The impact of Autism Spectrum Disorder on event memory and accuracy

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Preface

- This dissertation is the result of my own work and includes nothing which is the outcome of work done in collaboration except as declared in the Preface and specified in the text.
- It is not substantially the same as any that I have submitted, or, is being concurrently submitted for a degree or diploma or other qualification at the University of Cambridge or any other University or similar institution except as declared in the Preface and specified in the text.
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Statement of length

In accordance with the Department of Psychology guidelines, this thesis does not exceed 80,000 words. The total number of words is: 49,764. The word limit excludes footnotes and bibliography. The statistical tables in this thesis are, in accordance with the Department of Psychology guidelines, counted as 150 words per table.

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Abstract

Children who have developmental disorders that involve memorial deficits and impairments in social interaction and communication, such as Autism Spectrum Disorders (ASD), can present challenges to professionals seeking their testimony when they are victims or witnesses of a crime. Most forensic interviews involve long delays after an event, underscoring the importance of conducting experimental studies which consider the effect of delay on children's memory. In this research, fifty-nine children (age 6-15 years) with ASD (N=27) and without disabilities (N=32) were questioned about their participation in a set of activities after a two-week delay and again after a two-month delay, using the Revised National Institute of Child Health and Human Development (NICHD) Investigative Interview Protocol. A detailed coding scheme was designed to code and analyse the interviewers' utterances and the children's responses in 118 interviews. Transcripts were coded for completeness (with respect to the gist of the event), amount of narrative details, and accuracy. Results indicated that autistic children did not differ from typically developing (TD) peers on any dimensions of memory after both delays. Specifically, both groups of children provided equivalently complete accounts on both occasions. However, children in both groups provided significantly fewer narrative details about the event in the second interview, and the accuracy rates were lower. Recall prompts elicited more detailed and more accurate responses from children in both groups than recognition prompts. Although autistic children recalled fewer correct narrative details than TD peers when questioned using open-ended recall prompts, they were as accurate as TD peers in response to recognition prompts. The informativeness and accuracy of children's reports remained unchanged over time. Finally, social support was beneficial when children were interviewed for the first time but not after a longer delay. The findings indicate that autistic children can provide meaningful and reliable testimony about an event they personally experienced, but several aspects of their memory reports deteriorate over time.

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Chapter I

1.1. Introduction

There is no universally accepted way to describe individuals with autism. Many professionals in the scientific and medical community endorse the use of person-first language (e.g. “person with autism”), while members of the autism community (autistic people, caregivers, and broader support networks) favour identity-first terms, such as “autistic” or “autistic person” (Gernsbacher, 2017; Kenny et al., 2016). To respect the multiplicity of views on this issue in this thesis we use both identity-first language (i.e., autistic children) as well as person-first language (i.e., children with autism).

This PhD thesis is written in ‘paper’ format and is organized into four main chapters. In the current chapter, I discuss the key developmental features known or likely to affect autistic persons in legal contexts. I begin the chapter with a brief overview of the cognitive, emotional, and social characteristics likely to make autistic individuals susceptible to victimization or affect what they remember, forget, and report about their experiences. Legal participation is largely affected by memory, so I also review some of the relevant literature on memory in ASD and discuss how the memory profile associated with the disorder might affect their abilities to recall witnessed or experienced events.

Then, I briefly discuss the research to date that has examined how the distinct memory features of autistic persons actually affect their performance as eyewitnesses. I turn attention to external factors related to the recollection process known or likely to influence the involvement and performance of children and adults with and without autism in legal contexts, such as the delay between the target event and subsequent reporting and the interviewer’s demeanour. This chapter provides a broad overview of the several research topics central to the current study, but this initial review is not intended to be exhaustive. These topics (e.g., eyewitness testimony in ASD, delay, question types and social-emotional support) are covered in more depth in the individual papers presented in chapter III. Chapter I ends with a description and rationale for the current research program.

In the second major chapter, I describe, in detail, the sample and the methodologies used to collect and analyse the data and I provide preliminary results that are relevant to the understanding of the individual papers. In chapter III, I present two core research papers, which are currently under review by scientific journals. In each individual research paper, I review the relevant literature regarding the topics addressed in that study, describe the method and specific coding procedures, present the results of analyses concerned with the

topics examined and discuss the findings, reflecting on their contribution to knowledge and practical implications.

In the final chapter of the thesis, I summarize and discuss the key findings regarding recall by intellectually and linguistically able autistic children and conclude by reflecting on the implications of these findings.

1.2. Autism and the Criminal Justice System

Autism Spectrum Disorder (ASD) is one of the most common childhood neurodevelopmental disorders and is currently estimated to affect more than 40 million children worldwide (World Health Organisation, 2013). Prevalence estimates vary substantially across studies and countries, with some reporting higher prevalence rates (Kim et al., 2011), but epidemiological research illustrates an undeniable increase around the world over the past fifty decades (Christensen et al., 2016; Elsabbagh et al., 2012; Kim et al., 2014; Magnússon & Saemundsen, 2001; Wing & Potter, 2009).

This complex neurodevelopmental disorder typically manifests early in development and is characterized by developmental deficits that cause clinically significant impairment in everyday functioning. Since Kanner first described it in 1943 as “early infantile autism”, the body of knowledge about autism has grown considerably. The most recent diagnostic criteria for ASD encompass not only early infantile autism but also childhood autism, Kanner's autism, high-functioning autism, atypical autism, pervasive developmental disorder not otherwise specified, childhood disintegrative disorder, and Asperger's disorder (American Psychiatric Association [APA], 2013).

The core features of ASD are persistent deficits in reciprocal social communication and social interaction, as well as restricted, repetitive patterns of behaviour, interests, and activities (APA, 2013), with symptoms falling on a continuum of severity. These impairments can range from responding inappropriately in conversations, poor sharing of emotions, misinterpreting and misusing of nonverbal communication and interactions, and experiencing difficulties in making and maintaining friends of similar age, to expressing stereotyped or repetitive behaviour (e.g., repetitive speech, movements, or use of objects), insisting on sameness, being excessively dependent on routines, manifesting a need for pattern and structure, being extremely sensitive to changes in their environment, and exhibiting atypical sensory behaviours (e.g., high tolerance to pain; having a low tolerance to for specific sounds) (APA, 2013; Bogdashina, 2016; Carcani-Rathwell, Rabe-Hasketh, & Santosh, 2006; Hill, Berthoz, & Frith, 2004; Lerner, Haque, Northrup, Lawer, & Bursztajn,

2012; Mendelson, Gates, & Lerner, 2016; Richler, Bishop, Kleinke, & Lord, 2007; Tager-Flusberg & Kasari, 2013).

There is increasing consensus among researchers and professionals that, due to the limitations in social interaction, social communication, and adaptive behaviour, individuals with developmental disabilities, such as autism spectrum disorder, are more likely to witness or experience abuse than those without disabilities (e.g., Cross, Kaye, & Ratnofsky, 1992; Hershkowitz, Lamb, & Horowitz, 2007; Petersilia, 2001; Sullivan & Knutson, 1998, 2000). There are several notable cognitive and social-emotional features that can make autistic individuals susceptible to victimization. For example, autistic individuals demonstrate significant deficits in attributing others' mental states (Abell, Happé, & Frith, 2000; Baron-Cohen, 1995; Happé, 1994; Kaland et al., 2005). This diminished cognitive ability to perceive and understand other's peoples thoughts, feelings, intentions, and motivations (Baron-Cohen & Glidden, 2001; Baron-Cohen, Leslie, & Frith, 1985; Bowler, 1992; Brunsdon & Happé, 2014; Senju, Southgate, White, & Frith, 2009; Tager-Flusberg & Sullivan, 1994) can lead to physical, sexual or emotional exploitation by others.

They also experience high rates of psychiatric comorbidities (Simonoff et al., 2008), such as social anxiety (Kerns et al., 2015) and oppositional defiant disorder (Gadow, DeVincent, & Drabick, 2008), which may lead to physical or emotional abuse. Furthermore, approximately 30% of the ASD population exhibits intellectual disability and/or significantly limited or no verbal skills (Kasari, Brady, Lord, & Tager-Flusberg, 2013; Tager-Flusberg & Kasari, 2013). These important cognitive features may limit their capacity to properly perceive situations as threatening or abusive and restrict their ability to report victimization.

Estimates of the extent to which individuals on the autism spectrum are involved in the criminal justice system are scarce, but some studies have shown increases over the years in the number of crimes against them (e.g., Autism Society, 2006; Mandell, Walrath, Manteuffel, Sgro, & Pinto-Martin, 2005). A study on child abuse and autism revealed that 18.5% of autistic children in America had been physically and 16.6% sexually abused (Mandell et al., 2005). A survey developed by the American Autism Society about individuals on the autism spectrum and their caregivers revealed that 35% of the individuals with ASD had been victims of crimes (Gammicchia & Johnson, 2016).

More recently, Maras et al. (2017) explored the perspectives of legal professionals (judges, barristers, and solicitors) who practise in criminal courts in England and Wales about their experiences of working with individuals on the autism spectrum. Legal professionals estimated that they had encountered autistic persons as victims in around 13% of their cases

involving autistic individuals and 7% as a witness. The most frequent encounters of these professionals with the autistic individuals were in relation to crimes of violence (26% of victims; 17% of witnesses) and sex offences (19% of victims).

Autistic children and/or adults are often seen as easy targets, not only because they may have difficulty defending themselves or reporting the abuse (Sobsey & Doe, 1991), but also because their accounts are frequently dismissed by the professionals conducting criminal investigations (Groce, 1999) or adjudicating allegations (Mishra, 2001). When autistic individuals come into contact with the legal system as either victims or witness (Browning & Caulfield, 2011; Lindblad & Lainpelto, 2011; Mayes & Koegel, 2003), the primary goal is typically to obtain as much information as possible about the alleged crime via thorough investigative interviews. In many criminal investigations, physical evidence of the abuse does not exist (Pipe, Lamb, Orbach, & Cederborg, 2007) and the outcomes of the case rely on children's eyewitness testimony (Milne & Bull, 1999; Wells, Memon, & Penrod, 2006). It is thus important that professionals are able to obtain accurate and reliable reports of witnessed or experienced events from autistic individuals. Furthermore, sometimes members of a jury rely on non-verbal behaviours when making judgements about the credibility of a witness (Cooper, Quas, & Cleveland, 2014; Field et al., 2010; Nicholson, Yarbrough, & Penrod, 2014; Ozuru & Hirst, 2006; Wessel, Magnussen, & Melinder, 2013), and the atypical behaviours displayed by some autistic individuals could result in their credibility being questioned, particularly if the jury is not aware of the person's diagnosis (Crane et al., 2018; McCrory, Henry, & Happé, 2007).

It is equally imperative that all of those involved in the criminal justice system are aware of the idiosyncrasies that might compromise the performance of each autistic child or adult individually during forensic interviews or court testimony. Social interaction impairments, for example, are arguably one of the most prominent diagnostic criterion of ASD (APA, 2013) and, regardless of cognitive or language ability, can represent an important source of distress for many individuals on the autism spectrum (Carter, Davis, Klin, & Volkmar, 2005). Encounters with the legal system are emotionally demanding, whether in a forensic interview setting or court testimony and are associated with poorer memory performance in typically developing children (e.g., Nathanson & Saywitz, 2003; Quas & Lench, 2007). These represent uncertain and cognitively demanding contexts, where children are requested to describe their experiences honestly, accurately and in extensive detail to unfamiliar adults (Lamb, Malloy, Hershkowitz, & La Rooy, 2015). Autistic children are highly sensitive and intolerant of uncertainty and manifest great levels of anxiety when exposed to situations or

contexts that deviate from their usual routine (e.g., Boulter, Freeston, South, & Rodgers, 2014; Richler et al., 2007; Rodgers, Glod, Connolly, & McConachie, 2012). It is therefore understandable that unfamiliar and emotionally demanding settings, such as forensic or assessment interviews, can trigger high levels of anxiety in autistic persons.

