate the hypothesis that children with ASD differ in their abilities to correctly identify what they did with the previously seen and unseen objects following a 10-month delay compared to control children.

Method

Participants

In the original study (Bruck et al., 2007) researchers tested 38 control (i.e., TD) children and 30 children with ASD who ranged in age from 5- to 10-years of age. An additional 30 control children were tested (see London et al., 2009). Following an approximate 10-month delay since witnessing the staged event (M = 303 days, SD = 46 days), the researchers located, obtained parental consent and child assent, and retested 73 of these children. Participants tested at the 10-month delay interval included 51 control children and 22 children with ASD. The 17 control and 8 ASD children who were not re-interviewed could not be located because they had moved or did not respond to the researchers' phone calls. To ensure our control sample was representative while still having relatively equal sample sizes between group, sex, and age category the present studies final sample consisted of 41 control (randomly selected from the 51, stratified by age category) and 22 ASD children.

Children with ASD met the *DSM-IV* criteria for ASD (i.e., autism, pervasive developmental disorder, or Asperger syndrome), were verbal, and had a partial composite Stanford-Binet fourth edition full-scale IQ score of 70 or above (M = 95.00, SD = 12.87). IQ scores were computed from three subtests from the Stanford-Binet fourth edition: Matrices, absurdities, and vocabulary and routing. Previous studies have shown that using a combination of three subtests from the Sandford-Binet are highly correlated with full

scale IQ scores (e.g., Car- vajal & Gerber, 1987; DeLamatre & Hollinger, 1990; Prewett, 1992; Volker et al., 1999). Children with ASD also had a Childhood Autism Rating Scale score between 30 and 36.5 (M = 32.2, SD = 2.02), which indicates mild to moderate ASD (Schopler et al., 1980). Control children had an average partial compositive IQ score (M = 107.95, SD = 12.08).

Materials and Procedures

All study materials were administered face-to-face across four sessions. All procedures were audio and video recorded to allow the researchers to determine children's engagement and any script deviations. Children participated in four separate testing sessions. Figure 1 shows an overview of the study procedures. Before beginning the experiment, primary caregivers of child participants provided consent for their child's and their participation and children provided assent to participant in the experiment.

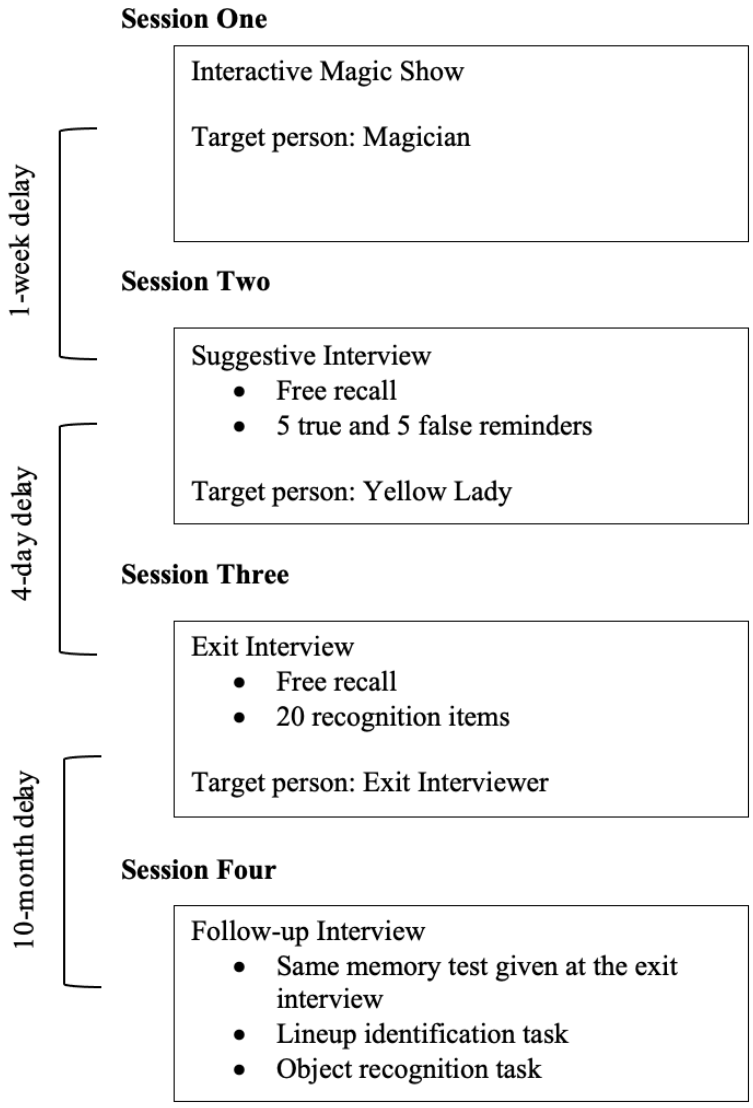


Figure 1. Overview of study procedure.

Original Study. The original study consisted of children participating in three sessions: (1) interactive magic show, (2) suggestive interview, and (3) exit interview.

Session 1: Interactive Magic Show. Children individually participated in a scripted 10-minute interactive magic show containing 20 target events. The research assistant told the child that she was a magician and asked the child to be her assistant. During the magic show, the magician put on a black hat, put a red helper cape on the

child, showed the child a stuffed rabbit, and taught the child a magic word. The magician also performed two tricks. In the first trick, the magician made a ball disappear from a cup into her pocket and then had the ball reappear in the container. During this trick the magician said a magic word, waved a wand, honked a horn, and pulled the child's ear. In the second trick, the magician made water disappear from a cup. For this trick the magician put Lightening Gel in the cup which caused the water to evaporate on contact. After performing the two tricks the magician tripped over her shoelaces and fell on the floor. While on the floor the magician told the child she was hurt and asked the child to get a band-aid from a backpack. At the end of the magic show the child was given a certificate for being a good assistant.

Session 2: Suggestive Interview. Approximately 8-days after the magic show (*M* = 8.2 days, *SD* = 1.4) children individually participated in a suggestive interview with an unfamiliar interviewer. The suggestive interviewer wore a large yellow stovepipe hat and called herself the "Yellow Lady." The suggestive interview began with the interviewer telling the child that she wanted to hear all about the magic show because she was not there. Children were given four prompts (e.g., "Tell me what happened at the beginning.", "What else?") during the free recall phase of the interview.

Next, in the second phase of the interview children were presented with true and false reminders (i.e., leading questions). The magic show contained 20 target events across five scenes: (1) setting up, (2) ball trick, (3) water trick, (4) the magician falling, and (5) cleanup. Each true reminder (e.g., "The magician wore a black hat.") was paired with a false or misleading reminder (e.g., "The magician wore black gloves."). The true reminder was never presented with its paired false reminder. In sum, the interviewer

presented children with five true and five false reminders in the suggestive interview. True and false reminders were given in a counterbalanced order. One true and one false reminder was selected from each of the five scenes from the magic show. To ensure full counterbalance of all reminders the researchers used eight different suggestive interview versions. Children were randomly assigned to one of the eight suggestive interview versions and the frequency of each interview version was counterbalanced across groups.

Following each reminder, children were asked a forced-choice question about the reminder (e.g., "Did she hug you at the beginning of the magic show or at the end of the magic show?"). The response choices were counterbalanced so that each response appeared equally often as the first versus the second answer choice in the forced-choice question. Thus, children were asked 10 forced choice questions. If a child resisted a reminder, the interviewer told the child "Well I just need to write something down." then ask the forced-choice question again. In the case children continued to resist the reminder the interviewer randomly chose an option for the child and repeated the statement back to the child. Once all reminders were given, the interviewer repeated each reminder for the child (e.g., "You told me that the magician hugged you at the beginning of the magic show.").

Session 3: Exit Interview. Approximately 4 days after the suggestive interview (M = 3.8 days, SD = 0.88) children were given an initial memory test from an unfamiliar interviewer. The exit interview began with the interviewer telling the child that she was not at the magic show and wanted to hear everything that happened and gave the child three prompts (e.g., "What happened next?", "Can you tell me one more thing?").

Next, children were asked 20 yes/no recognition questions that probed target details regarding the magic show. The 20 recognition questions included 5 true reminders, 5 false reminders, 5 true controls (i.e., true non-reminder), and 5 false controls (i.e., false non-reminder) regarding the magic show. True and false control questions contained details that were not rehearsed in the suggestive interviews. The inclusion of true non-reminders allows for the evaluation of the *facilitative effect*. That is, if presenting true items in the suggestive interview facilitates item recognition in the event interview, then children should be more accurate responding to true reminded than true non-reminded items (see Figure 2). Additionally, including false non-reminders allows for evaluation of the *misinformation effect*. Thus, if false items presented in the suggestive interview increased children's false assents in the event interview, then children should show elevated levels of false assents to the false reminders in comparison to the false non-reminders (see Figure 2). Children were asked four forced-choice questions per scene such that each scene contained a true reminder, false reminder, true non-reminder, and false non-reminder. Like the suggestive interview, true non-reminders were never presented with its paired false non-reminder. Finally, the interview ended with the interviewer thanking the child for talking to them today and asking if there is anything else the child would like to tell them before ending the interview.

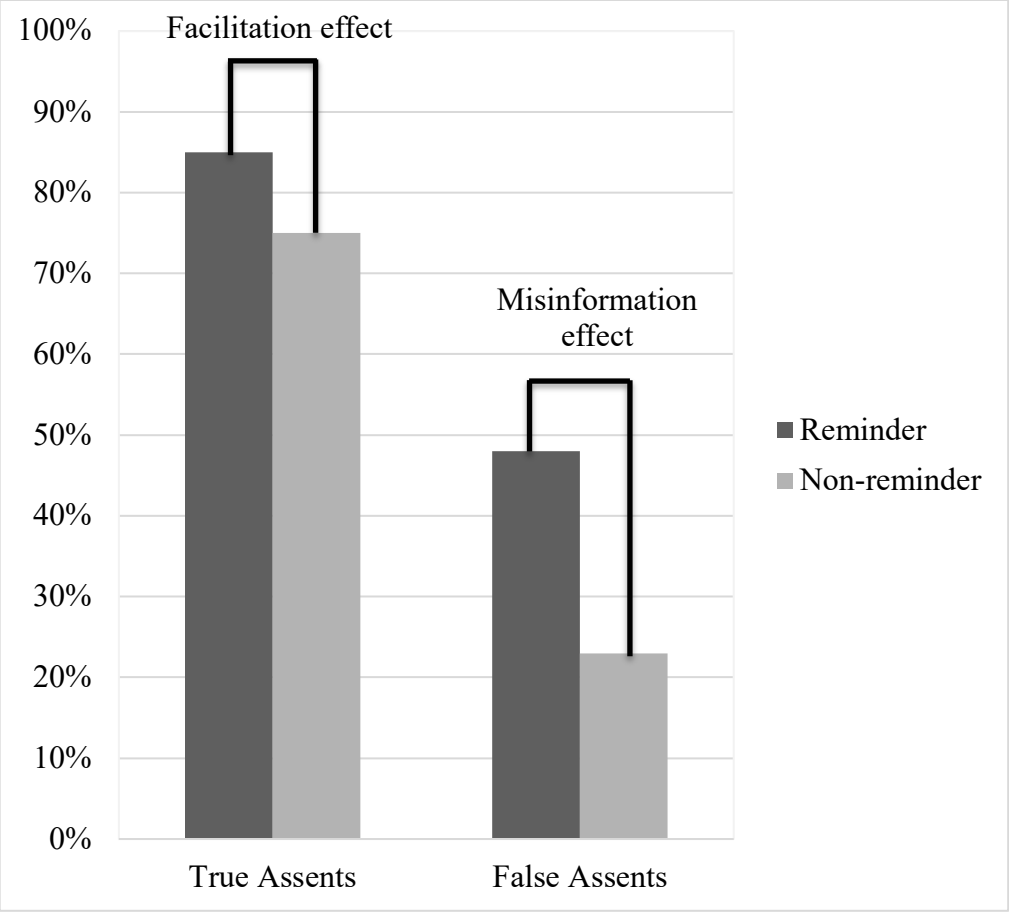


Figure 2. Conceptual graph of the facilitation and misinformation effects.

Session 4: Follow-up. Following an approximate 10-month delay after witnessing the magic show (M = 303 days, SD = 46 days) an unfamiliar interviewer visited all children. Children completed a memory test as well as lineup identification task and an object recognition task. The follow-up session took approximately 30 minutes.

Memory Test. Children were reminded that a magician had previously visited them. The unfamiliar interviewer then asked them whether they remembered the magic show. If children did not remember the magic show they were told, "Well, I am going to go ahead and ask you some questions about the magic show. You think really hard and maybe you will remember some things about it." Children were then administered the

same memory test from the original study in Session 3 consisting of free recall and 20 yes/no recognition questions.

Lineup Identification Task. Children were shown three lineups in sequential presentation and asked to identify the Magician, Yellow Lady, and the Exit Interviewer. For each person children were shown four photographs including the target person, two foil persons, and a wildcard in a sequential lineup. Foil persons matched the description of the target person with all other characteristics varying. The wildcard photograph consisted of a question mark. Children were then asked three source monitoring questions: (1) whether they knew the person, (2) what the person did, and (3) what the person said after viewing each photograph.

Object Recognition Task. Following the lineup identification task, children were showed 10 photographs which included 5 previously seen objects (i.e., container, chip, tape player, stuffed bunny, stuffed elephant) and 5 previously unseen objects (i.e., stapler, computer, record player, pencil sharpener, telephone) from the magic show. Children were shown each photograph in a randomized order and asked three questions about each object: (1) whether they saw that object during the magic show, (2) which person used the object, and (3) what they did with the object.

Data Coding

Video and audio recordings of the interviews were transcribed verbatim. All transcripts were verified for accuracy by two research assistants who did not transcribe the original file before the interviews were coded.

Suggestive Interview. The number of correct and incorrect utterances in free recall was summed. An utterance was defined as a statement bound by pauses containing

one verb. For example, “The magician tripped over her shoelaces, and we held hands,” contains two utterances. All recall coding was independently coded by two research assistants. The few discrepancies were resolved via discussion.

Exit/Follow-up Interviews. The number of off-topic and on-topic utterances in free recall was summed. For example, when asked to tell the interviewer about the magic show, responses such as “My favorite color is blue” were coded as off-topic. On-topic utterances were categorized as correct or incorrect and as derivative of a true or a false reminder. Again, all recall coding was independently coded by two research assistants and discrepancies were resolved through discussion.

The number of accurate responses for each type of recognition question was summed. A “yes” response was coded as the accurate response for true reminders and true non-reminders and a “no” response was coded as the accurate response for false reminders and false non-reminders.

Chapter Three

Results

Preliminary Analyses

Preliminary analyses were conducted on the follow-up data to examine whether: (1) ASD and control children were similar in age, (2) ASD and control children differed in terms of sex, and (3) group differences existed between partial IQ scores.