Anxiety in ASD can trigger sensory reactions, such as repetitive and restricted behaviours, which have been considered strong and core characteristics of individuals with ASD since its original conceptualisation (Asperger, 1991; Kanner, 1943). Research exploring possible associations between anxiety and repetitive and restricted behaviours in individuals with developmental disorders (Leekam, Prior, & Uljarevic, 2011; Rodgers et al., 2012; Sofronoff, Attwood, & Hinton, 2005; Sukhodolsky et al., 2008; Tantam, 2003) suggest that such behaviours (e.g., repetitive limb and trunk movements) can emerge to either regulate high levels of arousal (hyperarousal) and/or as a consequence of anxiety (Hutt & Hutt, 1965; Militerni, Bravaccio, Falco, Fico, & Palermo, 2002; Ooi et al., 2008; Spiker, Lin, Van Dyke, & Wood, 2011). Empirical evidence also suggests that greater levels of anxiety appear to be linked to a more intense frequency of repetitive and restricted behaviours in individuals with ASD (Joosten, Bundy, & Einfeld, 2009; Rodgers et al., 2012; Sukhodolsky et al., 2008; Tantam, 2003). Many legal professionals lack the appropriate training to effectively manage the – sometimes very intense – distress and atypical behaviour displayed by individuals with ASD in forensic contexts (Crane, Maras, Hawken, Mulcahy, & Memon, 2016; Maras et al., 2017). This inability to manage the sensory needs of autistic children and adults in legal settings can powerfully compromise the retrieval of essential information about traumatic experiences.

Autistic individuals also commonly face structural language and communication challenges (see, e.g., Boucher, 2012 for a full review), which can affect their ability to organize, recall and provide coherent narratives about witnessed or experienced events. To fully participate in the legal process, it is important that children and adults are able to understand the language used and the questions posed by the interviewers, and to express themselves and communicate their own thoughts effectively (Lamb et al., 2015). Current knowledge concerning structural language abilities across the autism spectrum suggests that preschool autistic children, even those with high language abilities, can have (at least some) difficulties in comprehending and processing the meaning of words, sentences and/ or concepts, and have at least some articulatory, syntactic errors/distortions and idiosyncratic word usage (e.g., Cleland, Gibbon, Peppé, O'Hare, & Rutherford, 2010; Koning & Magill-Evans, 2001; Minshew, Goldstein, & Siegel, 1997; Rapin & Dunn, 2003; Rapin, Dunn,

Allen, Stevens, & Fein, 2009; Saalasti et al., 2008; Shriberg, Paul, McSweeny, Klin, & Cohen, 2001; Williams, Goldstein, & Minshew, 2006). By school age, autistic children still show irregular comprehension, semantics, and certain facets of morphology, although articulation and syntax are least affected at this developmental stage (e.g., Condouris, Meyer, & Tager-Flusberg, 2003; Kjelgaard & Tager-Flusberg, 2001; Perkins, Dobbinson, Boucher, Bol, & Bloom, 2006; J. A. Roberts, Rice, & Tager-Flusberg, 2004). The challenges faced by autistic individuals in expressing and communicating their thoughts and emotions (Dritschel, Wisely, Goddard, Robinson, & Howlin, 2010) can also have a great impact on how they are understood by legal professionals who may not clearly comprehend their statements or behaviours and may consequently doubt the credibility of their testimony.

In addition to the social interaction, language, and communication difficulties and atypical behaviour, autistic people have a particular pattern of strengths and weaknesses in the domain of memory that can also affect their participation in legal contexts. In fact, the combination of these developmental characteristics - cognitive, emotional, and social - can constitute important challenges for professionals seeking the testimony of children and adults with autism. It is critical to understand their ability to describe past personal experiences and identify the best ways to interview them, developing interviewing strategies that complement their unique memory and behavioural characteristics.

1.3. Memory in Autism Spectrum Disorder

As this brief overview will demonstrate, many years of research into memory in ASD has established a distinct memory profile characterized by areas of impairment and areas of preserved skill (Boucher & Bowler, 2008). The autism spectrum comprises a diverse range of conditions and particular subgroups of people (i.e., ASD with or without accompanying intellectual disability; and ASD with or without language and communication deficits) may present distinct memory patterns (Bowler, Gaigg, & Lind, 2011). However, individuals across the spectrum also show some similar memory abilities and deficits.

Boucher, Mayes, and Bigham (2012) illustrated that cognitively (and verbally) able and disabled individuals share a similar profile of strengths in most forms of non-declarative memory (e.g., intact semantic priming), and some facets of declarative memory (e.g., immediate free recall of familiar, but unrelated, supra-span sets of items; cued recall; and paired associate learning – a type of cued recall), and working memory (e.g., immediate memory span for digits and unrelated words). They also show a shared profile of weaknesses, for example, in memory for emotion-related and person-related information, and free recall of

observed or personally experienced events. The memory profile of intellectually and linguistically capable and disabled individuals with ASD differ, however, with regard to some aspects of declarative memory, such as recognition and free recall of non-social stimuli, which are typically intact for one subgroup of people and impaired for the other (Boucher et al., 2012).

Of special interest for the current study is declarative memory. Declarative memory encompasses the semantic memory system, which is associated with *noetic conscious awareness*, and the episodic memory system, which is associated with *autonoetic conscious awareness* (Tulving, 2001). Episodic memory, also characterised by the conscious experience of "remembering", is a memory system that allows humans to mentally travel back in time and re-experience, through autonoetic awareness, the spatiotemporal context of a past event (Tulving, 1985, 2002). Episodic memory may be diminished in individuals with ASD (e.g., Boucher, 1981; Boucher & Warrington, 1976), whereas semantic memory (i.e., factual memory and general knowledge about the world) appears to be relatively unimpaired (e.g., Crane & Goddard, 2008). Both the episodic and semantic declarative memory systems acquire and encode information and can be assessed using tests of free recall, cued recall, and recognition (Bowler et al., 2011).

Autobiographical memory is a specialized form of memory, which comprises both personal episodic memories and personal semantic memories (i.e., self-related knowledge about the facts of their lives, such as name or address). There is a growing body of research demonstrating personal episodic memory deficits in adults with ASD in the absence of personal semantic memory deficits (e.g., Crane & Goddard, 2008; Tanweer, Rathbone, & Souchay, 2010). That is, individuals with ASD can demonstrate good self-related knowledge but fail to display the conscious awareness required to mentally time-travel to past events to re-experience them (e.g., Gardiner, 2002; Klein, Chan, & Loftus, 1999; Tulving, 1985). This may lead to difficulties recalling personally experienced past events.

Evidence gathered over the last four decades has consistently shown preserved declarative memory on tests of recognition (e.g., Boucher & Warrington, 1976; Bowler, Gardiner, & Grice, 2000; Bowler, Gardiner, Grice, & Saavalainen, 2000; Williams, Goldstein, & Minshew, 2006) and cued recall (e.g., Ambery, Russell, Perry, Morris, & Murphy, 2006; Bowler, Matthews, & Gardiner, 1997; Gardiner, Bowler, & Grice, 2003; Minshew & Goldstein, 2001; Williams et al., 2006), but impaired (although not always) on tests of free recall (Bennetto, Pennington, & Rogers, 1996; Bowler, Gaigg, & Gardiner, 2008;

Bowler et al., 1997; Gaigg & Bowler, 2008; Minshew & Goldstein, 2001; Salmond et al., 2005; Williams et al., 2006).

Our understanding of episodic memory in ASD has evolved over the past several decades. Knowledge about the atypicalities of episodic remembering in ASD stems from experiments using a variety of stimuli. Tulving (2002) proposed that the concepts of self, autonoetic awareness, and subjective sense of time together form the essence of episodic memory; many research findings point to impairment in the development of each of these concepts in individuals with ASD (Lind & Bowler, 2008). Research investigating self-image in ASD has shown undiminished performance on mirror or delayed self-recognition tasks (Ferrari & Matthews, 1983; Lind & Bowler, 2009a). However, in other studies, individuals with ASD showed impaired self-awareness and less differentiation of the self as well as impaired introspective awareness of their own thoughts, intentions, beliefs, and feelings (Shalom et al., 2006; Hill et al., 2004; Hurlburt, Happé, & Frith, 1994; Millward, Powell, Messer, & Jordan, 2000; Mitchell & O'Keefe, 2008; Williams & Happé, 2009a, 2009b).

Another strand of evidence consistent with the prediction of episodic memory deficits in ASD comes from Boucher, Pons, Lind, and Williams's (2007) findings of impaired temporal cognition in ASD. Lind and Bowler (2008) argued that difficulties with meta-representation and diminished interpersonal and conceptual self-awareness in ASD affect the development of autonoetic consciousness, which may adversely affect episodic memory. Several studies have also reported reduced memory of self-performed events (e.g., Millward et al., 2000; Toichi, 2008). For example, Boucher (1981) and Boucher and Lewis (1989) tested children's memory for a set of activities in which they had recently participated. They found that children with autism were significantly less able than typically developing children to recall those activities and argued that they were unable to use contextual cues (e.g., the room in which the activities and the testing took place) to aid recall performance.

Findings of impaired episodic memory and relatively intact semantic memory have also been drawn, for example, from experimental studies using the 'Remember/Know' procedure (Tulving, 1985). Bowler et al. (2000) tested the memory of adults with ASD for a supra-span list of frequent and infrequent English words using a remember versus know paradigm (originally developed by Tulving, 1985). They found that individuals with ASD showed impaired remember responses compared to a verbal IQ-matched control group, but equivalent know responses. Bowler et al. (2000) argued that these findings indicated that episodic memory was moderately impaired in individuals with ASD even when overall recognition performance was not. In a subsequent study, Bowler et al. (2007) have also shown that adults

with ASD demonstrated less episodic remembering and placed more reliance on semantic memory. The experiences of remembering reported by individuals with ASD were, however, qualitatively similar to those of typical individuals.

Research demonstrates that the recollection of sentences and word lists composed of semantically related words also poses particular challenges for autistic individuals (Bowler et al., 2008a, 1997; Bowler, Gardiner, & Grice, 2000; Bowler et al., 2000; Minshew & Goldstein, 2001; Salmond et al., 2005; Williams et al., 2006). Over a series of experiments, Boucher and Warrington (1976) found that autistic children showed impaired delayed recall for named pictures, written words and spoken words in comparison with typically developing peers. Similarly, Bowler et al. (1997) found that adults with ASD showed diminished recall compared to typical counterparts, and failed to use category information to aid their free recall of semantically related words. In contrast, most studies examining free recall of unrelated words have shown it to be unimpaired (e.g., Ambery et al., 2006; Bowler et al., 2008a, 1997; Williams et al., 2006). Individuals on the autism spectrum also fail to learn as rapidly as typical comparisons when the task involves multiple trials (Bowler et al., 2008; Bowler, Limoges, & Mottron, 2009). Studies on source memory (e.g., Bowler, Gardiner, & Berthollier, 2004; Lind & Bowler, 2009b) and memory for incidentally-encoded context (Bowler et al., 2008) similarly show diminished recall but undiminished recognition. All of these findings suggest compromised episodic remembering associated with ASD.