Based on a median split of the entire sample, children were categorized to a younger (Control: $n = 22$, $M = 74.36$, $SD = 13.82$; ASD: $n = 12$, $M = 87.67$, $SD = 7.97$) and older (Control: $n = 19$, $M = 109.37$, $SD = 7.13$; ASD: $n = 10$, $M = 108.60$, $SD = 11.18$) age category. The ASD and control groups did not significantly differ in terms of sex, $\chi 2\ (1) = .59$, $p = .44$. The control children had significantly higher partial IQ scores ($M = 107.95$, $SD = 12.08$) than the children with ASD ($M = 95.91$, $SD = 11.38$), $t(61) = 4.09$, $p < .001$. Thus, we report the analyses with and without partial IQ used as a covariate (see Appendix A for analyses controlling for partial IQ). We report the covariate in all analyses in Appendix A because partial IQ was not significant in any of the substantive analyses, and using a non-significant covariate reduces the power of the analyses.

Research Question 1

Do ASD and control children differ in their 10-month recall reports?

Two younger ASD, and one older ASD child recalled no details about the magic show at the two-week delay interview (i.e., Session 3). All control children recalled at least one detail about the magic show at the two-week delay interview. At the 10-month delay interview (i.e., Session 4), five younger ASD, three older ASD, and six younger

control children recalled no details about the magic show. Tables 2 and 3 show the mean number and proportions of correct and incorrect utterances at the two-week and 10-month delay interview by group and age category.

Table 2

Mean number of correct and incorrect utterances in free recall at the two-week delay and 10-month delay memory test (with standard deviations)

Group	Age category at follow-up	Correct utterances		Incorrect utterances	
		Two-week delay interview	10-month delay interview	Two-week delay interview	10-month delay interview
ASD					
	Younger	4.08	1.50	.92	1.58
	(*n* = 12)	(3.23)	(1.83)	(.90)	(2.57)
	Older	3.70	2.30	1.10	2.80
	(*n* = 10)	(4.45)	(2.54)	(1.59)	(3.61)
	Total	3.91	1.86	1.00	2.14
	(*n* = 22)	(3.74)	(2.17)	(1.23)	(3.07)
Control					
	Younger	6.09	2.27	1.45	1.73
	(*n* = 22)	(4.03)	(2.14)	(1.56)	(2.14)
	Older	10.16	3.95	2.68	2.42
	(*n* = 19)	(2.93)	(2.27)	(1.86)	(1.92)
	Total	7.97	3.05	2.02	2.05
	(*n* = 41)	(4.08)	(2.33)	(1.79)	(2.05)

Note. Older age category at the 10-month delay interview refer to control (*M* = 109.37 months) and ASD (*M* = 108.60 months) children above the median split. Younger age category refers to control (*M* = 74.36 months) and ASD (*M* = 87.67 months) children below the median split of the entire sample.

Table 3

Mean proportions of correct and incorrect utterances in free recall at the two-week delay and 10-month delay memory test (with standard deviations)

Group	Age category at follow-up	Correct utterances		Incorrect utterances	
		Two-week delay interview	10-month delay interview	Two-week delay interview	10-month delay interview
ASD					
	Younger	.82	.49	.18	.51
	(*n* = 12)	(.78)	(.42)	(.22)	(.58)
	Older	.77	.45	.23	.55
	(*n* = 10)	(.74)	(.41)	(.26)	(.59)
	Total	.80	.46	.20	.53
	(*n* = 22)	(.75)	(.41)	(.25)	(.58)
Control					
	Younger	.81	.57	.19	.43
	(*n* = 22)	(.72)	(.50)	(.28)	(.50)
	Older	.79	.62	.21	.38
	(*n* = 19)	(.62)	(.54)	(.39)	(.46)
	Total	.80	.60	.20	.40
	(*n* = 41)	(.69)	(.53)	(.30)	(.47)

Correct Utterances. We investigated the number of correct utterances children provided in a 2 (Group: ASD, control) x 2 (Age Category: Younger, older) x 2 (Delay: Two-week vs. 10-month delay interview) mixed ANOVA[1]. Delay served as the within-subjects variable. The results revealed a significant main effect of group, $F(1, 59) = 17.77$, $p < .001$, $\eta_p^2 = 23$, age category, $F(1, 59) = 5.69$, $p = .02$, $\eta_p^2 = 09$, and delay, $F(1, 59) = 54.90$, $p < .001$, $\eta_p^2 = .48$. In addition, a significant Group by Age Category

[1] The number of correct utterances variable was skewed for children with ASD (skewness at two-week delay interview: Control = .69, ASD = 1.42; skewness at the 10-month delay interview: Control = .64, ASD = 2.01). However, transforming the data and running non-parametric tests yielded substantively similar results. Therefore, we report the following analyses with the untransformed variable.

interaction emerged, $F(1, 59) = 4.25$, $p = .04$, $\eta_p^2 = .07$ (see Figure 3). Control children provided more correct utterances than children with ASD, but only among the older age categories ($M = 7.05$, $SD = 2.43$ and $M = 3.00$, $SD = 2.43$ for control children and children with ASD, respectively). For children in the younger age category, descriptively, differences were in the same direction as the older children, but the differences did not attain significance ($M = 4.18$, $SD = 2.43$ and $M = 2.79$, $SD = 2.43$ for control children and children with ASD, respectively).

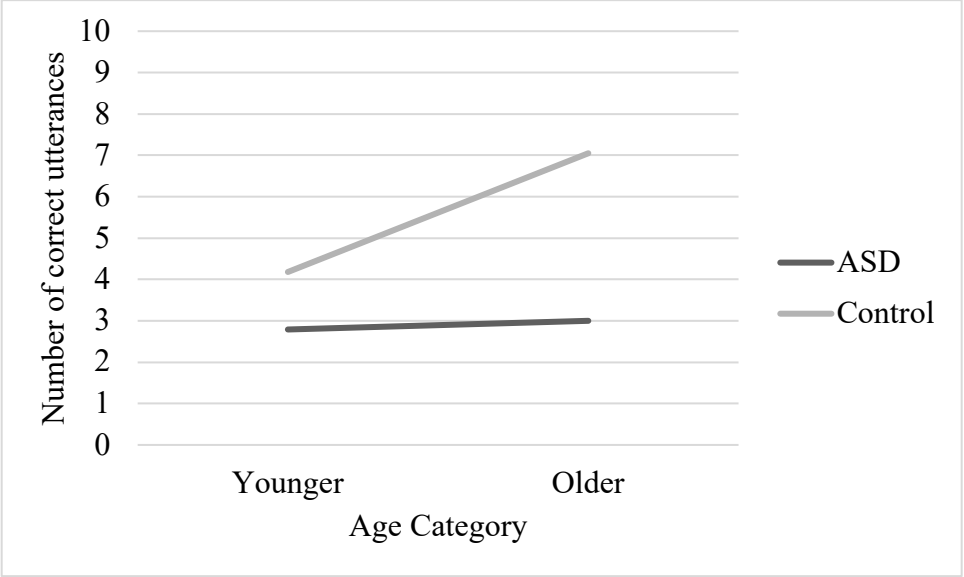


Figure 3. Correct utterances produced in free recall by group and age category.

Moreover, a Group by Delay interaction, $F(1, 59) = 10.22$, $p = .002$, $\eta_p^2 = .15$, revealed that control children provided significantly more correct utterances than children with ASD, but only at the two-week delay interview session (Control: $M = 8.12$, $SD = 3.67$, ASD: $M = 3.89$, $SD = 3.67$). Both groups showed a significant decline from the two-week delay to the 10-month delay interview session, particularly among the control children whose quantity of recall had further to drop (see Figure 4). The two groups did

not differ in correct utterances at the 10-month delay interview (Control: $M = 3.11$, $SD = 2.20$, ASD: $M = 1.90$, $SD = 2.20$).

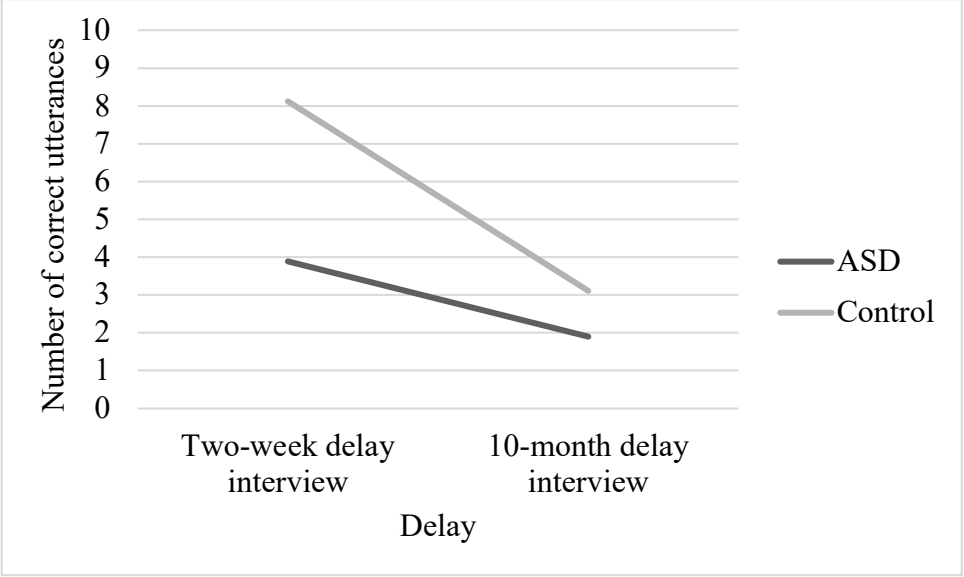
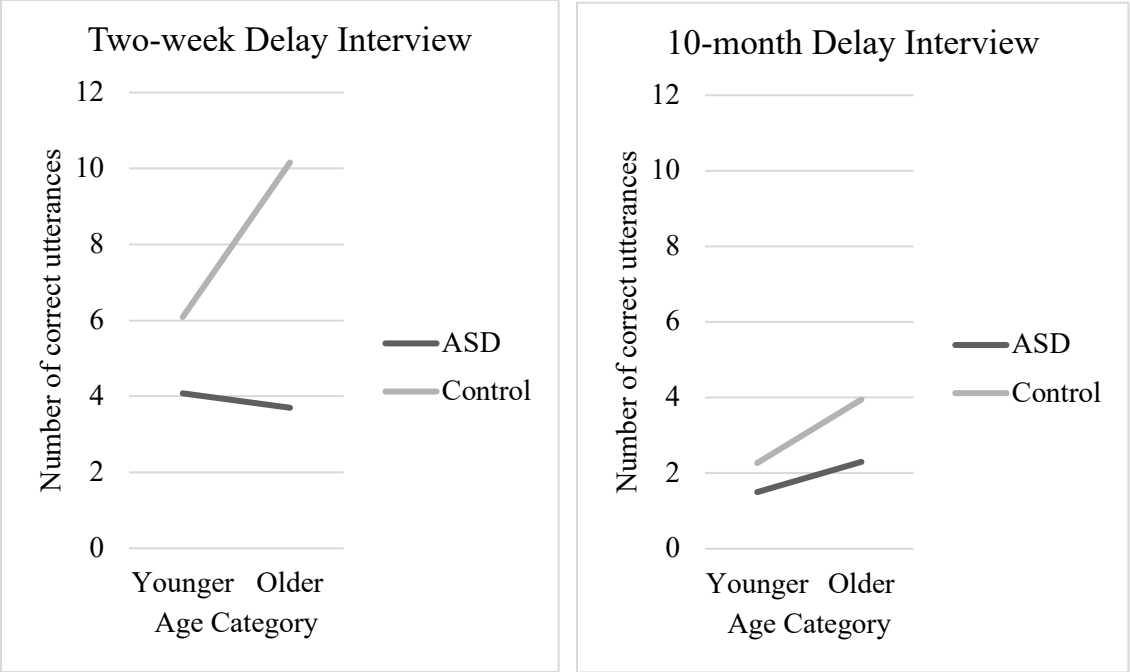


Figure 4. Correct utterances provided during free recall by group and delay.

Finally, these main effects and interactions were subsumed within a marginally significant Group by Age Category by Delay interaction, $F(1, 59) = 3.57$, $p = .06$, $\eta_p^2 = .06$ (see Figure 5). The results revealed that age category interacted with group but only at the two-week delay interview. At the two-week delay interview, control children produced a greater number of correct utterances than children with ASD but only in the older age category (Control: $M = 10.16$, $SD = 3.66$, ASD: $M = 3.70$, $SD = 3.65$). For the younger age category, control children ($M = 6.09$, $SD = 3.66$) and children with ASD ($M = 4.08$, $SD = 3.65$) did not differ in their number of correct utterances produced during the two-week delay interview. At the 10-month delay interview, both the younger ($M = 2.27$, $SD = 2.19$) and the older control children ($M = 3.95$, $SD = 2.19$) gave more correct utterances than children with ASD (Younger: $M = 1.50$, $SD = 2.19$, Older: $M = 2.30$, $SD = 2.19$).



Panel A: Correct utterances at the two-week delay interview.

Panel B: Correct utterances at the 10-month delay interview.

Figure 5. Number of correct utterances produced by group and age category at the two-week and 10-month delay interview.

Incorrect Utterances. We examined whether children differed in the number of incorrect utterances produced during free recall during the two-week delay interview versus the 10-month delay interview. A 2 (Group) x 2 (Age Category) x 2 (Delay) mixed ANOVA was carried out on the number of incorrect utterances. Delay was the within subject variable. The results yielded a significant main effect of age category, $F(1, 59) = 4.09$, $p = .05$, $\eta_p^2 = .06$, such that children in the older age category ($M = 2.25$, $SD = 1.62$) produced a greater number of incorrect utterances than children in the younger age category ($M = 1.42$, $SD = 1.62$). However, the results revealed no significant main effects of group, $F(1, 59) = 1.32$, $p = .25$, $\eta_p^2 = .02$, or delay, $F(1, 59) = 2.73$, $p = .10$, $\eta_p^2 = .02$. The results produced no significant interactions.

Research Question 1 Summary. Not surprising we found a greater number of children with and without ASD recalled no details about the magic show at the 10-month delay than the two-week delay interview. When examining children's correct utterances produced during free recall, we found control children provided more correct utterances than children with ASD, but only among the older age categories at the two-week delay interview. For younger children, descriptively, differences were in the same direction as the older category, but the differences did not attain significance at the two-week delay interview. At the 10-month delay interview, regardless of age category, control children provided more correct utterances than children with ASD. We also found both groups showed a significant decline from the two-week to the 10-month delay interview sessions, particularly among the control children who had further to drop.

The two groups did not differ in their incorrect utterances at the 10-month delay interview. For the number of incorrect utterances produced, although older children produced a greater number of incorrect details than younger children this does not mean that they are more inaccurate. Rather older children are just providing proportionally more total utterances in their free recall responses compared to younger children. However, both age categories are equally inaccurate in their reports when incorrect utterances are examined as a function of children's total utterances produced. No group differences emerged for the number of incorrect utterances children provided in free recall. Although ASD and control children did not differ in their number of incorrect utterances produced, if we consider children's total number of utterances, control children are reporting more overall utterances than children with ASD. As shown in Table 3, control and ASD children do not differ in their proportions of incorrect

utterances at the two-week delay interview (Control: 20%, ASD: 20%). However, at the 10-month delay interview the percentage in children with ASD is 53% versus 40% in control children.

Research Question 2

Are ASD and control children's recognition accounts differentially affected by a 10-month delay?

True Recognition Item. We examined children's performance on the true yes/no recognition questions. Table 4 shows the mean proportion of accurate assents to the true recognition items at the two-week delay and 10-month delay memory test.

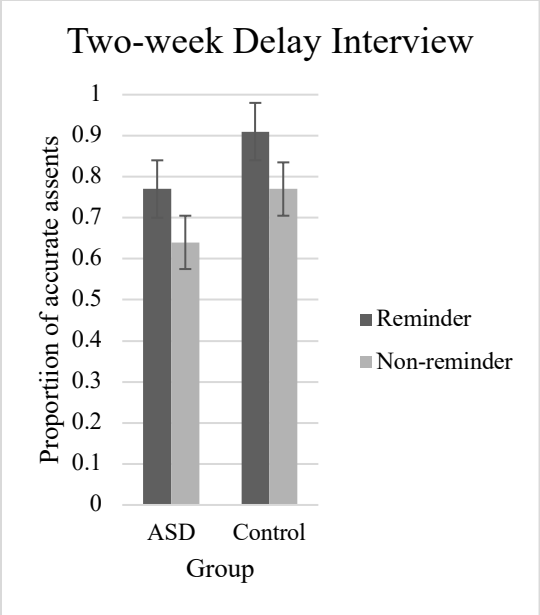
Table 4

Mean proportion (with standard deviations) of accurate assents to reminded and non-reminded true recognition items at the two-week delay and 10-month delay memory test

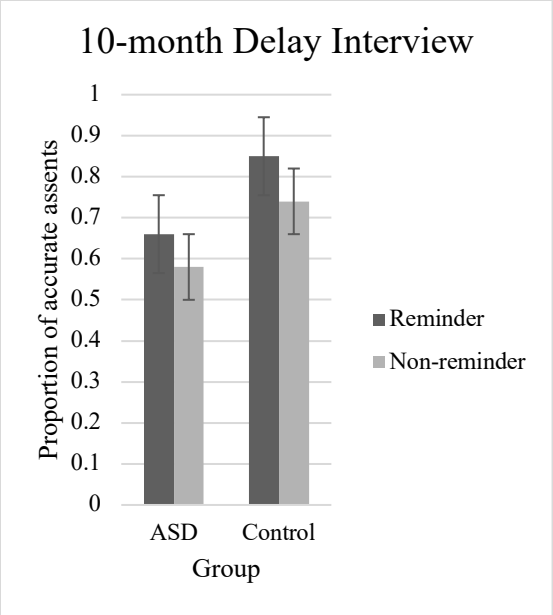
Group	Age category at follow-up	True reminders		True non-reminders	
		Two-week delay interview	10-month delay interview	Two-week delay interview	10-month delay interview
ASD					
	Younger (n = 12)	.72 (.35)	.63 (.35)	.58 (.33)	.52 (.35)
	Older (n = 10)	.84 (.18)	.70 (.25)	.72 (.25)	.66 (.23)
	Total (n = 22)	.77 (.28)	.66 (.30)	.64 (.30)	.58 (.30)
Control					
	Younger (n = 22)	.89 (.10)	.81 (.23)	.68 (.28)	.64 (.23)
	Older (n = 19)	.94 (.09)	.90 (.20)	.86 (.12)	.85 (.24)
	Total (n = 41)	.91 (.10)	.85 (.22)	.77 (.24)	.74 (.25)

Note. We present the mean proportion correct (out of five items for each reminded and non-reminded item type) in this table even though the raw scores were entered into the statistical analysis.

The number of accurate assents for true items was entered into a mixed factor 2 (Group) x 2 (Age Category) x 2 (Delay) x 2 (Reminder status: Reminded vs. non-reminded) repeated measures ANOVA. Delay and reminder status served as the within-subjects variables. A main effect of group, $F(1, 59) = 9.88$, $p = .003$, $\eta_p^2 = .14$, revealed control children ($M = .82$, $SD = .18$) outperformed children with ASD ($M = .67$, $SD = .18$) on the true recognition items. A main effect of age category, $F(1, 59) = 6.92$, $p = .01$, $\eta_p^2 = .10$, revealed that older children ($M = .81$, $SD = .19$) outperformed younger children ($M = .68$, $SD = .19$). A significant main effect of delay, $F(1, 59) = 5.60$, $p = .02$, $\eta_p^2 = .09$, revealed children performed better at the two-week delay session ($M = .78$, SD = .18) than the 10-month delay interview session ($M = .71$, $SD = .25$). Finally, a significant main effect of reminder status, $F(1, 59) = 23.74$, $p < .001$, $\eta_p^2 = .29$, revealed children performed better on the true reminded items ($M = .80$, $SD = .19$) over the true non-reminded items ($M = .69$, $SD = .23$). No significant interactions emerged from the analysis. Figure 6 shows facilitation effects by group and delay.



Panel A: Facilitation effects at the two-week delay interview.



Panel B: Facilitation effects at the 10-month delay interview.

Figure 6. Facilitation effects at the two-week and 10-month delay interview.

False Recognition Items. See Table 5 for the mean proportion of inaccurate assents to false recognition items at the two-week delay and 10-month delay memory test by group and age category. Recall misinformation effects are found if children's inaccurate assents to the false reminded items are larger than the false non-reminded items.

Table 5

Mean proportion (with standard deviations) of inaccurate assents to reminded and non-reminded false recognition items at the two-week delay and 10-month delay memory test

Group	Age category at follow-up	False reminders		False controls	
		Two-week delay interview	10-month delay interview	Two-week delay interview	10-month delay interview
ASD					
	Younger (n = 12)	.48 (.35)	.42 (.32)	.28 (.28)	.33 (.25)
	Older (n = 10)	.64 (.23)	.58 (.30)	.48 (.37)	.54 (.28)
	Total (n = 22)	.55 (.30)	.49 (.32)	.37 (.33)	.43 (.28)
Control					
	Younger (n = 22)	.54 (.25)	.44 (.26)	.16 (.23)	.34 (.26)
	Older (n = 19)	.61 (.20)	.61 (.26)	.21 (.19)	.38 (.24)
	Total (n = 41)	.57 (.23)	.52 (.27)	.18 (.21)	.36 (.25)

Note. We present the mean proportions in this table even though the raw scores were entered into the statistical analysis.

The number of inaccurate assents for false items was entered into a mixed factor 2 (Group) x 2 (Age Category) x 2 (Delay) x 2 (Reminder Status) repeated measures ANOVA. Delay and reminder status served as the within-subjects variables. No significant main effects of group, $F(1, 59) = 1.83$, $p = .18$, $\eta_p^2 = .03$, or delay emerged, $F(1, 59) = .64$, $p = .43$, $\eta_p^2 = .01$. However, a significant main effect of age category, $F(1, 59) = 9.18$, $p = .004$, $\eta_p^2 = .13$, revealed older children ($M = .51$, $SD = .17$) gave more inaccurate assents than younger children ($M = .37$, $SD = .17$). The results also revealed a significant main effect of reminder status, $F(1, 59) = 38.57$, $p < .001$, $\eta_p^2 = .39$. Children provided a greater number of inaccurate assents for false reminded items ($M = .54$, $SD =$

.22) than false non-reminded items (M = .34, SD = .21). However, this main effect was subsumed within two significant two-way interactions. An interaction of Delay by Reminder Status, $F(1, 59) = 11.20$, $p = .001$, $\eta_p^2 = .16$, revealed for the false reminded items, there was no change in inaccurate assents from the two-week delay (M = .57, SD = .27) to the 10-month delay interview (M = .51, SD = .29). However, for the false non-reminded items, there was a significant increase from the two-week delay (M = .28, SD = .27) to the 10-month delay interview (M = .40, SD = .27; see Figure 7). This interaction also shows a significant difference between reminded and non-reminded items at the two-week delay interview. However, this misinformation effect washes away at the 10-month delay interview because of children's significant increased assents to false non-reminded items.

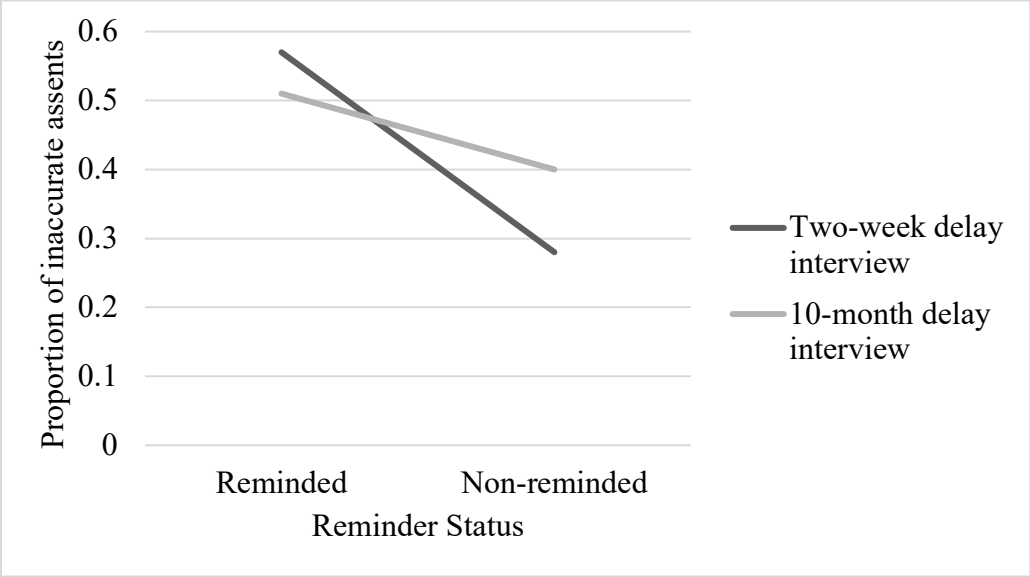


Figure 7. Inaccurate assents to the false recognition items by delay and reminder status.

Moreover, a Group by Reminder Status interaction, $F(1, 59) = 5.90$, $p = .02$, $\eta_p^2 = .09$, revealed that control (M = .55, SD = .21) and ASD (M = .53, SD = .21) children did not differ in their inaccurate assent rates to the false reminded items. However, for the

false non-reminded items, children with ASD (M = .41, SD = .20) inaccurately assented to more of the non-reminded items than did the control children (M = .27, SD = .20; see Figure 8).

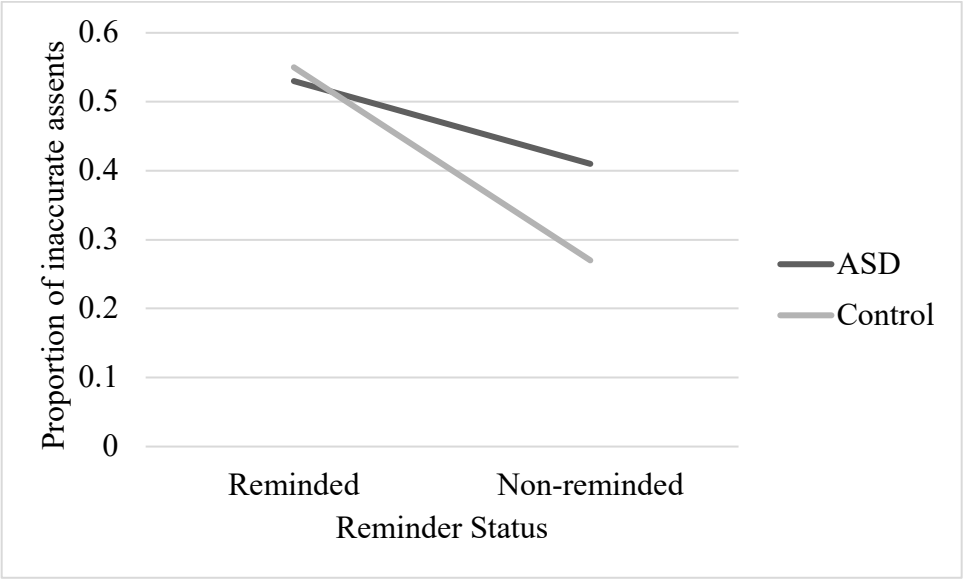
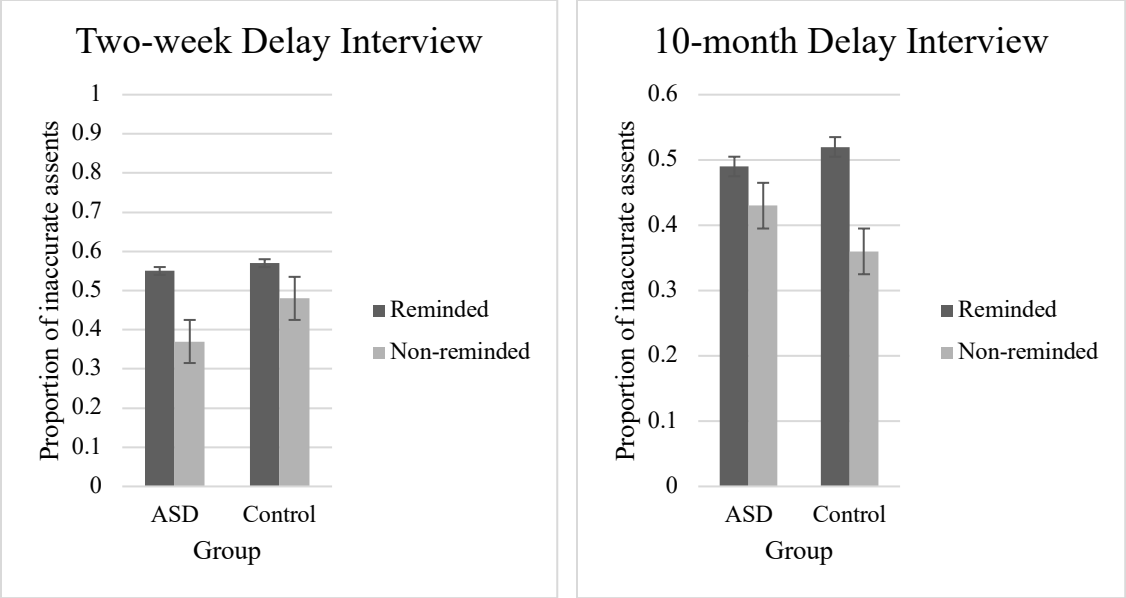


Figure 8. Inaccurate assents to the false recognition items by group and reminder status.