Early studies of memory that used a variety of stimuli have demonstrated that, in contrast with episodic remembering, cued recall and recognition memory are usually preserved in individuals with ASD (e.g., Bennetto et al., 1996; Boucher & Warrington, 1976; Bowler et al., 2004, 1997; Minshew, Muenz, Goldstein, & Payton, 1992). These findings prompted Bowler and colleagues (2004, 1997) to formulate the *Task Support Hypothesis,* which postulates that individuals with autism perform better in cued recall and recognition tasks because support for retrieval is provided at test. Researchers have consistently reported that category label cues facilitate recall in ASD (e.g., Boucher & Warrington, 1976; Bowler et al., 2009, 1997). However, cues that aid the retrieval of specific item–item associations tend to be less effective (e.g., Ambery et al., 2006; Gardiner et al., 2003; Minshew & Goldstein, 2001; Williams, Goldstein, & Minshew, 2005; but see also Bigham, Boucher, Mayes, & Anns, 2010; Brown, Aczel, Jiménez, Kaufman, & Grant, 2010).

The findings regarding compromised episodic and spontaneous remembering in ASD are particularly troublesome for the legal context, where victims or witnesses may be asked to provide detailed accounts of their experiences. The difficulty in retrieving specific events and

failure to use self-involvement to facilitate their memory (e.g., Crane, Goddard, & Pring, 2009; Klein et al., 1999; Toichi & Kamio, 2002) leads to deficits in recalling events that were personally experienced (e.g., Bruck, London, Landa, & Goodman, 2007; Millward et al., 2000). These findings suggest that when individuals with ASD play an active role in their experiences, as either victims or witnesses, they may find it difficult to recall what happened. This profile of memorial deficits, associated with the impairments in social interaction and communication faced by some autistic individuals (and highlighted above, APA, 2013), render autistic people particularly vulnerable when asked to recall personally experienced events, and can constitute important challenges for professionals seeking their testimony when they are victims or witnesses of crime. Such data have prompted research designed to elucidate how these children might be interviewed most effectively for forensic purposes.

1.4. Research on eyewitness testimony in Autism Spectrum Disorder

A growing amount of research exploring eyewitness testimony in ASD has made considerable strides in advancing our knowledge about the recall abilities and limitations of individuals on the spectrum. A large portion of existing eyewitness memory literature suggests that autistic children tend to remember less about witnessed or experienced events than typically developing children, particularly when asked to spontaneously produce complete accounts of what happened (e.g., Bruck et al., 2007; Mattison, Dando, & Ormerod, 2015, 2016; McCrory et al., 2007).

For example, Millward et al. (2000) found that, when interviewed about a personally experienced event (a 25-minute walk with the researcher), children with ASD (aged 12-16 years) recalled fewer incidents that happened to them than did typically developing peers in both free and cued recall. However, the authors found that children with ASD and non-ASD peers freely recalled the same number of incidents that happened to them and to other people when they experienced the event accompanied by another child. Mattison and colleagues (2015, 2016) recently explored the utility of the mental and sketch reinstatement mnemonic strategies for supporting children with ASD to recall event information, and then compared their performance to that of non-ASD peers in a control group. Overall, children with ASD recalled less correct information about a stimulus video than typically developing children in both free and probed recall contexts.

Bruck, London, Landa, and Goodman (2007) examined autobiographical memory and suggestibility in children with ASD using two different paradigms, a questionnaire and a staged event – a magic show. They found that children with ASD showed deficits reporting

both much earlier (e.g., events that occurred 2 years earlier and events that occurred when the children were 2 years old) and recent (e.g., events that occurred less than 6 months prior to the staged event) personally experienced events. Compared to typically developing peers, autistic children reported fewer details in both paradigms (i.e., autobiographical questionnaire and staged magic show event) in free and cued/probed recall, and some failed to recall the distant real-life events altogether. Similarly, Henry et al. (2017a) found that children with ASD freely recalled less information about a staged event involving a minor crime than non-ASD peers in an immediate brief interview. All of these findings seem to suggest that, compared to typical children or adults, the memory reports of individuals with ASD are indeed significantly less complete or less detailed.

However, other studies have demonstrated that children and adults with ASD can provide valuable and accurate information when questioned in a supportive manner (e.g., using cued recall prompts or techniques and procedures designed to improve recall in investigative interviews) and thus be reliable witnesses (e.g., Bruck et al., 2007; Henry et al., 2017a, 2017b; McCrory et al., 2007). Maras and colleagues (2013), explored how adults with ASD recalled a personally experienced live eyewitness event (providing first aid to a manikin). This study revealed that, when personally involved in a real event, adults with ASD recalled as many correct details as their typical peers. Maras and Bowler (2010) also compared recall performance by adults with ASD and matched typical adults and found that they provided eyewitness reports as detailed as those provided by typical individuals when interviewed using a Structured Interview.

One recent study by Henry and colleagues (2017b) explored the efficacy of three interventions designed to improve recall in investigative interviews: the “Verbal Labels” procedure, the “Sketch Reinstatement of Context” drawing technique, and assistance from a “Registered Intermediary” (RI). The authors found that 6- to 11-year-old autistic children were indistinguishable from their peers with respect to the amount of freely recalled information. There was one exception: TD children performed better in Registered Intermediary interviews than in Best-Practice interviews, whereas ASD children performed similarly in the two contexts. Further, Mattison et al. (2015) reported that, although children with ASD were significantly less accurate than typically developing children overall, children with ASD were just as accurate as TD children when the sketch reinstatement technique accompanied free recall. This positive effect was also evident in the probed recall phase of best-practice interviews (Mattison et al., 2016). All of these findings highlight the importance of developing effective interviewing methodologies to increase the amount of information

provided by child witnesses with ASD under demanding interview circumstances, without compromising the accuracy of that information.

1.5. Features of legal contexts that affect eyewitness testimony

As previously emphasised, encounters with the legal system are distressing, whether in a forensic interview setting or in court, and are associated with poorer memory performance than in other contexts (e.g., Nathanson & Saywitz, 2003; Quas & Lench, 2007). Legal contexts are cognitively demanding, with young witnesses requested to conduct challenging memory searches and recount information in a detailed and accurate manner (Lamb et al., 2015). In addition to feeling anxious and uncomfortable in such contexts, other motivational factors such as loyalty to caretakers (e.g., Malloy & Mugno, 2016; Malloy, Mugno, Rivard, Lyon, & Quas, 2016), the extensive delays involved in legal proceedings (Hershkowitz et al., 2007) or even the interviewer's demeanor during forensic interviews or court testimony (Teoh & Lamb, 2013) may influence children's willingness and ability to disclose information about their experiences.

Children, like adults, forget information over time and empirical evidence shows that younger children forget information more rapidly than older children (Brainerd, Reyna, Howe, & Kingma, 1990). Forgetting occurs most rapidly soon after information is encoded, and the rate of forgetting slowly decays with the passage of time (Ebbinghaus, 1964/1885; Jones & Pipe, 2002; Wixted, 2004). Furthermore, forgetting is sometimes accompanied by gradual increases in the number of errors reported (e.g., Bruck, Ceci, & Hembrooke, 2002; La Rooy, Pipe, & Murray, 2007).

As the delay between the to-be-remembered event and the interview increases, children's memory reports usually become less detailed and less accurate regardless of their ages or cognitive abilities (Brown, Lewis, & Lamb, 2015; Brown, Lewis, Lamb, & Stephens, 2012; Flin, Boon, Knox, & Bull, 1992; Hudson & Fivush, 1991; La Rooy et al., 2007; Pipe, Gee, Wilson, & Egerton, 1999). For example, Brown et al., (2015) have examined recall of an experienced event in children with varying degrees of intellectual disabilities (7–12 years) and typically developing children matched for chronological (7–12 years) or mental (4–9 years) age. They found that the deleterious effects of delay similarly affected both groups of children. Specifically, children who were interviewed soon after the staged event recalled that event in greater detail and more accurately six months later than children interviewed for the first time at 6 months.

Waterman and Blades (2013) have similarly demonstrated that delay adversely affected 5- to 8-year-olds without disabilities responses to answerable and unanswerable questions about a staged event. Children witnessed a 20-min staged event and were subsequently interviewed about that event either the following day or after five months, using *wh*- and yes/no questions. They reported that children provided more correct and appropriate responses to both *wh*- and yes/no answerable and unanswerable questions in the 1-day interview than in the five-month interview. More specifically, after a five-month delay, only one-third of children's responses to the unanswerable questions were appropriate "don't know" responses and children were only able to answer one-fifth of the answerable questions.

Similarly, Brown and colleagues (2012, 2015) interviewed children (7 to 12 years old) with and without intellectual disability one week and six months after they experienced a staged event. The interviews were conducted using the prompts and structure outlined in the NICHD Investigative Interview Protocol, with open invitations, cued invitations and specific *wh*- and option-posing questions. After a substantial delay, children's responses were less informative and less accurate in response to all types of questions. Research has also demonstrated that after long delays, children are more susceptible to suggestion (see Lamb, Hershkowitz, Orbach, & Esplin, 2008 for a review) and to incorporate misinformation introduced in daily conversations with family and friends, or in previous interviews, about a past experience into future recall (e.g., Bruck et al., 2002; Erdmann, Volbert, & Böhm, 2004; and see La Rooy, Lamb, & Pipe, 2009 for a review).

Although forgetting is inevitable, empirical evidence has also demonstrated that children are able to remember past experiences after a very long time. Many researchers have established that even very young typically developing children can recall neutral past experiences, such as routine paediatric examinations, after lengthy delays (Baker-Ward, Gordon, Ornstein, Larus, & Clubb, 1993; Clubb, Nida, Merritt, & Ornstein, 1993; Ornstein, Shapiro, Clubb, Follmer, & Baker-Ward, 1997), and medical treatments or procedures (Ornstein, Gordon, & Larus, 1992; Peterson, 1999). Typically developing children can also remarkably recall traumatic injuries (Peterson, 2011, 2015) and natural disasters (Burgwyn-Bailes, Baker-Ward, Gordon, & Ornstein, 2001; Fivush, Sales, Goldberg, Bahrick, & Parker, 2004; Peterson, 2011) after delays of several months or years. Some researchers have argued that the salience of the event and/or having the opportunity to discuss it soon after it occurred can help children to consolidate memories of that event over time (Fivush, 2002; Lamb et al., 2015).

As previous research illustrated, delays generally diminish the strength of the memory trace and thus, children, including those with disabilities, should be interviewed as soon as possible after alleged abuse (Lamb et al., 2015). However, most forensic interviews or court testimony involve delays of weeks, months, or even years (Hershkowitz et al., 2007). Reported delays between target events and courtroom testimony average 11 months in the United Kingdom (Plotnikoff & Woolfson, 1995), 15 months in New Zealand (Hanna, Davies, Henderson, Crothers, & Rotherham, 2010), and more than 24 months in Portugal and the United States (Peixoto et al., 2017; Quas & Sumaroka, 2011). Sometimes, delays are related to the pace of legal proceedings (e.g., Pipe, Orbach, Lamb, Abbott, & Stewart, 2008), but on many occasions they occur because children themselves delay disclosing the abuse. Reasons for hesitation to disclose abuse can be related to a variety of factors, including existing relationships with the suspects, such as parents or relatives (Pipe et al., 2007), feelings of embarrassment, shame or guilt, and fear of vengeance or of negative consequences of disclosure (e.g., Goodman, Goldfarb, Chong, & Goodman-Shaver, 2014; Hershkowitz, Horowitz, & Lamb, 2005).