We conducted a repeated measures ANOVA to determine whether group differences existed for children's inaccurate assent rates. Pairwise comparisons revealed a significant misinformation effect for control children at the 10-month delay interview, $F(1, 40) = 9.12$, $p = .004$, $\eta_p^2 = .19$. However, for children with ASD no significant misinformation effect was found, $F(1, 21) = 1.34$, $p = .26$, $\eta_p^2 = .06$. Figure 9 shows misinformation effects by group and delay.



Panel A: Misinformation effects at the two-week delay interview.

Panel B: Misinformation effects at the 10-month delay interview.

Figure 9. Misinformation effects at the two-week and 10-month delay interview.

Research Question 2 Summary. In sum, for true recognition items, control children outperformed children with ASD. For both the control and ASD groups, children overall performed better at the two-week delay interview compared to the 10-month delay interview. Children regardless of group also performed better on the true reminded items than true non-reminded items. Finally, older children outperformed younger children on the true recognition items. For the false recognition items, no main effect of group emerged. However, older children produced a greater number of inaccurate assents than younger children. In addition, for the false reminded items, there was no difference in children's inaccurate assents from the two-week delay to the 10-month delay interview. However, for the false non-reminded items, children's inaccurate assents significantly increased from the two-week delay interview to the 10-month delay interview. Moreover, although the two groups did not differ in their inaccurate assents to

the false reminded items, children with ASD inaccurately assented to a greater number of false non-reminded items than control children.

Research Question 3

Do group differences exist for children's ability to recognize people and identify what that person did and said following a 10-month delay?

At the 10-month delay interview, children were given three lineups and asked to identify three people with whom they previously interacted. For each lineup, children were shown four photographs including one of the target persons with whom they had previously interacted with, two foil persons, and a wildcard. Children were asked to identify the person and what the person did and said during their interaction with the person.

Was this the Target Person? A 2 (Group) x 2 (Age Category) ANOVA was carried out on the number of correct identifications of target persons (i.e., Magician, Yellow Lady, Exit Interviewer). The results yielded no significant main effects of group, $F(1, 59) = .07$, $p = .78$, $\eta_p^2 = .001$, or age category, $F(1, 59) = 2.56$, $p = .11$, $\eta_p^2 = .04$. Control ($M = 1.66$, $SD = .86$) and ASD children ($M = 1.72$, $SD = .86$) did not differ in their correct identification of the three target persons. No significant differences emerged between younger ($M = 1.51$, $SD = .90$) and older children ($M = 1.87$, $SD = .90$). No significant interaction emerged.

Next, three separate 2 (Group) x 2 (Age Category) ANOVAs were carried out on the number of correct rejections of foil persons for each target person. The results across all three photo identification tasks were consistent in showing, irrespective of age category, control children rejected the foil persons at a higher rate than children with

ASD. For the Magician, the results yielded a significant main effect of group, $F(1, 59) = 3.98$, $p = .05$, $\eta_p^2 = .06$. Control children ($M = 1.69$, $SD = .70$) correctly rejected the Magician foil persons at a higher rate than children with ASD ($M = 1.32$, $SD = .70$). However, since children were only shown four photographs these findings demonstrate that 42% of control children correctly rejected the Magician foil person compared to 33% of children with ASD. No significant main effect of age category emerged, $F(1, 59) = 1.46$, $p = .23$, $\eta_p^2 = .02$. Younger ($M = 1.40$, $SD = .73$) and older children ($M = 1.62$, $SD = .73$) did not significantly differ in their correct rejections of the Magician foil persons. For the Yellow Lady, a significant main effect of group emerged, $F(1, 59) = 6.59$, $p = .01$, $\eta_p^2 = .10$. Control children ($M = 1.56$, $SD = .65$) correctly rejected the Yellow Lady foil persons more than children with ASD ($M = 1.12$, $SD = .64$). In other words, 39% of control children compared to 28% of children with ASD correctly rejected the Yellow Lady foil persons. No significant main effect of age category emerged, $F(1, 59) = .40$, $p = .53$, $\eta_p^2 = .01$, (Younger: $M = 1.40$, $SD = .67$, Older: $M = 1.29$, $SD = .67$). Lastly, for the Exit Interviewer, the result revealed a significant main effect of group, $F(1, 59) = 6.39$, $p = .01$, $\eta_p^2 = .10$. Control children ($M = 1.90$, $SD = .54$) correctly rejected the Exit Interviewer foil persons at a higher rate compared to children with ASD ($M = 1.54$, $SD = .54$). Thus, 47% of control children and 38% of children with ASD correctly rejected the Exit Interviewer foil persons. Younger ($M = 1.75$, $SD = .49$) and older children ($M = 1.70$, $SD = .56$) did not significantly differ in their correct rejections of the Exit Interviewer foil persons, $F(1, 59) = .12$, $p = .73$, $\eta_p^2 = .002$.

We then conducted logistic regression analyses for each target person with lineup accuracy (i.e., correct or incorrect) as the dependent variable. Variables were entered into

the model simultaneously. For the Magician, the overall model did not significantly predict lineup accuracy (omnibus $\chi^2 = .21$, df = 2, $p = .90$). That is, none of the predictor variables significantly predicted children's performance at correctly identifying the Magician target person (group $p = .70$, age $p = .83$; see Table 6). The model accounted for 1% of the variance in lineup accuracy.

Table 6

Logistic regression predictors for the Magician lineup accuracy (N = 62)

Step	R^2	***B***	**Wald**	**df**	***p***	**Exp *B***	**95% confidence interval**	
							Lower	**Upper**
Constant		1.65	22.80	1	<.001	5.20		
Step 1								
Constant	.01	1.77	6.06	1	.01	5.85		
Age		.15	.05	1	.83	1.16	.30	4.50
Group		-.29	.15	1	.70	.75	.17	3.23

For the Yellow Lady, the overall model did significantly predict lineup accuracy (omnibus $\chi^2 = 10.11$, df = 2, $p = .01$). There was no significant effect of group ($p = .11$), however, there was a significant effect of age ($p = .01$; see Table 7). The odds ratio demonstrates that older children were more correct in identifying the Yellow Lady compared to younger children. Follow up chi-squared analysis confirmed a significant association between children's age and lineup accuracy, $\chi^2 (1, N = 63) = 7.36$, $p = .01$. The model accounted for 20% of the variance in children's performance at correctly identifying the Yellow Lady.

Table 7

Logistic regression predictors for the Yellow Lady lineup accuracy (N = 63)

Step	R^2	*B*	Wald	df	*p*	Exp *B*	95% confidence interval	
							Lower	Upper
Constant		.16	.40	1	.53	1.17		
Step 1								
Constant	.20	.40	.57	1	.45	1.50		
Age		-1.50	7.15	1	.01	.22	.07	.67
Group		.92	2.48	1	.11	2.50	.80	7.82

For the Exit Interviewer, the overall model did not significantly predict children's performance at correctly identifying the target person (omnibus $\chi^2 = 5.35$, df = 2, $p = .07$). Age ($p = .20$) was not a significant predictor of lineup accuracy. However, group ($p = .05$) was a significant predictor of children's lineup accuracy (see Table 8). The odds ratio demonstrates that control children were more accurate in identifying the Exit Interviewer than children with ASD. Follow up chi-squared analysis confirmed a significant association between group and lineup accuracy, $\chi^2 (1, N = 63) = 3.75$, $p = .05$. The model accounted for 11.5% of the variance in lineup accuracy.

Table 8

Logistic regression predictors for the Exit Interviewer lineup accuracy (N = 63)

Step	R^2	*B*	Wald	df	*p*	Exp *B*	95% confidence interval	
							Lower	Upper
Constant		-.84	9.36	1	.002	.43		
Step 1								
Constant	.09	.22	.17	1	.69	1.24		
Age		-.74	1.65	1	.20	.48	.15	1.48
Group		-1.13	3.74	1	.05	.32	.10	1.01

What did the Person do/say? After children's identification of the Yellow Lady and Exit Interviewer, children were shown another photograph and told "This is the yellow hat lady/exit interviewer" and asked two source monitoring questions: (1) "What did she do?" and (2) "What did she say to you?" Children were not asked these questions about the Magician because they were asked free recall questions about the magic show. Children were only asked these questions if they made an identification (either correct or incorrect). In our sample, all children made an identification in the lineup with the Yellow Lady. However, only 11 control and 10 ASD children made an identification of the Exit Interviewer. Overall, a majority of children reported no details about what the target persons did and said; therefore, we only report descriptive statistics below.

Correct Utterances for What the Target Person Did. For the Yellow Lady, 30 control (75%) and 17 ASD (77%) children reported no correct details for what the target person did. Eleven control (27%) and five ASD (23%) children reported one correct detail of what the Yellow Lady did. For the Exit Interviewer, eight control (73%) and six ASD (60%) children recalled no correct details, two control (18%) and two ASD (20%) children recalled one correct detail, and one control (9%) and two ASD (20%) children recalled two correct details of what the target person did.

Incorrect Utterances for What the Target Person Did. Thirty-five control (85%) and 14 ASD (64%) children recalled no incorrect utterances of what the Yellow Lady did. Five control (12%) and six ASD (27%) children reported one incorrect detail. One control (2%) and two ASD (9%) children recalled two or more incorrect utterances of what the Yellow Lady did. For the Exit Interviewer, nine control (82%) and nine ASD (90%) children recalled no incorrect details of the target persons actions. Two control

children (18%) and one ASD child (10%) reported two or more incorrect details of what the Exit Interview did.

Correct Utterances for What the Target Person Said. For the Yellow Lady, 31 control (76%) and 19 ASD (86%) children reported zero correct details of what actions the target person said. Ten control (24%) and three ASD (14%) children reported one of more correct details of what the Yellow Lady said. For the Exit Interviewer, six control (54%) and seven ASD (70%) children reported no correct utterances. Five control (45%) and three ASD (30%) children reported one of more correct details of what the Exit Interviewer said.

Incorrect Utterances for What the Target Person Said. For the Yellow Lady, 37 control (90%) and 18 ASD (82%) children reported no incorrect utterances. Four control (10%) and four ASD (18%) children reported one or more incorrect utterances for what the Yellow Lady said. For the Exit Interviewer, 11 control (100%) and seven ASD (70%) children reported no incorrect details. Three children with ASD (30%) recalled one of more incorrect details of what the Exit Interviewer said.

Research Question 3 Summary. In our logistic regression models, group was not a significant predictor of children's accuracy at identifying the Magician or the Yellow Lady. However, control children were more accurate in identifying the Exit Interviewer than children with ASD. Group differences also emerged when examining children's performance at correctly rejecting the foil persons. For all the target persons, control children correctly rejected the foil persons at a higher rate than children with ASD. Finally, children performed poorly on the source monitoring questions at the 10-

month delay interview. Most children did not recall any correct or incorrect details for what the target person did or said.

Research Question 4

Do group differences exist for children's identification of previously seen objects following a 10-month delay?

Children were given an object recognition task in the follow-up interview. Children were shown 5 photographs of previously seen objects and 5 photographs of previously unseen objects in a randomized order. For each object, children were asked whether they saw the object during the magic show, which person used the object, and what they did with the object.

Did the Person use the [Object]? A 2 (Group) x 2 (Age Category) ANOVA was carried out on the number of correct identifications of previously *seen* objects from the magic show. The results revealed no significant main effects of group, $F(1, 59) = .01$, $p = .94$, $\eta_p^2 < .001$, or age category, $F(1, 59) = 3.58$, $p = .06$, $\eta_p^2 = .06$. That is, regardless of group and age category, children performed above chance (i.e., 50%) in correctly recognizing previously seen objects from the magic show ($M = 4.35$, $SD = 1.58$). Most children correctly recognized at least three of the previously seen objects ($n = 55$, 87.3%).

However, children's performance at correctly rejecting previously *unseen* objects was significantly different by group, $F(1, 59) = 11.44$, $p = .001$, $\eta_p^2 = .16$. Control children ($M = 4.76$, $SD = 1.22$) correctly rejected previously unseen objects more than children with ASD ($M = 3.67$, $SD = 1.22$). No significant main effect of age category, $F(1, 59) = 1.63$, $p = .21$, $\eta_p^2 = .03$, or interaction emerged, $F(1, 59) = .61$, $p = .44$, $\eta_p^2 = .01$.

Which Person used the [Object]? Approximately one third of children (*n* = 20, 32%) incorrectly identified who used all the previously *seen* objects from the magic show. More specifically, 13 ASD and seven control children incorrectly identified which target person used the previously seen objects for all the object identification items. In addition, most children correctly rejected the previously *unseen* objects. That is, 48 children (76%) correctly rejected who used all the previously unseen objects. Fifteen children (24%; 10 ASD and five control children) falsely assented to knowing who used the previously unseen objects. Only two children with ASD (3%) falsely assented to knowing who used all five of the unseen objects.

What did you [the child] do with the [object]? Children were also asked to identify what they did with the previously seen and unseen objects.

The results demonstrated children remembered few *correct* details of previously *seen* objects with most children (*n* = 47, 75%) remembering two or less correct details from the magic show. More specifically, 16 ASD and 31 control children recalled two or less correct details for what they did with the previously seen objects. Additionally, most children (12 ASD and 29 control children; 65%) reported zero or one *incorrect* details regarding what they did with previously *seen* objects. Finally, children who falsely assented to previously *unseen* objects (*n* = 15) reported a range of 0 (*n* = 4, 6%) to 11 (*n* = 1, 2%) incorrect details from the magic show.

Research Question 4 Summary. Overall children performed above chance in correctly recognizing previously seen objects from the magic show. However, control children correctly rejected the previously unseen objects more than children with ASD. In addition, about one third of children incorrectly identified who used all the previously

seen objects, and a majority of children correctly rejected the previously unseen objects. Finally, children remembered few correct details of what they did with the previously seen objects.

Chapter Four

Discussion

The purpose of this study was to: (1) investigate whether a 10-month delay differentially affects memory and suggestibility among children with ASD compared with control children; (2) examine whether group differences exist for children's lineup identification; (3) investigate children's ability to monitor whether they only heard versus experienced an event (i.e., source monitoring abilities), and (4) evaluate children's performance in identifying previously seen objects following a 10-month delay. Building off the original study conducted by Bruck et al. (2007), 22 ASD and 41 control 5- to 10-year-old children were questioned at three different time points about a magic show they personally experienced. Children were also given a lineup identification and object recognition task following a 10-month delay of experiencing the magic show. Thus, the present study aimed to investigate ASD children's eyewitness reports and identification of persons and objects following a 10-month delay.

The present study maintained unique methodological strengths over prior investigations examining event memory, susceptibility to suggestion, and identification of previously seen people and objects. Building off other investigations that questioned ASD and control children about an event (e.g., Almeida et al., 2019; Bruck et al., 2007; Henry, Crane et al., 2017; Henry, Messer et al., 2017; Mattison et al., 2015; Millward et al., 2000), our study included a long delay that is typical in criminal investigations. Second, our study furthers previous investigations (Wilcock et al., 2019) by including three lineups of target persons children interacted with on three separate occasions.

Memory for Recognition Items

Our results support Bruck et al.'s (2007) findings that children with ASD show similar rates of facilitation effects as control children at both the two-week and 10-month delay interview. As shown in research question 2, both control and ASD children performed better on the true reminded (i.e., suggested) items than the true non-reminded (i.e., control) items at both the two-week and 10-month delay interview. We also observed older children accurately assented to the true recognition items more than younger children. In sum, the present study found that children with ASD show facilitation effects similar to TD children.

For false recognition items, both groups showed memory misinformation effects at the two-week delay interview but only control children showed these effects at the 10-month delay interview. Our findings suggest children with ASD inaccurately assented to more false non-reminded items than control children. Based on these results interviewers should be cautious in using direct prompts when interviewing both children with and without ASD. One limitation of the true and false recognition items is that the correct answer to the true reminded items was always 'yes' while the correct answer to the false reminded items was always 'no'. Therefore, our results suggest children with ASD may show a pattern of having a 'yes' bias when answering recognition items. In addition to these group differences, older children gave more inaccurate assents than younger children. These age differences are not surprising given, under some circumstances, previous literature shows an inverse relationship between suggestibility and age (e.g., Bright-Paul et al., 2005; Ceci et al., 1987; Chae & Ceci, 2005). Older children have better memory than younger children, and they may better encode or store the false reminders.

Memory for Free Recall Reports

Consistent with previous research, we found children with ASD showed deficits in their memory for personally experienced events. Compared to control children, children with ASD showed these deficits in terms of the number of details produced in free recall at both a two-week and 10-month delay interval (i.e., Session 3 initial interview and Session 4 follow-up interview) as well as the accuracy of responses to recognition questions. As summarized in research question 1, a large proportion of children with ASD could not recall any details from the magic show at the two-week delay or 10-month delay interview. More specifically, we found that age category interacted with group but only at the two-week delay interview. Older control children provided more correct utterances than older children with ASD. For younger children, this difference among group did not reach statistical significance even though it was in the same direction. In general, our results revealed that regardless of group older children produced more correct utterances than younger children. This association between age category and the number of correct utterances children provided during free recall is supported by previous research (e.g., Bjorklund et al., 2000; Lamb et al., 2003; London et al., 2009). Moreover, both groups revealed a significant decline in their free recall reports from the two-week delay to the 10-month delay interview. Although no group differences emerged, we found that older children produced more incorrect details than younger children in their free recall reports.

Identification of Photographs of People and Objects

Furthermore, consistent with Wilcock et al. (2019) our results demonstrated no significant group differences regarding correctly identifying the Magician or Yellow

Lady (see research question 3). However, we did find a significant difference between ASD and control children's ability to correctly identify the Exit Interviewer. Therefore, our results suggest that compared to control children, ASD children's performance on a lineup may change when the task demand increases (i.e., identifying multiple perpetrators, varying delay between interaction with target person and lineup). However, when examining children's performance at correctly rejecting the foil persons, we found children with ASD were more apt to make false assents to the foil persons compared to control children.

In addition, research suggests children with ASD show impairments in their source monitoring abilities compared to TD children (Bowler et al., 2004; Hala et al., 2005; Lind & Bowler, 2009). However, our results revealed no group differences in children's memory for people's actions completed following a 10-month delay. This finding may be a function of the long delay period. Group differences may exist in source monitoring abilities but may wash out following a long delay period since most children in our sample reported zero details for the target persons actions. Finally, as shown in research question 4, we found children overall performed above chance in correctly recognizing previously seen objects from the magic show. However, control children correctly rejected the previously unseen objects more than children with ASD.

Limitations and Directions for Future Research

Although the present study had strong experimental control, several limitations need to be discussed. The first limitation to address is the size and generalizability of our sample of children with ASD. Although best effects were put forth to retain participants across the four sessions, our ASD sample size was small (n = 22), therefore, increasing

the probability of being underpowered in the present study. Additionally, because of historical differences in diagnosing individuals with ASD, our findings may not generalize to all children with ASD. More specifically, our sample included children with ASD who met the *DSM-IV* criteria for ASD. However, the most recent version of the *Diagnostic and Statistical Manual for Mental Disorders* (i.e., DSM-5) has updated the diagnostic criteria for ASD. In the present study, children with ASD represent a specific subset of children who have average intelligence and no behavioral issues that would interfere with the testing procedures. Therefore, since ASD is diagnosed on a wide spectrum of symptoms and functioning, our findings do not generalize to all children with ASD who are diagnosed with different severity levels. Finally, individuals with ASD have high comorbidity rates making it difficult to parse out effects of ASD compared to other comorbid disorders (Mazzone et al., 2012; Salazar et al., 2015).

Next, the methodological goal of this study was to conduct a laboratory-based investigation with strong experimental control. Therefore, the strong experimental control leads to an issue of ecological validity of the present study. Compared to events about which children are questioned in a forensic setting, the interactive magic show used in this study evoked a mild emotional response. In real-life cases, children may be asked to provide an autobiographical report and identify a perpetrator from a negative event that evokes a strong emotional response which may in-turn impact their eyewitness abilities. Emotional valence is known to affect memory in both TD and ASD individuals. For example, Maras and Bowler (2010) found individuals with ASD were significantly less accurate in their autobiographical reports of a negative emotional event compared to individuals without ASD. However, if memory effects between ASD and control children

can be detected with a relatively neutral event in the present study, then these effects may be more robust with more ecologically valid events. That is, these group difference effects may be stronger when children personally experience an emotional event. Future research should investigate the effects of emotional valence of an event on ASD and control children's memory and suggestibility.

In addition, the findings from this study invite more questions for future research regarding the impact of an ASD diagnosis on children's memory suggestibility. First, research should be conducted to evaluate whether ASD children's free recall is enhanced when provided with narrative elaboration training, rapport building, and ground rules that set the stage for the interview as recommended by evidence-based investigative interviewing protocols (e.g., Hershkowitz et al., 2007; Lamb et al., 2007). Second, an important area for future research would be to investigate how to best support children with ASD in a forensic setting. Autobiographical memory is not a single skill but rather is related to myriad underlying cognitive (e.g., executive functioning, verbatim vs. gist processing), social (e.g., compliance, parental scaffolding of the narrative), and social cognitive (e.g., Theory of Mind abilities) underpinnings. Since peaks and valleys are seen in children with ASD in their cognitive and social abilities, future research can help identify optimal interviewing approaches that best promote the quantity and quality of their forensic reports. Although recent research has expanded in modifying interview protocols for adults with ASD (e.g., Maras et al., 2020; Norris et al., 2020), additional research is needed to determine how to best support children with ASD during a forensic interview. For instance, future research could examine whether writing down generated topics from the event or utilizing different questioning prompts (e.g., open-ended,

semantic support, and visual-verbal) influence the amount of information children with ASD report.

Finally, although our findings suggest that children with ASD perform similarly to control children future research is still needed to determine whether lineup identification procedures should be modified in cases involving children with ASD. A limitation of the present study is that our findings may not apply to real-life cases because the interactions with the target persons was a neutral interaction. In real-life cases, children may experience more anxiety and distress during the social interaction which in turn may decrease their accuracy in correctly identifying the target person. Moreover, we did not include both perpetrator-present and perpetrator-absent lineups. Based on Wilcock et al.'s (2019) mixed findings that children were more likely to be correct on the perpetrator-absent lineup for one target person but not the other person, we know that lineup type may have an impact on identification. Thus, future studies should examine whether this finding holds true in other event contexts. Additionally, similar to Wilcock et al. (2019), the lineups used in the present study may have varied in difficulty due to levels of similarities across target and foil persons. Therefore, future research is needed to better understand how children with ASD make eyewitness identifications since children with ASD may not process faces or experience emotional events in the same way as TD children. For example, ASD children's increased anxiety (Kuusikko et al., 2008) may cause them to experience negative emotions about an otherwise positive social interaction.

Conclusions and Forensic Implications

Similar to Maras and Bowler (2014), we conclude that children with ASD can be reliable witnesses, but investigative interviewing techniques may need to be modified when questioning this vulnerable population to bolster the amount of information provided. As suggested by previous research (e.g., Allen et al., 2008; Browning & Caulfied, 2011; Haskins & Silva, 2006; Murrie et al., 2002), forensic investigators are ill-equipped to effectively handle cases involving witnesses with ASD. Thus, similar to TD populations, we recommend investigators use open-ended techniques and are careful in their use of pronouns. Moreover, until additional data are available to guide modifications, we agree with Malloy et al. (2018) that investigators should follow a general evidence-based protocol such as the NICHD Investigative Interview Protocol to evaluate ASD children's communication at narrative practice.

Based on our findings in conjunction with extant studies, the general structure of the forensic interview should be the same for children with ASD. That is, the interviewer should engage in rapport building and narrative practice as well as include ground rule instructions to set the stage of the interview. Such techniques help demonstrate to the child that they are the expert and the one who should do the talking and the informing about the event in question. While studies have found narrative practice bolsters TD children's reports (e.g., Lamb et al., 2007), research has not explored whether it exerts similar positive effects in children with ASD. However, the narrative practice pre-substantive phase of the interview can evaluate whether the child's capable of offering a narrative about a specific event that is not related to the event of interest. The interviewer could also test whether the child can appreciate pronouns during the pre-substantive

questioning phase of the interview. However, as mentioned in the above section future research is needed to determine whether children with ASD benefit similarly to TD children from this component of the investigative interview.

Our findings add to previous research by providing further support that modifications to forensic interview protocols may need to be made to better support children with ASD due to their impairments in autobiographical memory. The results from this study can be used to further our knowledge on best practice guidelines for interviewing children with ASD. Our findings demonstrate that autobiographical accounts of an event following a long delay are sparse among children with ASD compared to those of control children. ASD children's sparse accounts are mainly due to their limited responses to open-ended questions. However, our results also show that providing direct and leading yes/no questions increases children's error rates, particularly among children with ASD. Thus, interviewers should be cautious in using direct prompts when interviewing both ASD and TD children.

In conclusion, this study furthers our knowledge regarding how to best support children with ASD in forensic settings. Nonetheless, this research shows the need to better understand developmental processes beyond simply listing out the deficits in memory performance among children with ASD.

References

Abrahams, B., & Geschwind, D. (2008). Advances in autism genetics: On the threshold of new neurobiology. *Nature Reviews Genetics, 9,* 341-355. https://doi.org/10.1038/nrg2346

Allen, D., Evans, C., Hider, A., Hawkins, S., Peckett, H., & Morgan, H. (2008). Offending behaviour in adults with Asperger syndrome. *Journal of Autism and Developmental Disorders*, *38*, 748–758. https://doi.org/10.1007/s10803-007-0442-9

Almeida, T. S., Lamb, M. E., & Weisblatt, E. J. (2019). Effects of Delay, Question Type, and Socioemotional Support on Episodic Memory Retrieval by Children with Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders*, *49*, 1111-1130. https://doi.org/10.1007/s10803-018-3815-3

American Psychiatric Association (1987). *Diagnostic and statistical manual of mental disorders* (DSM-III-R). *Washington, DC: APA.*

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., Text Revison). Arlington, VA: American Psychiatric Publishing.

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental Disorders: DSM-5.* Washington, D.C.: American Psychiatric Association.

Baio, J., Wiggins, L., Christensen, D. L., Maenner, M. J., Daniels, J., Warren, Z., ... & Durkin, M. S. (2018). Prevalence of autism spectrum disorder among children

aged 8 years — autism and developmental disabilities monitoring network, 11 sites, United States, 2014. *MMWR Surveillance Summaries*, *67*, 1-23. doi:10.15585/mmwr.ss6706a1

Baker-Ward, L., Hess, T. M., & Flannagan, A. (1990). The effects of involvement on children's memory for events. *Cognitive Development, 5*, 55–69. https://doi.org/10.1016/0885-2014(90)90012 -I.

Baron-Cohen, S. (2000). Theory of mind and autism: A fifteen year review. In S. Baron Cohen, H. Tager-Flusberg, & D. J. Cohen (Eds.), *Understanding other minds: Perspectives from developmental cognitive neuroscience., 2nd ed.* (pp. 3-20). New York, NY: Oxford University Press. Retrieved from https://search.ebscohost.com/login.aspx?direct=true&db=psych&AN=2007-%20%2001999-001&site=eds-live

Bennetto, L., Pennington, B. F., & Rogers, S. J. (1996). Intact and impaired memory functions in autism. *Child Development*, *67*, 1816-1835. https://doi.org/10.1111/j.1467-8624.1996.tb01830.x

Bowler, D. M., Gaigg, S. B., & Gardiner, J. M. (2009). Free recall learning of hierarchically organized lists by adults with Asperger's syndrome: Additional evidence for diminished relational processing. *Journal of Autism and Developmental Disorders*, *39*, 589–595. doi:10.1007/s10803-008-0659-2

Bowler, D. M., Gardiner, J. M., & Berthollier, N. (2004). Source memory in adolescents and adults with Asperger's syndrome. *Journal of Autism and Developmental Disorders*, *34*, 535–542. https://doi.org/10.1007/s10803-004-2548-7

Bowler, D. M., Matthews, N. J., & Gardiner, J. M. (1997). Asperger's syndrome and memory: Similarity to autism but not amnesia. *Neuropsychologia*, *35*, 65-70. https://doi.org/10.1016/S0028-3932(96)00054-1

Brainerd, C. J., Reyna, V. F., & Ceci, S. J. (2008). Developmental reversals in false memory: A review of data and theory. *Psychological Bulletin*, *134*, 343. https://doi.org/10.1037/0033-2909.134.3.343

Bright-Paul, A., Jarrold, C., & Wright, D. B. (2005). Age-appropriate cues facilitate source-monitoring and reduce suggestibility in 3-to 7-year-olds. *Cognitive Development*, *20*, 1-18. https://doi.org/10.1016/j.cogdev.2004.06.001

Browning, A., & Caulfield, L. (2011). The prevalence and treatment of people with Asperger's Syndrome in the criminal justice system. *Criminology & Criminal Justice*, *11*, 165-180. https://doi.org/10.1177/1748895811398455

Bruck, M., & Ceci, S. J. (2013). Expert testimony in a child sex abuse case: Translating memory development research. *Memory*, *21*, 556-565. https://doi.org/10.1080/09658211.2013.769606

Bruck, M., London, K., Landa, B., & Goodman, J. (2007). Autobiographical memory and suggestibility in children with autism. *Development & Psychopathology*, *19*, 73–95. https://doi.org/10.10170S0954579407070058

Burack, J. A., Charman, T., Yirmiya, N. & Zelazo, P. R. (2001). Development and autism:Messages from developmental psychopathology, In J. A. Burack, T. Charman, N. Yirmiya, & P.R. Zelazo (Eds.), *The development of autism: Perspective from theory and research* (pp. 3-15). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

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

Capps, L., & Sigman, M. (1996). Autistic Aloneness. In R.D. Kavanaugh, B. Zimmerberg, & S. Fein (Eds), *Emotion: Interdisciplinary Perspectives.* (pp. 273-296). Hillsdale, NJ: Erlbaum.