The existing literature exploring episodic memory in ASD has not yet considered this forensically relevant issue and no research to date has examined how autistic children recall a personally experienced event after a lengthy delay, and how their memory reports change over time. Such research is necessary to inform the development of effective strategies to maximize memory retrieval after lengthy delays by autistic children.

It is well established that the way children are questioned about their experiences has a great impact on the amount and accuracy of the information retrieved. Children's responses are influenced by the way in which questions are formulated and by the inclusion of interviewer input (i.e., introduction of information that had not been previously disclosed by the child) (see Lamb, La Rooy, Malloy, & Katz, 2011; Lamb et al., 2015). Decades of research involving typically developing children indicate that the information retrieved using free-recall prompts (i.e., open-ended prompts that provide no specific cues) is most accurate and reliable, regardless of the children's ages or cognitive ability (e.g., Lamb et al., 2008; Milne, Clare, & Bull, 1999).

Responses elicited using cued recall questions (i.e., more focused open-ended questions that ask for specific details) and recognition prompts (i.e., closed yes/no or multiple choice questions) are usually less detailed and organized, as they elicit single-word or -phrase responses, and result in more errors and inconsistencies (e.g., Brown et al., 2013; Feltis, Powell, Snow, & Hughes-Scholes, 2010; Korkman, Santtila, & Sandnabba, 2006; Lamb &

Fauchier, 2001). It is well known that older children provide more details in response to open-ended prompts and are less likely to provide erroneous details in response to close-ended questions than younger children (Lamb, Sternberg, & Esplin, 2000; Melnyk, Crossman, & Scullin, 2007; Waterman, Blades, & Spencer, 2004).

Open-ended input free prompts are the most desirable means of eliciting information because they access recall memory and what is recalled depends on children's own memory search - as opposed to interviewers' requests which specify or cue certain aspects of memory (Lamb et al., 2015). Very young children (3- to 4-year-olds) find it difficult to respond to broad open-ended prompts (e.g., "Tell me everything you remember") because these don't provide the necessary structure for them to understand the questions (Korkman et al., 2006; Melinder & Gilstrap, 2009), but with age (from 5 years old), children's responses to free recall prompts become increasingly more detailed (Lamb, Brown, Hershkowitz, Orbach, & Esplin, 2018; Lamb et al., 2008, for reviews). Open-ended follow-up prompts that encourage children to elaborate on their responses (e.g., "And then what happened?") also access recall memory and elicit more and more accurate forensically important information than other forms of questions (Brown et al., 2013; Lamb & Fauchier, 2001; Phillips, Oxburgh, Gavin, & Myklebust, 2012).

However, as reviewed above, current knowledge concerning memory (dis)abilities across the autism spectrum has demonstrated that such broad open-ended recall prompts are likely problematic for autistic children who have difficultly engaging in the type of mental time travel demanded by open-ended prompts resulting from impaired autonoetic consciousness (Gardiner, 2001). As mentioned above, autistic individuals typically recall less information than those without disabilities in response to free-recall prompts. For example, Bruck, London, Landa, and Goodman (2007), cited above, showed that, compared to typically developing peers, children in the ASD group recalled less information about the magic show in response to free recall prompts. Similarly, McCrory et al. (2007) found that autistic children recalled less information than typically developing children in response to free recall prompts when questioned about a 5-min classroom event the day after it was witnessed and were significantly less likely to freely recall the most salient or gist elements of that event. Importantly, autistic children were no less accurate with regards to the proportion of incorrect details that they freely recalled.

More recently, Mattison and colleagues (2015, 2016), also cited above, reported that autistic children interviewed soon after seeing a short film freely recalled significantly less correct information than typically developing children. Henry et al. (2017a) similarly found

that 6- to 11-year-old children with ASD recalled fewer correct details about a staged event involving a mock crime than did children in the typically developing comparison group in an immediate brief interview mostly comprising free recall prompts. All the above evidence denotes that it is crucial to improve the amount of information elicited from autistic children in response to such recall memory prompts.

More focused open-ended (cued recall) prompts refocus the child's attention on details of the target event that the child had previously mentioned and, using *wh*-questions, they provide categories for requesting additional information (e.g., "Where was the car?"). Categorical recall prompts (i.e., directive) are sometimes more useful than broad open-ended prompts when interviewing very young children (3- to 4-year-olds), because these provide more concrete retrieval cues that emphasize the category of information on which to focus (Hershkowitz, Lamb, Orbach, Katz, & Horowitz, 2012). However, research demonstrates that these usually elicit single-word responses and, consequently, fewer details, than broader free recall prompts (e.g., Cederborg, Orbach, Sternberg, & Lamb, 2000; Lamb et al., 1996). Although on some occasions children are more likely to respond to directive prompts (Korkman et al., 2006; Korkman, Santtila, Westeråker, & Sandnabba, 2008), they also tend to provide more erroneous and inconsistent information in response these prompts than to free recall prompts (Brown et al., 2013; Lamb, Orbach, Hershkowitz, Horowitz, & Abbott, 2007).

Closed-ended prompts (e.g., option-posing, leading, and suggestive questions) access recognition memory and simply request children to confirm, reject, or choose between interviewer-generated options (Lamb et al., 2011). Multiple-choice and yes/no questions refocus children on specific information and many researchers have demonstrated that these are more likely to elicit erroneous responses from children than other question formats (e.g., free recall or cued recall prompts) (Brown et al., 2013; Ceci & Bruck, 1995; Dent & Stephenson, 1979; Lamb & Fauchier, 2001). Children often feel pressured to respond to these sorts of close-ended questions, even if they are unsure of their answers, and end-up contradicting themselves (Andrews, Lamb, & Lyon, 2015; Jack, Leov, & Zajac, 2014; Orbach & Lamb, 2001; Zajac & Hayne, 2003) or responding "yes" or "no" without reflection (i.e., response bias) (Ahern, Lyon, & Quas, 2011; Fivush, Peterson, & Schwarzmueller, 2002; Peterson, Dowdin, Tobin, Dowden, & Tobin, 1999). Informed by these findings, the current best-practice interviewing guidelines consistently encourage interviewers to rely on open-ended recall prompts before proceeding to more focused questions (American Professional Society on the Abuse of Children, 2012; Home Office, 2011; Lamb et al., 2018).

As previously highlighted, years of research has demonstrated that cued recall and recognition memory, which can be accessed by directive or closed-ended prompts, are usually preserved in individuals with ASD (e.g., Bennetto et al., 1996; Boucher & Warrington, 1976; Bowler et al., 2004, 1997; Minshew et al., 1992). Bowler and Gaigg's (2008) *Task Support Hypothesis* suggests that providing support at recall improves memory performance in autistic individuals and previous studies have investigated the efficacy of cued recall and recognition prompts and other specific cognitive supportive techniques that can be used with children with ASD to complement a best-practice interview (e.g., Henry et al., 2017; Mattison et al., 2015, 2016). For example, McCrory et al. (2007) reported that children with ASD provided the same amount of information as non-ASD controls in response to guided questions (i.e., general and specific *wh-* prompts) and were no more suggestible in response to leading questions. Likewise, Maras and colleagues (2013), found that autistic adults provided the same amount of accurate information about a personally experienced event as their counterparts when questioned using guided *wh-* questions after a free recall phase.

Bruck et al. (2007) found that autistic children recalled less and less-accurate information than non-ASD controls about salient recent and past events in response to specific questions requiring one-word responses and yes/no questions. They also made more errors than typically developing peers when answering recognition questions about a witnessed staged event. In another study by Millward et al. (2000), children's memory about walks they had taken was tested using open *wh-* prompts (e.g., "What did you do this morning Alan?") and cued/leading questions (i.e., *wh-* questions that introduced information about the walk that had not been previously mentioned by the child). The authors found that, when autistic children experienced the walks alone, they recalled fewer self-performed tasks than did typically developing peers in response to both open *wh-* prompts and cued/leading questions. Overall, the studies reviewed above have illustrated the challenges of eliciting testimony from children with developmental disorders and have highlighted the urgent need to establish clear rules and specific guidelines to be followed by professionals seeking children's testimony.

As mentioned earlier in this chapter, children's willingness to disclose abuse or other experiences and their performance when formally interviewed in forensic contexts by unfamiliar adults is influenced by many factors. Those include the fear of negative consequences (Block, Oran, Oran, Baumrind, & Goodman, 2010; Quas, Wallin, Horwitz, Davis, & Lyon, 2009), feelings of helplessness or embarrassment (Brown et al., 2013;

Burgess, Rossvoll, Wallace, & Daniel, 2010; Gilligan, 2000; Roberts, Lamb, & Sternberg, 2004) and the interviewer's demeanor, in particular the provision (or lack) of socio-emotional support during investigative interviews (Hershkowitz, 2011; Teoh & Lamb, 2013). The later has been the focus of an increasing body of research, as it can influence children's ability to deliver their best evidence within legal proceedings (e.g., Carter, Bottoms, & Levine, 1996; Goodman, Bottoms, Schwartz-Kenney, & Rudy, 1991; Hershkowitz, Orbach, Lamb, Sternberg, & Horowitz, 2009; Price, Ahern, & Lamb, 2016; Saywitz, Larson, Hobbs, & Wells, 2015; Vallano & Compo, 2015).

Supportive and non-suggestive interviewing contexts have been proven helpful to decrease typically developing children's anxiety, discomfort and even suggestibility, enabling them to participate fully and provide detailed and accurate reports of past experiences in both field and experimental studies (Ahern, Hershkowitz, Lamb, Blasbalg, & Winstanley, 2014; Bottoms, Quas, & Davis, 2007; Carter et al., 1996; Davis & Bottoms, 2002; Goodman et al., 1991; Hershkowitz, Lamb, Katz, & Malloy, 2013; Hershkowitz, Orbach, Lamb, Sternberg, & Horowitz, 2006; Rush et al., 2014).

Experimental research on the effects of support have demonstrated that supportive interview environments sometimes improve the accuracy of the information reported by typically developing children (e.g., Greenstock & Pipe, 1997; Moston, 1992) and, importantly, there is no evidence that it is detrimental for children's accuracy. In field studies, interviewer support was found to increase both the likelihood of disclosure by abused children (e.g., Hershkowitz, Lamb, & Katz, 2014; Hershkowitz et al., 2006) and the amount of information they provide (e.g., Hershkowitz, 2009; Lewy, Cyr, & Dion, 2015; Ruddock, 2006).

For example, Goodman et al. (1991) found that typically developing children (3- to 7-year-olds) interviewed by supportive, rather than neutral, interviewers provided more accurate free recall accounts of (stressful) inoculations. The strongest effects of interviewer support were found after a four-week delay (rather than a two-week delay), at which time younger children were as accurate as older children when answering misleading questions. Similarly, Bottoms et al. (2007) found that social support had positive effects on children's memory (about a staged event – games and activities) even after one year. Social support increased the amount of correct and decreased the amount of incorrect information retrieved using free recall prompts and reduced the number of commission errors made in response to both specific and misleading questions.