Carter, A. S., Ornstein Davis, N., Klin, A., & Volkmar, F. R. (2005). Social Development In Autism. In F. R. Volkmar, R. Paul, A. Klin, & D. Cohen (Eds), *Handbook of Autism and Pervasive Developmental Disorders* (Vol. 1, pp. 312-334). Hoboken, NJ: Wiley.

Carvajal, H., & Gerber, J. (1987). 1986 Stanford–Binet abbreviated forms. *Psychological Reports*, *61*, 285–286. https://doi.org/10.2466/pr0.1987.61.1.285

Ceci, S. J., & Bruck, M. (1993). Suggestibility of the child witness: A historical review and synthesis. *Psychological Bulletin*, *113*, 403-439. https://doi.org/10.1037/0033-2909.113.3.403

Ceci, S. J., Ross, D. F., & Toglia, M. P. (1987). Suggestibility of children's memory: Psycholegal implications. *Journal of Experimental Psychology: General*, *116*, 38-49. https://doi.org/10.1037/0096-3445.116.1.38

Chae, Y., & Ceci, S. J. (2005). Individual differences in children's recall and suggestibility: The effect of intelligence, temperament, and self-perceptions. *Applied Cognitive Psychology: The Official Journal of the Society for Applied Research in Memory and Cognition*, *19*, 383-407. https://doi.org/10.1002/acp.1094

Charman, T., Jones, C. R. G., Pickles, A., Simonoff, G., Baird, G., & Happé, F. (2011). Defining the cognitive phenotype of autism. *Brain Research, 1380,* 10-21. https://doi.org/10.1016/j.brainres.2010.10.075

Corbett, B. A., Constantine, L. J., Hendren, R., Rocke, D., & Ozonoff, S. (2009). Examining executive functioning in children with autism spectrum disorder, attention deficit hyperactivity disorder and typical development. *Psychiatry Research*, *166*, 210–222. https://doi.org/10.1016/j.psychres.2008.02.005

Chevallier, C., Kohls, G., Troiani, V., Brodkin, E. S., & Schultz, R. T. (2012). The social motivation theory of autism. *Trends in Cognitive Sciences*, *16*, 231-239. https://doi.org/10.1016/j.tics.2012.02.007

Corbett, B. A., Constantine, L. J., Hendren, R., Rocke, D., & Ozonoff, S. (2009). Examining executive functioning in children with autism spectrum disorder, attention deficit hyperactivity disorder and typical development. *Psychiatry Research*, *166*, 210-222. https://doi.org/10.1016/j.psychres.2008.02.005

Cornett, K. A., Miora, D. S., Fass, T., & Dixon, D. (2013). Memory Functioning for Personally Experienced and Witnessed Events in Children with Autism and the Implications for Educators, Mental Health Professionals, and the Law. *Journal of Applied Research on Children*, *4*, Retrieved from https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ1188935&site=eds-live

Crane, L., & Goddard, L. (2008). Episodic and semantic autobiographical memory in adults with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *38*, 498-506. https://doi.org/10.1007/s10803-007-0420-2

DeLamatre, J. E., & Hollinger, C. L. (1990). Utility of the Stanford–Binet IV abbreviated form for placing exceptional children. *Psychological Reports*, *67*, 973–974. https://doi.org/10.2466/pr0.1990.67.3.973

Diehl, J. J., Bennetto, L., & Young, E. C. (2006). Story recall and narrative coherence of high-functioning children with autism spectrum disorders. *Journal of Abnormal Child Psychology*, *34*, 77-102. https://doi.org/10.1007/s10802-005-9003-x

Ebbinghaus, H. (1885/1964). Memory (H. A. Ruger & C. E. Bussenius, Trans.). New York, NY: Dover. (Original work published 1885).

Eisen, M. L., Goodman, G. S., Diep, J., Lacsamana, M. T., Olomi, J., Goldfarb, D., & Quas, J. A. (2019). Effects of Interviewer Support on Maltreated and At-Risk Children's Memory and Suggestibility. *International Journal on Child Maltreatment: Research, Policy and Practice*, 1-24. https://doi.org/10.1007/s42448-019-00016-7

Eigsti, I. M., de Marchena, A. B., Schuh, J. M., & Kelley, E. (2011). Language acquisition in autism spectrum disorders: A developmental review. *Research in Autism Spectrum Disorders*, *5*, 681-691. https://doi.org/10.1016/j.rasd.2010.09.001

Fitzgerald, R. J., Oriet, C., & Price, H. L. (2015). Suspect filler similarity in eyewitness lineups: A literature review and a novel methodology. *Law and Human Behavior, 39*, 62-74. http://dx.doi.org/10.1037/lhb0000095

Fivush, R., Gray, J. T., & Fromhoff, F. A. (1987). Two- year-olds talk about the past. *Cognitive Development*, *2*, 393–409. https://doi.org/10.1016/S0885-2014(87)80015-1

Fivush, R., & Hamond, N. R. (1989). Time and again: Effects of repetition and retention interval on 2 year olds' event recall. *Journal of Experimental Child Psychology, 47*, 259–273. https://doi.org/10.1016/0022-0965(89)90032-5.

Foley, M. A., & Johnson, M. K. (1985). Confusions between memories for performed and imagined actions: A developmental comparison. *Child Development*, *56*, 1145-1155. doi: 10.2307/1130229

Gardiner, J. M., Bowler, D. M., & Grice, S. J. (2003). Further evidence of preserved priming and impaired recall in adults with Asperger's syndrome. *Journal of Autism and Developmental Disorders*, *33*, 259-269. https://doi.org/10.1023/A:102445041

Geschwind, D. H., & Levitt, P. (2007). Autism spectrum disorders: Developmental disconnection syndromes. *Current Opinion in Neurobiology, 17,* 103-111. https://doi.org/10.1016/j.conb.2007.01.009

Goldfarb, D., Goodman, G. S., Larson, R. P., Gonzalez, A., & Eisen, M. L. (2018). Putting children's memory and suggestibility in their place: An analysis considering person, topic, and context. In H. Otgaar & M. L. Howe (Eds.), *Finding the truth in the courtroom: Dealing with deception, lies, and memories* (p. 137–159). Oxford University Press.

Goldman, S. (2008). Brief Report: Narratives of personal events in children with autism and developmental language disorders: Unshared memories. *Journal of Autism & Developmental Disorders*, *38*, 1982-1988. https://doi.org/10.1007/s10803-008-0588-0

Goodman, G. S., Sharma, A., Thomas, S. F., & Considine, M. G. (1995). Mother Knows

Best: Effects of Relationship Status and Interviewer Bias on Children′ s Memory. *Journal of Experimental Child Psychology*, *60*, 195-228. https://doi.org/10.1006/jecp.1995.1038

Gudjonsson, G. H. (2003). *The psychology of interrogations and confessions: A handbook*. Chichester, England: John Wiley & Sons, Ltd.

Hala, S., Rasmussen, C., & Henderson, A. M. (2005). Three types of source monitoring by children with and without autism: The role of executive function. *Journal of Autism and Developmental Disorders*, *35*, 75-89. https://doi.org/10.1007/s10803-004-1036-4

Haskins, B. G., & Silva, J. A. (2006). Asperger's disorder and criminal behavior: forensic-psychiatric considerations. *Journal of the American Academy of Psychiatry and the Law Online*, *34*, 374-384.

Henry, L. A., Crane, L., Nash, G., Hobson, Z., Kirke-Smith, M., & Wilcock, R. (2017). Verbal, visual, and intermediary support for child witnesses with autism during investigative interviews. *Journal of Autism and Developmental Disorders*, *47*, 2348-2362. https://doi.org/10.1007/s10803-017-3142-0

Henry, L. A., Messer, D. J., Wilcock, R., Nash, G., Kirke-Smith, M., Hobson, Z., & Crane, L. (2017). Do measures of memory, language, and attention predict eyewitness memory in children with and without autism? *Autism & Developmental Language Impairments*, *2*, 1–17. https://doi.org/10.1177/2396941517722139

Hershkowitz, I., Fisher, S., Lamb, M. E., & Horowitz, D. (2007). Improving credibility assessment in child sexual abuse allegations: The role of the NICHD investigative

interview protocol. *Child Abuse and Neglect*, *31*, 99-110. https://doi.org/10.1016/j.chiabu.2006.09.005

Howe, M. L., Courage, M. L., & Edison, S. C. (2003). When autobiographical memory begins. *Developmental Review*, *23*, 471–494. https://doi.org/10.1016/j.dr.2003.09.001

Howe, M. L., Courage, M. L., & Peterson, C. (1994). How can I remember when "I" wasn't there: Long- term retention of traumatic experiences and emergence of the cognitive self. *Consciousness and Cognition*, *3*, 327–355. https://doi.org/10.1006/ccog.1994.1019

Hudson, J. A. (1993). Reminiscing with mothers and others: Autobiographical memory in young two- year-olds. *Journal of Narrative and Life History*, *3*, 1–32. https://doi.org/10.1075/jnlh.3.1.01rem

Hudson, J. A., & Fivush, R. (1991). As time goes by: Sixth graders remember a kindergarten experience. *Applied Cognitive Psychology, 5*, 347–360. https://doi.org/10.1002/acp.2350050405.

Johnson, M. K., Hashtroudi, S., & Lindsay, D. S. (1993). Source monitoring. *Psychological Bulletin*, *114*, 3-28. doi:10.1037/0033-2909.114.1.3

King, D., Dockrell, J. E., & Stuart, M. (2013). Event narratives in 11-14 years olds with autism spectrum disorder. *International Journal of Language & Communication Disorder*, *48*, 522-533. https://doi.org/10.1111/1460-6984.12025

Koenig, K., Tsatsanis, K. D., & Volkmar, F. R. (2001). Neurobiology and Genetics in Autism: A developmental perspective. In J. A. Burack, T. Charman, N. Yirmiya, & P.R. Zelazo (Eds.), *The development of autism: Perspective from theory and*

research (pp. 81-101). Mahwah, NJ: Lawrence Erlbaum Associates Publishers. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=psych&AN=2001-01233-005&site=eds-live

Kuusikko, S., Pollock-Wurman, R., Jussila, K., Carter, A. S., Mattila, M. L., Ebeling, H., ... & Moilanen, I. (2008). Social anxiety in high-functioning children and adolescents with autism and Asperger syndrome. *Journal of Autism and Developmental Disorders*, *38*, 1697-1709. https://doi.org/10.1007/s10803-008-0555-9

Lamb, M. E., & Fauchier, A. (2001). The effects of question type on self-contradictions by children in the course of forensic interviews. *Applied Cognitive Psychology*, *15*, 483-491. https://doi.org/10.1002/acp.726

Lamb, M. E., Hershkowitz, I., Orbach, Y., & Esplin, P. W. (2008). *Tell me what happened: Structured investigative interviews of child victims and witnesses.* Hoboken, NJ: John Wiley & Sons Inc. https://doi.org/10.1002/9780470773291

Lamb, M. E., Orbach, Y., Hershkowitz, I., Esplin, P. W., & Horowitz, D. (2007). A structured forensic interview protocol improves the quality and informativeness of investigative interviews with children: A review of research using the NICHD Investigative Interview Protocol. *Child Abuse and Neglect*, *31*, 1201-1231. https://doi.org/10.1016/j.chiabu.2007.03.021

La Rooy, D., Pipe, M.E., & Murray, J. E. (2005). Reminiscence and hypermnesia in children's eyewitness memory. *Journal of Experimental Child Psychology, 90*, 235–254. https://doi. org/10.1016/j.jecp.2004.11.002.

Lind, S. E., & Bowler, D. M. (2009). Recognition memory, self-other source memory, And theory-of mind in children with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 39,* 1231-1239. https://doi.org/10.1007/s10802-009-0735-2

Lindsay, D. S., Johnson, M. K., & Kwon, P. (1991). Developmental changes in memory source monitoring. *Journal of Experimental Child Psychology*, *52*, 297-318. https://doi.org/10.1016/0022-0965(91)90065-Z

Lindsay, R. C., Pozzulo, J. D., Craig, W., Lee, K., & Corber, S. (1997). Simultaneous lineups, sequential lineups, and showups: Eyewitness identification decisions of adults and children. *Law and Human Behavior*, *21*, 391-404. https://doi.org/10.1023/A:102480720

London, K., Bruck, M., Ceci, S.J., & Shuman, D.W. (2005). Disclosure of child sexual abuse: What does the research tell us about the ways that children tell? *Psychology, Public Policy, and Law*, *11*, 194-226. doi: 10.1037/1076-8971.11.1.194

London, K., Bruck, M., & Melynk, L. (2009). Post-event information affects children's autobiographical memory after one year. *Law and Human Behavior*, *33*, 344–355. https://doi.org/10.1007/s10979-008-9147-7

London, K., Bruck, M., Wright, D., & Ceci. S. (2008) Review of the contemporary literature on how children report sexual abuse to others: Findings, methodological issues, and implications for forensic interviewers. *Memory*, *16*, 29-47. http://doi.org/10.1080/09658210701725732

Lord, C., & Spence, S. (2006). Autism spectrum disorder: Phenotype and diagnosis. In S.

O. Moldin & J. L. Rubenstein (Eds.), *Understanding autism: From basic neuroscience to treatment* (pp. 1-23). Boca Raton, FL: CRC Press, Taylor & Francis Group.