Carter, Bottoms, and Levine (1996) found that 5- to 7-year-old children interviewed about a standardized, non-stressful, play event in a warm, supportive manner (as opposed to an intimidating environment) were more resistant to misleading questions and more accurate in their responses to non-abuse questions. More recently, Rush and colleagues (2014) had 7- to 8- and 12- to 14-year-olds complete a high- or low-stress laboratory protocol while observed by two unfamiliar adults and then (two weeks later) identify the observers. Children who experienced the high-stress event and were questioned by a supportive interviewer were most accurate. Similarly, Teoh and Lamb (2013) explored the association between interviewer support and children's verbosity and informativeness in 75 investigative interviews with alleged sexual abuse victims (5- to 15-year-olds) in Malaysia. Older children were more informative when questioned under supportive conditions.

Even those studies that have failed to find an effect of support on children's responses in term of the amount of information provided (e.g., Carter et al., 1996; Lewy et al., 2015) have at least demonstrated that it is not detrimental for children's accuracy. For example, Davis and Bottoms (2002) failed to find an effect of social support on free recall, specific questions, or questions about whether abuse had occurred when interviewing 6- and 7-year-old children about a personally experienced play event (immediately afterwards). Children interviewed by a supportive person were, however, more resistant to misleading suggestions than were those interviewed by a non-supportive person. Imhoff and Baker-Ward (1999) found that interviewer support did not affect the accuracy of 3- and 4-year-old children's responses to direct, yes-no, or misleading questions about a personally experienced classroom demonstration after a two-week delay. And Imhoff (2000) similarly found that interviewer support did not affect the same children's responses to free recall and specific questions after a four-week delay.

In the case of autistic children, to our knowledge, no studies have examined the impact of interviewer-provided social support during investigative interviews on their memory performance. Empirical evidence suggests that they typically demonstrate higher levels of anxiety than TD children, particularly in unexpected situations, and may react negatively (emotionally, cognitively, and/or behaviourally) in uncertain contexts (e.g., Boulter et al., 2014). It is thus essential to explore ways to help autistic children feel more comfortable and less anxious in legal settings and to develop effective strategies to maximize their memory retrieval in demanding interview circumstances.

1.6. The current research program

The current research program aimed to provide a comprehensive assessment of memory for personally experienced events by autistic children. Previous studies exploring episodic memory in autistic individuals have used short delays between the target event and subsequent reporting. However, as underlined above, it is common that forensic interviews often occur a long period of time after an event has been witnessed or experienced (Hershkowitz et al., 2007). Therefore, this research was primarily designed to advance our understanding of how this particular group of vulnerable witnesses recall information regarding personally experienced events after a long delay, and how their reports change over time.

Specifically, we examined recall and reporting of a personally experienced event in autistic and typically developing children, after two-time delays. This was the first study exploring how well autistic children could recall a personally experienced event an extended period of time later and how different, yet complementary, aspects of their episodic memory changed over time.

To accomplish this, we first assessed children's overall memory of the event across time by measuring the completeness (i.e., the gist of the event), elaboration (i.e., amount of narrative details) and accuracy of their recall (paper 1, chapter III). We then investigated how different factors related to the recollection process affected children's responses, specifically the types of questions asked and the provision of social support by the interviewer (paper 2, chapter III). We investigated how autistic children responded to various types of interviewer prompts within a best-practice interview protocol and how effectively different formulations of questions elicited new and accurate event-relevant information from them on both occasions. We examined recall across two-time delays to determine whether children's recall and reporting in response to each type of question were affected by the delay. We also examined the effects of interviewer supportiveness on the amount and accuracy of autistic children's accounts of a personally experienced event, in the course of non-suggestive, child-oriented interviews.

Informed by previous research I formulated several hypotheses, regarding each topic addressed in this study and these are described in the individual papers presented in chapter III.

Chapter II

2.2. Method

This chapter begins with a detailed description of the sample and the methodologies used to collect and analyse the data. The current research program was conducted in three phases. In phase 1, children personally experienced a non-abusive interactive live event and in phases 2 and 3 they were interviewed about this event using a best practice structured interview protocol, the first time after a short two-week delay and again after a longer two-month delay. The chapter ends with some preliminary results that are relevant to the understanding of the study overall and the individual papers presented in chapter III.

I sought and obtained approval for the study from the NHS Research Ethics Committee (NRES Committee East of England - Cambridge South). Prior to recruitment of the research participants I developed Participant Information Sheets and Consent Forms, which were approved by the NHS Research Ethics Committee and the R&D Department of the Cambridgeshire and Peterborough NHS Foundation Trust. Following ethics approval, the autistic children were recruited from the Peterborough Integrated Children's Health Services in Peterborough and the Cambridgeshire Community Services NHS Trust. Typically developing children were recruited from local schools in Peterborough and Cambridge. All children or their legal representatives provided informed consent.

Data from both samples were collected between August 2014 and March 2017. It is a long, slow, and laborious process to obtain sufficient numbers of children with ASD as research participants because the recruitment process was entirely dependent on the flow of children that came through the Peterborough Integrated Children's Health Services and met the criteria for participation.

2.2.1. Sample

Fifty-nine children between 6 and 15 years old (mean = 9 years, 9 months) participated in the study (18 females and 41 males): 27 children with an ASD diagnosis who were able to verbally communicate and 32 typically developing children.

All ASD participants (23 males and 4 females) had received, independently of the research study and two weeks before the research interview, a formal autism diagnosis by an appropriately qualified clinical professional. This diagnosis was obtained according to the assessment measures of the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2; a cut-off point of 7 or 8), and the Autism Diagnostic Interview, Revised, which

confirmed that the participants met DSM-V criteria for ASD (American Psychiatric Association, 2013). After diagnosis, the children and their caregivers were informed about the study by their clinician at the Peterborough Integrated Children's Health Services and given the relevant Participant Information Sheets and Consent forms. Children with ASD whose intellectual and linguistic abilities were currently within the normal range (verbal quotients of 85 or above; full-scale IQ of 90 or above - measured by the clinician using the Wechsler Intelligence Scale for Children-Third Edition) and were interested in taking part in the study were then referred to me and contacted to set up the subsequent study sessions. Although 28 children with ASD were initially recruited, one was excluded because he refused to cooperate during the second study session.

Thirty-two comparison children (18 males and 14 females) were recruited through local mainstream schools in Peterborough and Cambridge, UK. Typically developing children were matched individually for chronological age to the ASD participants. Independent *t-tests* confirmed that the groups did not differ significantly with respect to chronological age, $t(57) = -1.70$, $p = .095$ (ASD: $M = 10.63$, $SD = 3.02$, range = 6-15; TDC: $M = 9.38$, $SD = 2.66$, range = 6-15). They had no known psychiatric, developmental or neurological disorders, as indicated by parents/caregivers and the absence of symptomology. They were included in the study if they had an overall total ADOS-2 score of less than the autism spectrum cut-off (i.e., 6 or less). Practical constraints prevented us from testing verbal or full-scale IQ for the TD sample and thus these data are not reported here. Although 34 children were initially recruited for the typically developing sample, two were excluded because they were unable to participate in the second study session during the appropriate time period.

2.2.2. Materials and procedure

Phase 1: Event-to-be-recalled

The event-to-be-recalled was a set of activities included in the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2), about which children were later questioned. The ADOS-2 is a standardized instrument that assesses social interaction, communication, and imagination during a semi-structured interaction with an examiner (Lord, Luyster, Gotham, & Guthrie, 2012). As previously highlighted, autistic children are highly sensitive and intolerant of uncertainty and can manifest great levels of anxiety when exposed to situations or contexts that deviate from their usual routine (e.g., Boulter et al., 2014; Richler et al., 2007; Rodgers et al., 2012). Therefore, we chose this specific rich and

interactive assessment moment which autistic children had as part of their routine clinical care as the event-to-be-remembered to minimize, as far as possible, their exposure to uncertain and cognitively demanding contexts, hence avoiding potential discomfort or distress that could occur as a result of participation in this research.

In this session, children engaged in a series of activities involving interactive stimulus materials. For autistic children, a qualified psychiatrist conducted the ADOS-2 as part of the child's diagnosis process, independently from the research study. This session occurred two weeks before children took part in the study. Typically developing children experienced the activities included in the ADOS-2 as part of the research study. A psychiatrist, with prior ADOS-2 training, conducted this session either at the Peterborough Integrated Children's Health Services or at the University of Cambridge.

The activities that children engaged in during the event session corresponded to Module 3 of the ADOS-2 and remained unchanged, with the exception of seven autistic children who experienced Module 4, as per the clinician's decision. The same tasks and materials comprised both modules 3 and 4. The modules differed only in relation to the topics about which the children were questioned (explained in more detail below). The examiners strictly followed the ADOS-2 manual and always provided the same instructions and displayed the same items, in the same way, and sequence, so the duration of the sessions (M = 44.63 minutes; range 40-53 minutes) depended only on the amount of time each child took to perform each task. Bivariate correlations revealed no significant relationships between the length of the event (ADOS-2 session) and the total number of unique narrative details recalled at the two-week interview by children in the ASD $r(27) = -.03$, $p = .901$, and TD $r(32) = .16$, $p = .381$ groups. The same results emerged for the two month interview with no significant relationships between the length of the event and the total number of unique narrative details recalled by children in the ASD $r(59) = -.06$, $p = .773$, and TD $r(32) = .25$, $p = .161$, groups. All event sessions were video recorded, and the recordings were later used to determine the accuracy of children's information.

The event-to-be-recalled included a construction task, a make-believe play, a joint interactive play, a demonstration task, the description of a picture, telling of a story from a book, telling of a story depicted in cartoons, conversations about something that happened to the child in the past, questions about a variety of topics, a break, and the creation of a story using objects provided. The description of each of these activities is provided below.

Children were first asked to perform a construction task in which they assembled blocks to construct a design shown on a printed form. After this task, children were given some

miniature play objects (e.g., male and female action figures, hairbrush, toy dinosaur, spoons, plates, toy car, a toy rocket, small ball, etc.) and were instructed to play with these materials. After a few moments, the examiner joined in, making it clear that the play had become collaborative. Children were then told it was time to move on to the next activity and allowed to help clean up the materials. Thereafter, children were asked to demonstrate tooth-brushing. The examiner drew with his/her finger a sink and faucet handles, a toothbrush, toothpaste, and a cup on the table in front of the participant and always gave the same instruction, *Now I want you to show me and tell me how to brush your teeth. Start right at the beginning. You've just come into the bathroom to brush your teeth. What do you do now?*. Children were then shown a picture and asked to tell the examiner what was happening in it.

The next task involved recounting a sequential story from a book of pictures. The examiner always provided the same instruction to the participant, *Let's look at this book. It tells a story in pictures. See, it starts out with (first picture in the book). Can you tell me the story as we go along? You go first. Then, I'll take a turn*. Children were then shown a set of cards presenting a brief story in cartoon form, one frame per card, without any dialogue or narrative text. The examiner placed the cards one by one on the table and offered a brief statement describing the relevant setting (*This is a story about a fisherman and a cat*). Children were then instructed to push their chair back from the table, stand up, and tell the story. Children performed another task in which they had to create a story using objects provided by the examiner. Six small objects with a definite purpose (e.g., cocktail umbrella, car) and six small objects with no clear purpose (e.g., a piece of string, wooden block) were provided. The examiner picked five things from a bag and used them to make up a story and then instructed the participant to pick five different things from the bag and make up a story.