Loveland, K. A., McEvoy, R. E., Tunali, B., & Kelley, M. L. (1990). Narrative story telling in autism and Down's syndrome. *British Journal of Developmental Psychology*, *8*, 9-23. https://doi.org/10.1111/j.2044-835X.1990.tb00818.x

Maenner, M. J., Shaw, K. A., & Baio, J. (2020). Prevalence of autism spectrum disorder among children aged 8 years—autism and developmental disabilities monitoring network, 11 sites, United States, 2016. *MMWR Surveillance Summaries*, *69*(4), 1-12. doi: 10.15585/mmwr.ss6904a1

Malloy, L. C., Mugno, A. P., & Arndorfer, A. (2018). Interviewing Children with Autistic Spectrum Disorder: The NICHD Protocol and Ten-Step Investigative Interview. In J. L. Johnson, G. S. Goodman, & P. C. Mundy (Eds.), *The Wiley Handbook of Memory, Autism Spectrum Disorder, and the Law*. (pp. 292-310). Wiley-Blackwell. https://doi.org/10.1002/9781119158431.ch15

Mandell, D. S., Walrath, C. M., Manteuffel, B., Sgro, G., & Pinto-Martin, J. A. (2005). The prevalence of abuse among children with autism served in comprehensive community based mental health settings. *Child Abuse and Neglect, 29*, 1359-1372. https://doi.org/10.1016/j.chiabu.2005.06.006

Maras, K. L., & Bowler, D. M. (2010). The cognitive interview for eyewitnesses with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *40*, 1350–1360. https://doi.org/10.1007/s10803-010-0997-8

Maras, K., & Bowler, D. M. (2011). Brief report: Schema consistent misinformation

effects in eyewitnesses with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *41*, 815-820. https://doi.org/10.1007/s10803-010-1089-

Maras, K. L., & Bowler, D. M. (2014). Eyewitness testimony in autism spectrum disorder: A review. *Journal of Autism and Developmental Disorders*, *44*, 2682-2697. doi 10.1007/s10803-012-1502-3

Maras, K., Norris, J. E., & Brewer, N. (2020). Metacognitive monitoring and control of eyewitness memory reports in autism. *Autism Research*, *13*, 2017-2029. https://doi.org/10.1002/aur.2278

Mattison, M. L. A., Dando, C. J., & Ormerod, T. C. (2015). Sketching to remember: Episodic free recall task support for child witnesses and victims with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *45*, 1751–1765. https://doi.org/10.1007/s10803-014-2335-z

Mazzone, L., Ruta, L., & Reale, L. (2012). Psychiatric comorbidities in Asperger Syndrome and high functioning Autism: Diagnostic challenges. *Annals of General Psychology*, *11*, 16. doi:10.1186/1744-859X-11-16

McCloskey, M., & Zaragoza, M. (1985). Misleading postevent information and memory for events: Arguments and evidence against memory impairment hypotheses. *Journal of Experimental Psychology: General*, *114*, 1-16. doi: 10.1037/0096-3445.114.1.1

McCrory, E., Henry, L. A., & Happé, F. (2007). Eye-witness memory and suggestibility in children with Asperger syndrome. *Journal of Child Psychology and Psychiatry, 48,* 482-489. https://doi.org/10.1111/j.1469-7610.2006.01715.x

Miller, H. L., Odegard, T. N., & Reyna, V. (2018). Autobiographical memory in autism

spectrum disorder through the lens of fuzzy trace theory. In J. L. Johnson, G. S. Goodman, & P. C. Mundy (Eds.), *The Wiley handbook of memory, autism spectrum disorder, and the law* (pp. 27–52). Wiley Blackwell. https://doi.org/10.1002/9781119158431.ch2

Millward, C., Powell, S., Messer, D., & Jordan, R. (2000). Recall for self and other in autism: Children's memory for events experienced by themselves and their peers. *Journal of Autism and Developmental Disorders*, *30*, 15–28. https://doi.org/10.1023/A:1005455926727

Murrie, D. C., Warren, J. I., Kristiansson, M., & Dietz, P. E. (2002). Asperger's syndrome in forensic settings. *International Journal of Forensic Mental Health*, *1*, 59-70. https://doi.org/10.1080/14999013.2002.10471161

Norris, J. E., Crane, L., & Maras, K. (2020). Interviewing autistic adults: Adaptations to support recall in police, employment, and healthcare interviews. *Autism*, *24*, 1506-1520. https://doi.org/10.1177/1362361320909174

North, A. S., Russell, A. J., & Gudjonsson, G. H. (2008). High functioning autism spectrum disorders: an investigation of psychological vulnerabilities during interrogative interview. *The Journal of Forensic Psychiatry & Psychology*, *19*, 323-334. https:doi.org/10.1080/14789940701871621

Orbach, Y., Hershkowitz, I., Lamb, M. E., Sternberg, K. J., Esplin, P. W., & Horowitz, D. (2000). Assessing the value of structured protocols for forensic interviews of alleged child abuse victims. *Child Abuse and Neglect*, *24*, 733-752. doi:10.1016/S0145-2134(00)00137-X

Otgaar, H., Howe, M. L., Patihis, L., Merckelbach, H., Lynn, S. J., Lilienfeld, S., &

Loftus, E. (2019). The Return of the Repressed: The Persistent and Problematic Claims of Long-Forgotten Trauma. *Perspectives on Psychological Science*. doi: 10.1177/1745691619862306

Parker, J. F., & Carranza, L. E. (1989). Eyewitness testimony of children in target-present and target-absent lineups. *Law and Human Behavior*, *13*, 133-149. https://doi.org/10.1007/BF01055920

Peterson, C. (2011). Children's memory reports over time: Getting both better and worse. *Journal of Experimental Child Psychology, 109*, 275–293. https://doi.org/10.1016/j.jecp.2011.01.009.

Pezdek, K., & Roe, C. (1995). The effect of memory trace strength on suggestibility. *Journal of Experimental Child Psychology*, *60*, 116-128. doi: 10.1006/jecp.1995.1034

Pipe, M.E., Gee, S., Wilson, J. C., & Egerton, J. M. (1999). Children's recall 1 and 2 years after the event. *Developmental Psychology, 35*, 781–789. https://doi.org/10.1037/0012-1649.35.3.781.

Pipe, M.E., Sutherland, R., Webster, N., Jones, C., & Rooy, L., D (2004). Do early interviews affect children's long-term event recall? *Applied Cognitive Psychology, 18*, 823–839. https://doi. org/10.1002/acp.1053.

Pozzulo, J. (2007). Person description and identification by child witnesses. In R. C. L. Linsay, D. F. Ross, J. D. Read, & M. P. Toglia (Eds.), *The Handbook of Eyewitness Psychology: Vol II: Memory for people.* (pp. 297-322). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

Pozzulo, J. D., & Lindsay, R. C. L. (1998). Identification accuracy of children versus

adults: A meta-analysis. *Law and Human Behavior*, *22*, 549-570. https://doi.org/10.1023/A:1025739514042

Prewett, P. N. (1992). Short forms of the Stanford–Binet Intelligence Scale, fourth edition. *Journal of Psychoeducational Assessment*, *10*, 257–264. https://doi.org/10.1177/073428299201000305

Principe, G. F., & E. Schindewolf (2012). Natural conversations as a source of false memories in children: Implications for the testimony of young witnesses. *Developmental Review*, *3*, 205-223. doi: 10.1016/j.dr.2012.06.003

Roberts, K. P., & Blades, M. (1998). The effects of interacting in repeated events on children's eyewitness memory and source monitoring. *Applied Cognitive Psychology: The Official Journal of the Society for Applied Research in Memory and Cognition*, *12*, 489-503. https://doi.org/10.1002(SICI)1099-0720(199810)12:5<489::AID-ACP535>3.0.CO;2-%23

Rogers, T. B., Kuiper, N. A., & Kirker, W. S. (1977). Self-reference and the encoding of personal information. *Journal of Personality and Social Psychology*, *35*, 677-688. https://doi.org/10.1037/0022-3514.35.9.677

Rutter, M. (2005). Genetic influences and autism. In F. R. Volkmar, R. Paul, A. Klin, & C. Cohen (Eds), *Handbook of Autism and Pervasive Developmental Disorders* (Vol. 1, pp. 425-452). Hoboken, NJ: Wiley.

Salazar, F., Baird, G., Chandler, S., Tseng, E., O'Sullivan, T., Howlin, P., ... & Simonoff, E. (2015). Co-occurring psychiatric disorders in preschool and elementary school-aged children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *45*, 2283–2361.

https://doi.org/10.1007/s10803-015-2361-5

Salmon, K., & Pipe, M.E. (1997). Props and children's event reports: The impact of a 1-year delay. *Journal of Experimental Child Psychology, 65*, 261–292. https://doi.org/10.1006/jecp.1996.2362.

State v. Michaels, Superior Court, Essex County, New Jersey (1988).

Tager-Flusberg, H., Paul, R., & Lord, C. (2005). Language and communication in autism. *Handbook of Autism and Pervasive Developmental Disorders*, *1*, 335-364.

Tanweer, T., Rathbone, C. J., & Souchay, C. (2010). Autobiographical memory, autonoetic consciousness, and identity in Asperger syndrome. *Neuropsychologia, 48*, 900-908. https://doi.org/10.1016/j.neuropsychologia.2009.11.007

Volker, M. A., Guarnaccia, V., & Scardapane, J. R. (1999). Short forms of the Stanford–Binet Intelligence Scale: Fourth Edition for screening potentially gifted pre-schoolers. *Journal of Psychoeducational Assessment*, *17*, 226–235. https://doi.org/10.1177/073428299901700303

Volkmar, F. R. (2011). Understanding the social brain in autism. *Developmental Psychobiology, 53*, 428-434. https://doi.org/10.1002/dev.20556

Weigelt, S., Koldewyn, K., & Kanwisher, N. (2012). Face identity recognition in autism spectrum disorders: a review of behavioral studies. *Neuroscience & Biobehavioral Reviews*, *36*, 1060-1084. https://doi.org/10.1016/j.neubiorev.2011.12.008

Wilcock, R., Crane, L., Hobson, Z., Nash, G., Kirke-Smith, M., & Henry, L. A. (2019). Eyewitness identification in child witnesses on the autism spectrum. *Research in Autism Spectrum Disorders*, *66*, 101407.

https://doi.org/10.1016/j.rasd.2019.05.007

Williams, D. L., Goldstein, G., & Minshew, N. J. (2006). The profile of memory function in children with autism. *Neuropsychology*, *20*, 21–29. https://doi.org/10.1037/0894-4105.20.1.21

Williams, D. L., Minshew, N. J., & Goldstein, G. (2015). Further understanding of complex information processing in verbal adolescents and adults with autism spectrum disorders. *Autism*, *19*, 859-867. https://doi.org/10.1177/1362361315586171

Zaragoza, M. S., Payment, K. E., Ackil, J. K., Drivdahl, S. B., & Beck, M. (2001). Interviewing witnesses: Forced confabulation and confirmatory feedback increase false memories. *Psychological Science*, *12*, 473-477. https://doi.org/10.1111/1467-9280.00388

Appendix A

Results Controlling for Partial IQ

Research Question 1

Do ASD and control children differ in their 10-month recall reports?

Correct Utterances. We examined whether children differed in the number of correct utterances produced during free recall during the two-week delay interview versus the 10-month delay interview. A 2 (Group) 2 (Age Category) x 2 (Delay) mixed ANOVA on the number of correct utterances controlling for partial IQ yielded significant main effects of group, $F(1, 58) = 7.99$, $p = .01$, $\eta_p^2 = 12$, and age category, $F(1, 58) = 8.25$, $p = .01$, $\eta_p^2 = .12$. Control children recalled a greater number of correct utterances ($M = 5.39$, $SD = 2.50$) than children with ASD ($M = 3.34$, $SD = 2.64$). Older children ($M = 5.32$, $SD = 2.64$) recalled more correct utterances during free recall than younger children ($M = 3.42$, $SD = 2.50$). However, no significant main effects of or delay, $F(1, 58) = .23$, $p = .63$, $\eta_p^2 = .004$, or partial IQ, $F(1, 58) = 3.50$ $p = .07$, $\eta_p^2 = .06$, emerged on the number of correct utterances produced during free recall. Further, a significant Group by Delay interaction emerged, $F(1, 58) = 4.52$, $p = .04$, $\eta_p^2 = .07$ (see Figure 10). Control children gave significantly more correct utterances compared to children with ASD, but only at the two-week delay interview ($M = 7.78$, $SD = 3.76$ and $M = 3.59$, $SD = 3.96$ for control children and children with ASD, respectively). However, at the 10-month delay interview, no group differences emerged ($M = 3.01$, $SD = 2.31$ and $M = 2.10$, $SD = 2.44$ for control children and children with ASD, respectively). No other interactions emerged.

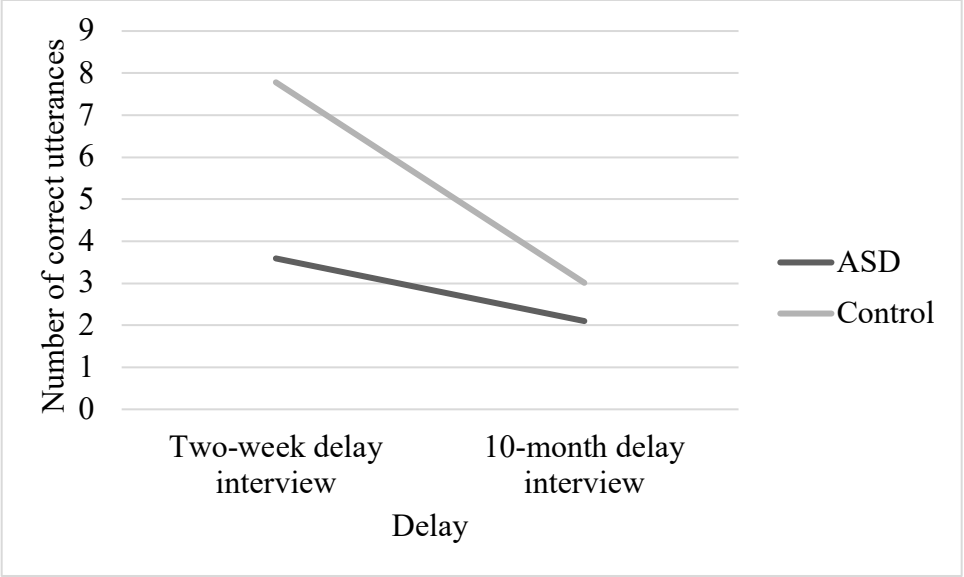


Figure 10. Correct utterances produced during free recall by group and delay controlling for partial IQ.

Incorrect Utterances. A mixed factor 2 (Group) 2 (Age Category) x 2 (Delay) repeated measures ANOVA was carried out on the number of incorrect utterances with partial IQ entered as a covariate. Our results demonstrated no significant main effects of group, $F(1, 58) = .70$, $p = .41$, $\eta_p^2 = .01$, delay, $F(1, 58) = .01$, $p = .92$, $\eta_p^2 < .001$, or partial IQ, $F(1, 58) = .10$, $p = .75$, $\eta_p^2 = .002$. However, a significant main effect of age category emerged, $F(1, 58) = 4.07$, $p = .05$, $\eta_p^2 = .07$. Older children ($M = 2.28$, $SD = 1.73$) gave more incorrect utterances during free recall compared to younger children ($M = 1.41$, $SD = 1.64$). No significant interactions emerged.

Research Question 1 Summary. When controlling for partial IQ, older children recalled more correct utterances than younger children. In addition, control children produced more correct utterances than children with ASD, but only at the two-week delay interview. At the 10-month delay interview, no group differences emerged. For incorrect utterances produced in free recall no group differences emerged when controlling for

partial IQ. However, older children gave a greater number of incorrect details than younger children when controlling for partial IQ.

Research Question 2

Are ASD and control children's recognition accounts differentially affected by a 10-month delay?