During the session, children were also encouraged to describe an event (e.g., a non-routine episode that had actually occurred, as opposed to an account of a film or story, such as a birthday party, a family celebration, a holiday, etc.). Children also had to answer a set of questions regarding a variety of topics. All children were asked the exact same questions about emotions (e.g., *what do you like doing that makes you feel happy and cheerful? What about things that you're afraid of?*), social difficulties and annoyances (e.g., *Are there things that other people do that irritate or annoy you? Have you even been teased or bullied?*), friends and relationships (e.g., *Do you have some friends? How is a friend different from someone whom you just go to school with?*), and loneliness (e.g., *Do you ever feel lonely?*). The seven children with ASD who experienced module 4 of the event were asked the same questions, as well as questions about responsibility (e.g., *Who takes care of your money*) and

future plans and hopes. During this session, children also had a break during which they were given some objects and materials (e.g., shape puzzle, drawing paper, set of markers, pin art, spin pen, small radio, etc.) and were encouraged to play freely.

Parents were asked not to discuss the event with their child because I was interested in what the children themselves remembered. On each subsequent session, parents confirmed not having talked with their child about what had happened during the event.

Phases 2 and 3: Interviews

Children were interviewed about the personally experienced event twice, the first time after a short two-week delay and again after a longer two-month delay. One-way ANOVAs confirmed that the groups did not differ significantly with respect to the delay (in days) between the event and the first interview, $F(1, 57) = 1.19$, $p = .281$ (ASD: $M = 12.19$, $SD = 3.41$, 95% CI [10.84, 13.53]; TD: $M = 11.06$, $SD = 4.35$, 95% CI [9.50, 12.63]); and between the event and the second interview, $F(1, 57) = 3.95$, $p = .052$ (ASD: $M = 65.00$, $SD = 13.60$, 95% CI [59.62, 70.38]; TD: $M = 73.84$, $SD = 19.47$, 95% CI [66.82, 80.86]).

One of three interviewers conducted the interviews, using the best practice Revised NICHD Protocol (see Lamb et al., 2018, for a full review of the Protocol). The majority of the interviews were conducted by me ($n = 98$ out of 118 interviews). I am a licenced forensic psychologist with experience of interviewing vulnerable witnesses using the NICHD Protocol. The remainder of the interviews ($n = 20$) were conducted by a graduate ($n = 12$) and a post-graduate ($n = 8$) psychology research assistant, both with previous training in the use of the NICHD Protocol and/or experience interviewing vulnerable interviewees.

The two interviews were conducted by the same person, except in four cases where practical constraints prevented the same interviewer from conducting both interviews. One-way Analyses of Variance (ANOVA) showed no significant effect of Interviewer on all dependent variables tested in the current study: completeness of children's reports (i.e., gist recall) in the two-week interview $F(2, 56) = 1.83$, $p = .170$, or in the two-month interview, $F(2, 56) = .62$, $p = .540$; total number of narrative details reported by children in the two-week interview, $F(2, 56) = 1.63$, $p = .204$, or in the two-month interview, $F(2, 56) = .89$, $p = .417$; and accuracy of children's reports in the two-week interview $F(2, 56) = .29$, $p = .753$, or in the two-month interview, $F(2, 56) = 2.23$, $p = .117$.

Both interviews were conducted using the best practice Revised NICHD Protocol developed by Lamb and colleagues (see Lamb et al., 2018, for a full review of the Protocol). This was the first study to use the NICHD Protocol (standard or revised versions) to

interview autistic children about events they had personally experienced. The NICHD Protocol is a structured, non-suggestive, and child-directed interview protocol. It has been systematically evaluated in the field, is currently used by forensic interviewers in several countries worldwide and is recommended to forensic investigators in the United Kingdom (Home Office, 2011). The positive impact of using this Protocol to interview children in several countries has been examined recently (La Rooy et al., 2015) and throughout the years it has been proven effective with different populations, including children as young as 4 years-old (Hershkowitz et al., 2012; Lamb et al., 2003), and children with intellectual disabilities (e.g., Brown & Lamb, 2015; Brown, Lewis, & Lamb, 2015; Brown, Lewis, Lamb, & Stephens, 2012; Brown, Lewis, Stephens, & Lamb, 2017).

The recently developed Revised NICHD Protocol helps interviewers deal more effectively with reluctant children by advising them on how to build better rapport and provide children with more support throughout the interview (Ahern, Hershkowitz, Lamb, Blasbalg, & Winstanley, 2014; Blasbalg, Hershkowitz, & Karniel-Visel, in press; Blasbalg, Hershkowitz, Lamb, Karniel-Visel, & Ahern, in press; Hershkowitz et al., 2017; Hershkowitz, Lamb, & Katz, 2014; Lamb, Malloy, Hershkowitz, & La Rooy, 2015). A brief description of the interview protocol is provided below, and the full interview protocol is available in Appendix 1 and in Lamb et al. (2018).

All interviews, at both time points, comprised the same phases in the same order, as follows: (1) greet; (2) rapport (3) ground rules, truth-and-lie exercise; (4) substantive recall part of the interview (i.e., interviewers' statements or questions and children's responses that pertained to the investigated event); and (5) closure. For the entire interview, interviewers behaved supportively; children were assured that there were no wrong or right answers and that there were no time limits. While children were explaining what they could remember, the interviewer exhibited active listening and did not interrupt the child. Literal and concrete thinking is common in autistic individuals, so interviewers framed each question/statement (for both groups of children) as directly, briefly, and clearly as possible to avoid providing too much information at once. Children were provided long wait/processing time after each question/statement to give them time to reflect on the questions and answers.

This research focused on the information elicited during the *substantive portion of the interviews*, and so only this portion of the interview is described in detail below. I briefly describe the greet, truth and lie, rapport and closure phases, and, as mentioned above, the full interview protocol is available in Appendix 1 and in Lamb et al. (2018).

Interviewers began by introducing themselves and establishing rapport and proceeded to clarify the children's task (the need to describe experienced events truthfully and in detail) and explain the ground rules for the interview (i.e., that they could and should say *I don't remember, I don't know, I don't understand* or correct the interviewers when appropriate). In the rapport-building phase, children were prompted to provide information about personally meaningful topics using open-ended invitations (e.g., *Tell me about things you like to do*) and were encouraged to elaborate on their responses. They were then asked to describe in detail a recent event they had experienced (e.g., holiday, birthday party, first day at school, etc.) to practice retrieval of episodic memories and to further develop rapport. Here the interviewer introduced other types of questions that could be used when seeking information about the to-be-recalled event.

The substantive portion of the interview followed the structure outlined in the Revised NICHD Protocol and began with an *open-ended recall phase*. The interviewers started orienting the child to the event using some informative prompts (*I understand that you may have been at [place of the event]. Tell me everything that happened from the beginning to the end when you were there*). Once the event had been identified, interviewers used a series of open prompts (e.g., *Tell me everything that happened*), to encouraged children to provide as much information as they could remember about the event. Once the child had finished speaking, the interviewer asked if he or she could remember anything else about the event.

Children were then encouraged to provide further details about the information that they had just reported using a series of follow-up open-ended prompts. The children's words were used to frame cued invitations (e.g., *You mentioned [a person/object/activity mentioned by the child], tell me everything about that*.) and *wh*- questions, (e.g. *You mentioned a book. Where was the book?*) and these were paired with open prompts (e.g., *Tell me more about that*). More focused questions, such as yes/no and forced-choice option-posing prompts, were avoided, but used if needed to clarify unclear information and these were followed by open prompts (e.g., *Tell me more about that*).

The interviewers also used brief summary sentences to focus children on what had already been mentioned and provide them with opportunities to elaborate and/or correct any information that had been misunderstood (e.g., *Let's see if I understood everything that you told me.* (Pause). *You mentioned you did a puzzle*. (Pause). *And you played with some toys*. (Pause)…). Once the child had finished speaking and was waiting for the next instruction, they were once again asked: *Is there anything else you remember?* This prompt was

repeatedly asked until the child could not offer further information. After children stated they couldn't remember anything else about the event, the next recall phase began.

Our study included an additional questioning phase that is not part of the Revised NICHD Protocol, which I called the *cued recall phase*. The cued recall phase was implemented after children stated they couldn't remember anything else about the event, but there was still information that was missing (i.e., only some of the activities children experienced during the event had been recounted).

In this phase, the interviewer probed the child for the information that was missing, asking a series of focused questions. The focused questions introduced event-related information (i.e., activities, aspects) that had not been disclosed by the child in the previous recall phase but did not imply that a particular response was expected (as opposed to suggestive questions). All focused/contaminating questions in this study asked about events or details that had occurred (as opposed to misleading questions) and varied depending on whether they were closed, requiring a yes or no answer (e.g., *Did you see a book that time?*), or whether they were open, requiring the children to provide the response (e.g., *I heard there was a book that time.*). The number and content of these questions were dependent on the activities that the child had failed to remember during the *open-ended recall phase*. These were paired and followed-up with open prompts to encourage children to elaborate in their responses. For example, if in response to the focused question *Did you see a book that time?* a child responded *Oh yeah. A book with flying frog*s, the interviewer would then ask *Tell me more about the book with flying frogs*. Before ending the interview by discussing a neutral topic, the interviewer once again asked whether the child remembered anything else about the event and after that they were thanked for their efforts and participation.

A variety of supportive non-suggestive comments were used throughout the interviews. Interviewers expressed interest in the reported experiences (e.g., *I really want to know more about [reported experience]*), provided positive non-suggestive reinforcement (e.g., *You are really helping me understand what happened that day*), encouraged elaboration (e.g., *It is really important that you tell me everything you remember*) and offered reassurance (e.g., *Don't worry. It's ok that you don't remember*). Interviewers also showed appreciation for the children's efforts (e.g., *Thank you for telling me about that*) and used neutral facilitative comments (e.g., *ok, yes, uhuh, go on,* or repetition of the child's last words). More details about the coding and categorisation of these comments and questions are provided later in the thesis.

2.2.3. Coding procedure

All interviews were video recorded and transcribed verbatim. Coding focused on information that pertained to the target event (i.e., the substantive portion of the interview), therefore excluding any introductory exchanges at the beginning of the interview, attempts to establish rapport with the child, and attempts at the end of the interview to discuss neutral topics. Below I describe in detail the coding procedures used in the current research program and the full codebook is also available in Appendix 2[1].

Interviewer utterance types

The interviewer utterance types were coded using the NICHD Codebook - Quality of Interview: Content Analysis of Investigative Interviews (Unpublished), developed by Lamb and colleagues at the National Institutes of Health and used in previous studies (e.g., Lamb et al., 1996). Substantive utterances consisted of interviewers' statements or questions that were focused on anything that happened during the investigated event. These were coded as invitations, cued invitations, directive, or option-posing prompts and the total number of each type of utterances was recorded for each child. Focused/contaminating questions were also identified and totalled for each child.

Invitations referred to open-ended utterances using questions, statements, imperatives, or contextual cues to elicit narrative free-recall responses. These did not restrict the child's focus except in a general sense. Invitations could also follow-up on information just mentioned or request additional free-recall elaboration about details previously mentioned. Invitations included the following variations: *general invitation,* such as utterances asking about a whole activity or about one of multiple activities (e.g., *Tell me everything that happened from the beginning to the end; Tell me everything about the first/ last/ best remembered* [child's label] *activity*); *Follow-up Invitation*, such as utterances asking about the last content mentioned by the child (e.g. *Tell me more about that*), or about the content of events occurring after the last point in time mentioned by the child (e.g., *Then what happened?*); *Refocusing Invitation*, such as utterances that refocused on previous content and request elaboration (e.g., *Think back to the last time [or any other disclosed content], and tell me everything about that*); and

[1] The scoring procedure used in each topic analysed is also described (although in lesser detail) in each individual paper in chapter III.

Closing Invitation such as closing utterances aiming for the child to disclose more information about the event (e.g., *Is there anything else you remember about that day?*).

Cued invitations were utterances that refocused the child's attention on previously mentioned details and used them as contextual cues in open-ended invitations to elicit narrative free-recall responses. Refocusing could be related to content cues (e.g., activities, objects, people, actions) mentioned by the child (e.g., *You mentioned [content mentioned by the child], tell me about that; Tell me everything that happened from [an occurrence/action mentioned by the child] until [another occurrence/action mentioned by the child]*).

Directive questions referred to utterances that focused on event-related information mentioned by the child earlier in the interview and requested additional information (or clarification) using a category, mostly *wh*- questions (who, what, when, where, how). Directive questions were "cued-recall" prompts (e.g., *Where/when did it happen? What colour was the puzzle?*).

Option-posing prompts were closed-ended questions that focused the child's attention more narrowly on aspects of the event. They tapped recognition memory processes and could be formulated as yes/no or forced-choice questions (e.g., *Were the toys on the table when this happened? Were the toys inside the bag or on the table?*).

Focused/contaminating questions introduced event-related information (i.e., activities, aspects) that had not been previously disclosed by the child but did not imply that a particular response was expected (as suggestive questions would do). As previously mentioned, all focused/contaminating questions in this study asked about events or details that had occurred (as opposed to misleading questions) and varied depending on whether they were closed, requiring a yes or no answer (e.g., *Did you see a book that time?*), or whether they were open, requiring the children to provide the response (e.g., *I heard there was a book that time.*).

Interviewer supportiveness

In the current research I also analysed the interviewers' demeanour, more specifically, the provision of supportive non-suggestive comments (inserted within any type of utterance) intended to unconditionally encourage children to be informative. Expressions of support in the substantive portion of the interviews were coded using an adaptation of the scheme developed by Hershkowitz and colleagues (2006). The total number of each type of utterance (supportive versus non-supportive prompts) was recorded for each child. The interviewer prompts were either supportive or neutral; thus, non-supportive prompts refer to the absence of supportive comments within interviewer utterances.

Expressions of *social support* referred to comments intended to unconditionally encourage children to be informative. These included addressing the child in a personal way, by using his/her name (e.g., *John, tell me everything about the book*); providing supportive non-suggestive positive reinforcement of the child's behaviour during the interview that was unrelated to the content of their reports or to any other substantive issue (e.g., *You are remembering a lot*); providing comments showing appreciation for the child's efforts and collaboration during the interview, but not specific contents (e.g., *Thank you for telling me about that*); and providing comments offering general reassurance (e.g., *That's ok; Don't worry*).

Children's responses

Children's responses were coded exhaustively into one of the following categories: responsive, uncertain, or non-substantive. *Responsive* answers referred to verbal or action responses (e.g., points, shrugs, nods, shakes head, etc.) which related to the interviewer's previous utterance. A responsive child utterance could follow any interviewer utterance type. *Uncertain* responses referred to statements indicating lack of knowledge, and that did not provide the information requested in the eliciting prompts, such as, *don't know* (responses expressing lack of knowledge regarding the requested information included responses indicating children were not sure about the information required by the interviewer), *don't remember* (responses indicated children did not remember the information requested by the interviewer), *deny* (responses denying a particular activity or aspect of the event had happened) and *no answer* (no verbal or action response to the interviewer question). *Non-substantive* responses referred to answers, within the substantive part of the interview, that did not contain information about the event. The analyses presented in this thesis focused on children's responsive substantive answers.

In the current research program, children's recall of the personally experienced live event was assessed using three different, but complementary, measures: (a) assessment of the overall completeness, using a checklist of relevant event features, (b) counting the number of unique narrative details, and (c) assessment of the accuracy of the narrative details recalled. This approach was used to provide a more comprehensive assessment of how the children's memory reports changed across time.

Recall completeness (gist)

I developed a checklist of the key components that comprised the event. Although seven autistic children experienced module 4 of the event, the activities and materials used were the same and thus the checklist of components also applied to them. This measure captured memory of the event as a whole by assessing how many of the components of the overall target event were recalled. Each component of the checklist was scored as present or not (the first time they were mentioned), regardless of how much narrative detail was provided, giving a possible total score of 11.

The eleven key features of the event were defined as follows: (1) who was present, (2) where it took place, (3) the construction task in which they assembled some blocks, (4) play with the miniature toys, (5) demonstration of tooth-brushing, (6) recounting a story from a book of pictures, (7) describing a picture, (8) acting out the set of cards presenting a brief story in cartoon form, (9) creating a story using five objects picked from a bag, (10) conversing with the interviewer (i.e., that they were asked and answered questions about themselves during the target event), and (11) the break during which they were asked to play freely with some objects and materials provided.

Gist scores were tabulated only with reference to the open-ended recall phase of the interview (spontaneous recall of the event) and included the information provided in response to the substantive interviewer prompts (i.e., invitation, cued invitation, directive, and option-posing).

Identifying and counting narrative details

Children's recall of the personally experienced live event was also assessed by counting the number of unique narrative details provided. I tabulated the number of details conveyed in the child's statement by employing an adaptation of the technique first developed by Yuille and Cutshall (1986, 1989) and elaborated by Lamb et al. (1996). In the current study, a detail was defined as any information pertaining to the event that was conveyed by the interviewee during the investigative interview. More specifically, a detail consisted of words naming, identifying, or describing individual(s), object(s), event(s), place(s), and action(s) that were part of the event, as well as any of their features (e.g., appearance, location, time, duration, sound). Details provided following facilitators, defined as nonsuggestive words such as *ok* or *yes* that encouraged the child to continue with an ongoing response to the previous utterance,

were attributed to the preceding substantive utterance (invitation, cued invitation, directive, option posing, or focused/contaminating).

Each narrative detail provided was counted, but only when it was new and added to the understanding of the target event. Therefore, details that were presented and counted earlier in the interview were not counted again when/if they reappeared. Repeated words were also not counted twice, unless the repetition appeared intentional (as for emphasizing). Details expressing personal knowledge or habits (e.g., *I always wash my teeth like this*) and subjective statements of opinion (e.g. *he looked a bit suspicious*) were not counted. False starts (e.g., *I – they went…* and *Um, well…*), statements that expressed the child's present mental or emotional state (e.g., *I am bored*), phrases that suggested the level of confidence of the interviewee during the interview (e.g., *I know*, *I think*, and *Maybe*), and claims of lack of knowledge/ignorance (e.g., *I don't know* and *I don't remember*) are also examples of what were *not* counted as substantive details.

The meaning of a sentence is conveyed partly by the meaning of the content (lexical) words and partly by the relationship between content words (grammatical structure), conveyed by function words. Both were counted as narrative details as explained below.

Content words convey information (nouns, verbs, adjectives and adverbs) and each has a meaning that can be understood fully in and of itself. When counting the narrative details *nouns* were counted as detail once per utterance, provided that they appeared in conjunction with new information. *Pronouns* were also counted as narrative details as follows: personal pronouns subject form (*I, you he, she, it, we, they*) were counted once per utterance; personal pronouns object form (*me, you, him, her, it, us, them*) were counted once per utterance and with each verb; personal pronouns compound form (*myself*, *yourself, himself, herself, itself, ourselves, themselves*) were counted as details when they were reflexive (i.e., expressing an action turned back on the subject, e.g., *she dressed herself*), but were *not* counted as details when they were intensive (for emphasis). When a person word appeared twice in an utterance (e.g., once as a subject and once within a "because" clause: *she played with me because she wanted to*), I counted both words as details (although normally I only counted each person as a detail once per utterance). *Relative pronouns* (*who, what, which, whom, whose*) - words that connected two clauses, or related back to a noun or a pronoun in a preceding clause - were *not* counted as details. Finally, *identifying pronouns* – words that described "which" without referring to a definite person, object, event or place (*somebody, both, each, many, one, other*) were counted as details once per utterance, in conjunction with each noun.

I also counted all *verbs* (e.g., *push*, *run*, *came*, *throw*, *hit*, etc.) as details. There were, however, specific rules involved. *Was* was only counted as a detail when it was the main verb. Verbs such as *try* and *want*, which modify other verbs, were counted each time they appeared with a new verb (e.g., in *she tried to teach me and she tried to help me*, *tried* would be counted as a detail both times). *Said* was counted once per person per utterance (not just once total per utterance). *Wasn't, isn't, doesn't* were counted as two details (verb + not). Auxiliary verbs (*have, do, will*) which preceded main verbs and determined the tense or aspects of other verbs in verb phrases, linked subjects to an adjective or a noun and/or were used with another verb to form a verb tense were *not* counted as details (e.g., *I ~~was~~ bored, He ~~started~~ assembling the puzzle there*). Finally, *adverbs* (*forcefully, quickly, very, extremely, soon, fully*) were counted as details once per utterance, in conjunction with a particular action.

Function words (grammatical word) express grammatical or structural relationships with other words in a response. Function words have little or no meaningful content and can be understood completely only when occurring with other words in a sentence. To code function words I used the following procedure. I tabulated determiners – a word or a group of words that are used in front of a noun and introduce it, including: *articles, demonstrative pronouns, quantifiers and possessives. Demonstrative pronouns*, which point out a particular person, object, place or event (*this, that, these, those*), and *possessives* (*my, mine, your, his, her, our, ours, their, theirs*) were counted as details once per utterance in conjunction with a particular noun (e.g. *That man)*. *Quantifiers* (*all, most*), which may also function as pronouns, were counted as detail once per utterance (e.g., *All have returned),* but *articles* (*the, a, an*) were *not* counted as details.

Prepositions (*by (via), like, as… as, to, toward, through, at (location), by (location), on, of, for, from, out of, at (time), before, on*) were counted as details only when indicating location, position or direction (e.g., *at home, in the room, under the table, towards me, on Sunday, by train, on/in my head*). Complex prepositions – words/groups of words functioning like simple prepositions - were counted as one detail (e.g., *in front of, on top of*).

Non-verbal cues (e.g., *points, nods, demonstrates*) and all details included in verbal content (quotations) were counted as details. Verbal (or verbatim speech replication) were coded as one detail per word, subject to the following specific rules. For example, I: *What questions did she ask you?* C: *She, do I ever get annoyed or anything. What annoys me. What makes me happy. Stuff like that.* = 12 details.

Generic responses were also counted as details. If a *general detail* was followed by a *more specific one* (on the same issue) both were counted as details (e.g., *She was seating at the table with me. And that's when she took notes, when she was seating at the table in front of me*."). In the case of spontaneous corrections (when the child corrected himself immediately) only the corrected detail was counted. Contradictions in different portions of the interview were all counted as details. The response "No" to a Yes/No question was also counted as a detail. When the interviewer asked *Was the puzzle red?* and the child answered *Yes, Yes* was counted as one detail, even though it was referring to two aspects of the event *puzzle* and *red.*

Regarding units accompanying figures, number of times counted as one detail (e.g., *two times* was one detail) but order counted as two details (e.g., *second time we did it* – second time was two details). Measurements were counted as one detail as long as none of the words conveyed meaningful information independently (e.g., *5 centimetres*). *When* was counted as detail when it conveyed temporal information of a simultaneous occurrence of two actions (or of two event components: e.g., *She started to take notes when I was playing with the radio*). *Where* was counted as a detail when it conveyed location or body part information (e.g., *She took me to the room where the toys were*). Conjunctions (*and, or, but, however, because*) were *not* counted as details, except when *because* indicated causality.