True Recognition Items. The number of accurate assents for true items was entered into a mixed factor 2 (Group) x 2 (Age Category) x 2 (Delay) x 2 (Reminder Status) repeated measures ANOVA controlling for partial IQ. The results showed significant main effects of group, $F(1, 58) = 6.75$, $p = .01$, $\eta_p^2 = .10$, and age category, $F(1, 58) = 6.60$, $p = .01$, $\eta_p^2 = .10$. Control children gave a greater number of correct responses to true items than children with ASD. Moreover, older children ($M = .81$, $SD = .20$) provided more accurate assents for true items compared to younger children ($M = .68$, $SD = .19$). The results revealed no significant main effects of delay, $F(1, 58) = .46$, $p = .49$, $\eta_p^2 = .01$, reminder status, $F(1, 58) = .20$, $p = .66$, $\eta_p^2 = .003$, or partial IQ, $F(1, 58) = .06$, $p = .81$, $\eta_p^2 = .001$, on the number of accurate assents children gave to the true recognition items. Finally, no significant interactions were found.

False Recognition Items. The number of inaccurate assents for false items was entered into a mixed factor 2 (Group) x 2 (Age Category) x 2 (Delay) x 2 (Reminder Status) repeated measures ANOVA controlling for partial IQ. The results showed no significant main effects of group, $F(1, 58) = .41$, $p = .52$, $\eta_p^2 = .01$, delay, $F(1, 58) = .11$, $p = .74$, $\eta_p^2 = .002$, or reminder status, $F(1, 58) = .06$, $p = .81$, $\eta_p^2 < .001$. However, a significant main effect of age category emerged, $F(1, 58) = 6.74$, $p = .031$, $\eta_p^2 = .10$, such that older children ($M = .49$, $SD = .18$) provided more inaccurate assents for false items

than younger children (M = .38, SD = .17). Moreover, a marginally significant Group by Reminder Status interaction emerged $F(1, 58) = 3.44$, $p = .07$, $\eta_p^2 = .06$ (see Figure 11). Control (M = .55, SD = .22) and ASD children (M = .52, SD = .23) did not significantly differ in their inaccurate assents for false reminder items. However, children with ASD (M = .38, SD = .22) produced more inaccurate assents to the false non-reminded items compared to control children (M = .28, SD = .21). No other significant interactions emerged.

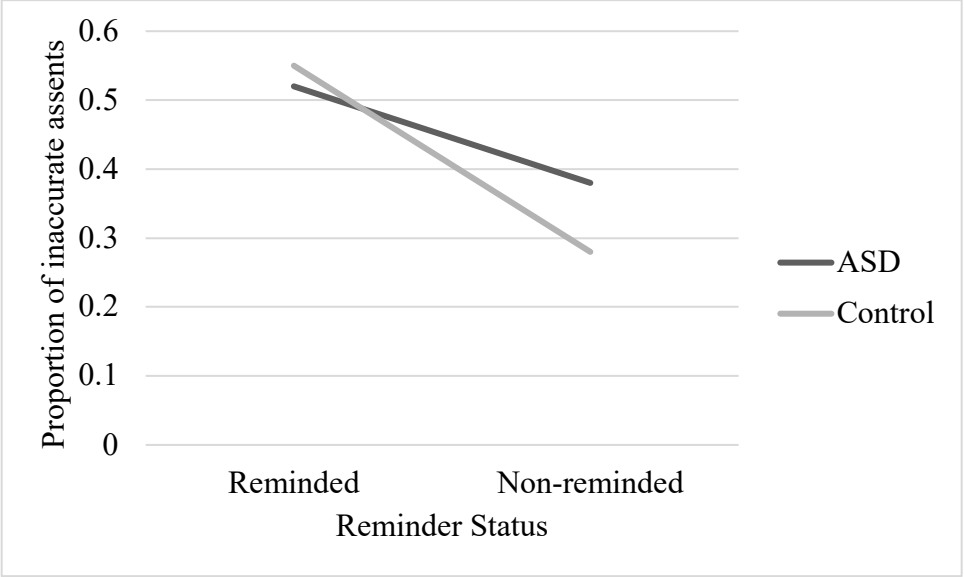


Figure 11. Inaccurate assents to the false recognition items by group and reminder status controlling for partial IQ.

Research Question 2 Summary. In sum, when controlling for partial IQ control children gave more correct responses to the true recognition items than children with ASD. Additionally, older children provided a greater number of correct responses to true items than younger children. For false recognition items, when controlling for partial IQ, older children provided more inaccurate assents for false items than younger children. Moreover, group differences did not emerge in children's inaccurate assents for the false

reminder items. However, when controlling for partial IQ, children with ASD gave more inaccurate assents to the false control items compared to control children.

Research Question 3

Do group differences exist for children's ability to recognize people and identify what that person did and said following a 10-month delay?

Was this the Target Person? A 2 (Group) x 2 (Age Category) ANOVA controlling for partial IQ was carried out on the number of correct identifications of target persons. There were no significant main effects of group, $F(1, 58) = .21$, $p = .64$, $\eta_p^2 = .004$, age category, $F(1, 58) = 2.74$, $p = .10$, $\eta_p^2 = .04$, or partial IQ, $F(1, 58) = .21$, $p = .64$, $\eta_p^2 = .004$. Control ($M = 1.64$, $SD = .91$) and ASD children ($M = 1.76$, $SD = .96$) did not significantly differ in their correct identifications of the three target persons. No significant age category differences were found between younger ($M = 1.51$, $SD = .91$) and older children ($M = 1.90$, $SD = .96$). Further, no significant Group by Age interaction emerged when controlling for partial IQ.

We then conducted three separate 2 (Group) x 2 (Age Category) ANOVAs controlling for partial IQ on the number of correct rejections of foil persons for each target person. For the Magician, no significant main effects of group, $F(1, 58) = 2.20$, $p = .14$, $\eta_p^2 = .04$, age category, $F(1, 58) = 1.67$, $p = .20$, $\eta_p^2 = .03$, or partial IQ emerged, $F(1, 58) = .24$, $p = .62$, $\eta_p^2 = .004$. Control ($M = 1.68$, $SD = .74$) and ASD children ($M = 1.36$, $SD = .78$) did not significantly differ in the number of correct rejections of the Magician foil persons. No significant differences were found between younger ($M = 1.39$, $SD = .73$) and older children ($M = 1.64$, $SD = .77$). For the Yellow Lady, a significant main effect of group emerged, $F(1, 58) = 5.07$, $p = .03$, $\eta_p^2 = .08$. Control children ($M =$

1.56, *SD* = .65) correctly rejected the Yellow Lady foil persons at a greater rate than children with ASD (*M* = 1.12, *SD* = .64). No significant main effects of age category, $F(1, 58) = .39$, $p = .53$, $\eta_p^2 = .01$, or partial IQ, $F(1, 58) = .01$, $p = .94$, $\eta_p^2 < .001$ emerged. Younger (*M* = 1.40, *SD* = .68) and older children (*M* = 1.29, *SD* = .71) did not significantly differ in their number of correct rejections of the Yellow Lady foil persons. Finally, for the Exit Interviewer, the results revealed a significant main effect of group, $F(1, 58) = 4.35$, $p = .04$, $\eta_p^2 = .07$. Control children (*M* = 1.90, *SD* = .54) performed better at correctly rejecting the Exit Interviewer foil persons compared to children with ASD (*M* = 1.54, *SD* = .54). The results revealed no significant effects of age category, $F(1, 58) = .07$, $p = .79$, $\eta_p^2 = .001$, or partial IQ, $F(1, 58) = .04$, $p = .84$, $\eta_p^2 = .001$. No significant differences emerged between younger (*M* = 1.74, *SD* = .56) and older (*M* = 1.70, *SD* = .69) children's correct rejection of the Exit Interviewer foil persons.

Next, we conducted logistic regression analyses for each person with lineup accuracy entered into the model as the dependent variable. At Step 1, partial IQ was entered into the model. At Step 2, age in months was entered. Finally, at Step 3, group was entered into the model.

For the Magician, at Step 1, the overall model did not significantly predict lineup accuracy (omnibus $\chi^2 = .63$, df = 1, $p = .43$). Partial IQ ($p = .43$) was not a significant predictor (see Table 9). The model accounted for 1.0% of the variance in lineup accuracy. At Step 2, the overall model did not significantly predict children's lineup accuracy (omnibus $\chi^2 = .04$, df = 1, $p = .85$), and age in months ($p = .85$) was not a significant predictor. The model accounted for 1.1% of the variance, with the over accuracy being 83.9%. Finally, at Step 3, the overall model was not significant (omnibus $\chi^2 = .75$, df = 1,

p = .39). Group (p = .40) was not a significant predictor of children's lineup accuracy. The model accounted for 2.3% of the variance in lineup accuracy. The overall accuracy of the model was 83.9%.

Table 9

Logistic regression predictors for the Magician lineup accuracy controlling for partial IQ (N = 62)

Step	R^2	*B*	Wald	df	*p*	Exp *B*	95% confidence interval	
							Lower	Upper
Constant		1.65	22.80	1	<.001	5.20		
Step 1								
Constant	.01	-.41	.02	1	.88	.66		
IQ		.02	.62	1	.43	1.02	.97	1.07
Step 2								
Constant	.01	-.86	.06	1	.81	.42		
IQ		.02	.65	1	.42	1.02	.97	1.07
Age		.01	.04	1	.85	1.00	.97	1.04
Step 3								
Constant	.02	-1.40	.16	1	.69	.24		
IQ		.03	1.19	1	.27	1.03	.97	1.10
Age		.002	.01	1	.93	1.00	.97	1.04
Group		-.73	.71	1	.40	.48	.09	2.64

For the Yellow Lady, at Step 1 the overall model did not significantly predict children's lineup accuracy (omnibus χ^2 = 1.25, df = 1, p = .26), and partial IQ (p = .27) was not a significant predictor (see Table 10). The overall model accounted for 2.0% of the variance with the overall accuracy of the model being 65.1%. At Step 2, the overall model did significantly predict lineup accuracy (omnibus χ^2 = 4.01, df = 1, p = .04). Although partial IQ (p = .14) was not a significant predictor, age in months (p = .06) was a marginally significant predictor of children's lineup accuracy. The model accounted for 8.0% of the model's variance. At Step 3, the overall model did not significantly predict

children's lineup accuracy for the Yellow Lady (omnibus $\chi^2 = 1.82$, df = 1, $p = .18$). There were no significant effects of partial IQ ($p = .44$) or group ($p = .18$). However, there was a significant effect of age in months ($p = .04$). The odds ratio demonstrates that as age increased children were more likely to be correct in identifying the Yellow Lady. The model accounted for 10.6% of the variance and the overall accuracy of the model was 63.5%.

Table 10

Logistic regression predictors for the Yellow Lady lineup accuracy controlling for partial IQ (N = 63)

Step	***R²***	***B***	**Wald**	**df**	***p***	**Exp *B***	**95% confidence interval**	
							Lower	**Upper**
Constant		.16	.40	1	.53	1.17		
Step 1								
Constant	.02	-1.99	1.02	1	.31	.14		
IQ		.02	1.21	1	.27	1.02	.98	1.06
Step 2								
Constant	.08	-5.65	3.96	1	.05	.004		
IQ		.03	2.21	1	.14	1.03	.99	1.07
Age		.03	3.66	1	.06	1.03	.99	1.06
Step 3								
Constant	.11	-5.05	3.11	1	.08	.01		
IQ		.02	.60	1	.44	1.02	.97	1.06
Age		.03	4.15	1	.04	1.03	1.00	1.06
Group		.84	1.78	1	.18	2.31	.67	7.92

For the Exit Interviewer, at Step 1 the overall model did not significantly predict children's lineup accuracy (omnibus $\chi^2 = 3.15$, df = 1, $p = .08$), and partial IQ ($p = .09$) was not a significant predictor (see Table 11). The model accounted for 4.9% of the variance and the overall accuracy of the model was 71.45%. At Step 2, the overall model dd not significantly predict lineup accuracy (omnibus $\chi^2 = .17$, df = 1, $p = .68$). Partial IQ

(p = .11) and age in months (p = .68) were not significant predictors. The model accounted for 5.1% of the variance. Finally, at Step 3, the overall model did not significantly predict children's lineup accuracy (omnibus χ^2 = 1.43, df = 1, p = .23), and partial IQ (p = .36), age in months (p = .76), and group (p = .23) were not significant predictors of lineup accuracy. The model accounted for 7.3% of the variance and the overall accuracy of the model was 74.6%.

Table 11

Logistic regression for the Exit Interviewer lineup accuracy controlling for partial IQ (N = 63)

Step	R^2	*B*	Wald	df	*p*	Exp *B*	95% confidence interval	
							Lower	Upper
Constant		-.84	9.36	1	.002	.43		
Step 1								
Constant	.05	2.93	1.78	1	.18	18.69		
IQ		-.04	2.92	1	.09	.96	.92	1.00
Step 2								
Constant	.05	2.15	.56	1	.46	8.57		
IQ		-.03	2.57	1	.11	.96	.92	1.01
Age		.01	.17	1	.68	1.01	.98	1.04
Step 3								
Constant	.07	1.47	.24	1	.62	4.33		
IQ		-.02	.85	1	.36	.98	.93	1.03
Age		.01	.09	1	.76	1.00	.97	1.04
Group		-.77	1.43	1	.23	.46	.13	1.64

Research Question 3 Summary. When controlling for partial IQ, no group differences emerged for children's ability to correctly identify the three target persons. Moreover, for the Magician foil persons no group differences emerged for children's ability to correctly reject the foil persons. However, for the Yellow Lady and the Exit

Interviewer we found that control children correctly rejected the foil persons at a greater rate than children with ASD.

Research Question 4

Do group differences exist for children's identification of previously seen objects following a 10-month delay?

Did the Person use [Object]? A 2 (Group) x 2 (Age Category) ANOVA controlling for partial IQ was carried out on the number of correct identifications of previously *seen* objects from the magic show. No significant main effects of group, $F(1, 58) = .01$, $p = .92$, $\eta_p^2 < .001$, or age category emerged, $F(1, 58) = 3.62$, $p = .06$, $\eta_p^2 = .06$. Children overall performed above chance (i.e., 50%) in correctly identifying previously seen objects from the magic show.

However, group differences emerged when examining children's correct rejections to previously unseen objects. A 2 (Group) x 2 (Age Category) ANOVA controlling for partial IQ was carried out on the number of correct rejections of previously un*seen* objects from the magic show. A main effect of group, $F(1, 58) = 6.62$, $p = .01$, $\eta_p^2 = .10$ revealed control children correctly rejected previously unseen objects more than children with ASD. No other main effects or interactions emerged.

Research Question 4 Summary. Regardless of group or age category, children performed above chance in correctly recognizing previously seen objects from the magic show. However, control children performed better at correctly rejecting the previously unseen objects compared to children with ASD.