Action responses were also counted as details. New details included in the interviewer's verbalization of the child's action were counted as details only if they added to the total number of details awarded to the child's verbal response accompanying his/her action. The details from the interviewer's verbalization were added to the child's detail count in the last utterance before the interviewer's verbalization (the utterance that contained the child's action response). Any overlapping details in the child's utterance and the interviewer's verbalization were subtracted (e.g. C : *Two minutes here*. I : *I see you are pointing to your teeth*.; The child's "here" detail were subtracted from the interviewer's verbalization of it (*your teeth* = 2 details) and 1 detail was added to the child's utterance. When the interviewer did not verbalise all of the child's actions I counted as details those actions the interviewer verbalized and those that he didn't verbalise (e.g., C: *He touched me here and here,* I: *He touched you on your leg).*

In the following example, each separately underlined word received unique credit for that particular information: *Yeah. There was a man fishing and he caught a fish and put it in his bucket. Then the cat took the fish out of the bucket and sort of walked away with it. And*

then there was a pelican, which took the fish out of the cat's hand and put it in his mouth and flew away with it. (38 narrative details).

Accuracy of narrative details

To determine the accuracy of the information supplied, I searched the video recordings of the event. Narrative details were coded as either correct or incorrect (i.e., errors of commission, such as describing a ball as red instead of blue, as well as reporting a piece of information that was not present or did not occur within the event). Details that could not be verified using the video recordings of the event were not scored. Accuracy was determined by dividing the total number of correct narrative details recalled by the total overall number of narrative details recalled (i.e., correct + incorrect narrative details). As with the number of narrative details, the percentage accuracy was calculated for each child.

Reliability of scoring

I was the lead coder and scored all of the 118 transcripts. I was blind to the children's diagnosis and age. An independent rater scored twenty-four randomly selected interview transcripts (20% of the total), which included transcripts relating to children of different ages and groups (ASD, TDC). He was blind to the group membership of the children and to the aims and hypotheses of the research but familiar with the template method of scoring used. Reliability assessments were performed throughout the duration of coding and all disagreements were resolved by discussion. Cohen's Kappa coefficients for agreement between raters for each topic analysed are described in detail in each individual paper presented in chapter III.

2.3. Preliminary results

2.3.1. Analytical Plan

This chapter provides descriptive and one-way analyses of variance (ANOVA) regarding the interviewers' questions and children's responses. In the next chapter (III) I present the results of analyses concerned with each of the topics analysed, in each individual paper. Our research questions were addressed using repeated measures and mixed design ANOVAs. All parametric tests were conducted with child as the unit of analysis. Data are presented for the two interview delays – two weeks and two months – and include all 59 children. Post hoc

power analyses were conducted for each inferential test reported using G*Power version 3.1. When the assumption of sphericity was violated (Mauchly's test), degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity. Effect sizes are indicated by partial eta-squared (η_p^2). Simple effects analyses (with Bonferroni corrections) were used to unpack significant interactions. All statistical comparisons were two-tailed, using $p < .05$ as the level of significance.

2.3.2. Construction of the interviews

We analysed the substantive portions of the 118 interview transcripts. In total, an average of 49.47 (*SD* = 4.13, *n* = 5838) question-response pairs were identified in each transcript. Of these, an average of 36 (*SD* = 13.18, *n* = 4248, 72.76%) were substantive prompts, and 13.68 (*SD* = 9.49, *n* = 1587, 27.18%) were non-substantive prompts (i.e., procedural prompts or questions not related to the target event).

Of the substantive prompts per interview, an average of 13.14 were invitations (*SD* = 3.95, *n* = 1551, 36.51%), 5.75 were cued invitations (*SD* = 2.48, *n* = 661, 15.56%), 1.26 were summary statements (*SD* = .93, *n* = 39, 0.92%), 6.70 were directive prompts (*SD* = 6.07, *n* = 771, 18.15%), 4.86 were option posing (*SD* = 3.98, *n* = 501, 11.79%) and 6.14 were focused/contaminating questions (*SD* = 3.12, *n* = 725, 17.07%).

The total number of prompts (invitations, cued invitations, directive, option-posing and focused/contaminating questions) given was totalled for each child. One-way ANOVAs with Group as the fixed factor were carried out for each time point, using the total number of prompts given the whole interview as the dependent variable. There was a significant main effect for Group in the two-week interview, $F(1, 57) = 14.39$, $p < .001$, and in the two-month interview, $F(1, 57) = 10.53$, $p = .002$. Two weeks after the experienced event, children with autism (*M* = 53.67, *SD* = 21.77, 95% CI [45.05, 62.28]) were given significantly more prompts than typically developing peers (*M* = 37.75, *SD* = 8.74, 95% CI [34.60, 40.90]). Two months after the experienced event, children with autism (*M* = 45.85, *SD* = 13.89, 95% CI [40.36, 51.35]) were also given significantly more prompts than TD peers (*M* = 36.16, *SD* = 8.85, 95% CI [32.96, 39.35]).

Next, one-way ANOVAs with group as a fixed factor were carried out for each time point, using the total number of prompts during the *open-ended recall phase* (sum of invitations, cued invitations, directive, and option-posing questions) as the dependent variable. There was a significant main effect for Group in the two-month interview, $F(1, 57) = 4.64$, $p = .035$, but not in the two-week interview, $F(1, 57) = 2.95$, $p = .091$. In the open-

ended recall phase two months after the experienced event, children with autism (M = 22.93, SD = 11.42, 95% CI [18.41, 27.44]) were given significantly more prompts than TD peers (M = 17.97, SD = 5.75, 95% CI [15.41, 20.04]).

One-way ANOVAs carried out on the total number of prompts asked during the *cued recall phase* (sum of invitations, cued invitations, directive, option-posing, and focused/contaminating questions) revealed a significant main effect for group in the two-week interview, $F(1, 57) = 12.14$, $p = .001$, but not in the two-month interview, $F(1, 57) = 3.82$, $p = .056$. In the cued recall phase two weeks after the experienced event, children with autism (M = 30.44, SD = 17.58, 95% CI [23.49, 37.40]) were given significantly more prompts than TD peers (M = 18.06, SD = 9.00, 95% CI [14.82, 21.31]).

Next, one-way ANOVAs with Group as a fixed factor were carried out for each time point, using the total numbers of each type of prompt as the dependent variables. For directive questions, there was a significant main effect for Group in the two-week interview, $F(1, 57) = 14.05$, $p < .001$, and in the two-month interview, $F(1, 57) = 12.39$, $p = .001$. No significant main effects for Group were found for the remaining question types (invitations, cued invitations, option-posing, and focused questions), at both time points, all Fs < 14.05, all ps > .077. In both interviews, children with autism (two weeks: M = 9.93, SD = 7.37, 95% CI [7.01, 12.84]; two months: M = 8.85, SD = 7.51, 95% CI [5.88, 11.82]) were given significantly more directive prompts than TD peers (two weeks: M = 4.44, SD = 3.48, 95% CI [3.18, 5.69]; two months: M = 3.81, SD = 2.81, 95% CI [2.80, 4.83]).

In total, 27% (n = 1289) of the interviewer prompts were supportive and 73% (n = 3535) were neutral/non-supportive. Of the supportive prompts, children with ASD received an average of 6.78 (SD = 3.56, range = 1-17) supportive prompts per interview and typically developing children (TDC) received an average of 8.06 (SD = 3.05, range = 2-15) supportive prompts per interview.

Two 5 (Prompt: invitations, cued invitations, directive, option-posing) x 2 (Group: ASD, TDC) repeated measures ANOVAs were carried out on the number of supportive prompts for each delay. Mauchly's test indicated that the assumption of sphericity had been violated for the main effect of Prompt in the two-month interview, $\chi 2\ (5) = 12.65$, $p < .028$, so degrees of freedom were corrected using Greenhouse–Geisser estimates of sphericity ($\varepsilon = .66$). There was a significant main effect of Prompt in the two-week interview, $F(3, 45) = 4.70$, $p = .006$, $\eta_p^2 = .24$, but not in the two-month interview, $F(3, 27) = 1.16$, $p = .336$, $\eta_p^2 = .11$. At both time points, there was no significant main effect of Group and no significant Prompt x Group interaction, all Fs < 1.44, all ps > .245. In the two-week interview, children were given more

supportive invitations (M = 3.79, SD = 2.30, 95% CI [2.60, 4.98]), than supportive directive prompts (M = 1.82, SD = 1.11, 95% CI [1.25, 2.39]). No other significant differences were found.

Next, a 2 (Delay) x 2 (Group) repeated measures ANOVA was carried out on the number of supportive prompts. There was a significant main effect of Group, $F(1, 56) = 5.02$, $p = .029$, $\eta_p^2 = .08$, with TD children receiving more supportive prompts (M = 7.50, SD = 2.98, 95% CI [6.72, 8.28]) than children with ASD (M = 6.19, SD = 3.33, 95% CI [5.32, 7.06]) but there was no significant main effect of Delay $F(1, 56) = 3.81$, $p = .056$, $\eta_p^2 = .064$, and no significant Delay x Group interaction, $F(1, 56) = .19$, $p = .668$, $\eta_p^2 = .003$.

2.3.3. Children's responses

Children were responsive to the interviewer questions 78.06% of the time (n = 3316) and 18.83% (n = 800) of the time they responded with uncertainty. The remainder of children's responses were non-substantive (3,11%, n = 132). Of all uncertain responses, "don't remember" (n = 476, 59.50%) responses were the most common. Denials (n = 154, 19.25%), "don't know" (n = 85, 10.63%), and no responses (n = 85, 10.63%) were less common. The analyses presented in this thesis (and individual papers) refer to the children's responsive answers (78.06%, n = 3316) to the interviewer questions.

As mentioned above, the samples in the current study were individually matched for chronological age. There was not enough power to include age as a covariate in the individual analyses presented in each individual paper, but because our study included children of diverse ages, we investigated whether the recall scores were related to chronological age. Bivariate correlations conducted for each group and for each time point separately were carried out on the recall completeness scores, the number of narrative details reported and the accuracy of those narrative details. A summary of these results is detailed below.

For children with ASD, age was positively associated with the completeness of recall, at both time points: two-week interview: $r(27) = .616$, $p = .001$; two-month interview: $r(27) = .494$, $p = .009$; and with the overall number of correct narrative details reported, at both time points: two-week interview: $r(27) = .474$, $p = .013$; two-month interview: $r(27) = .447$, $p = .019$. Older autistic children recalled more components of the event and more narrative details than younger autistic children. The accuracy of the information reported in the two-month interview also increased with age for autistic children: $r(27) = .418$, $p = .030$. There were no other significant relationships.

Similarly, for TD children, age was also positively associated with the completeness of recall at the two-month interview, $r(32) = .367$, $p = .039$, and with the overall number of correct narrative details reported, at both time points: two-week interview: $r(32) = .434$, $p = .013$; two-month interview: $r(27) = .398$, $p = .024$. Older TD children recalled more components of the event and more narrative details than younger children. There were no other significant relationships.

Chapter III

3.1. Effects of delay on episodic memory retrieval by children with Autism Spectrum Disorder

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Abstract

Twenty-seven 6- to 15-year-old children with Autism Spectrum Disorder (ASD) and 32 typically developing (TD) children were questioned about their participation in a set of activities after a two-week delay and again after a two-month delay using a best-practice interview protocol. Transcripts were coded for completeness with respect to the gist of the event, the number of narrative details provided, and accuracy. Results indicated that children with ASD did not differ from TD peers on any dimensions of memory after both delays. Specifically, both groups of children provided equivalently complete accounts on both occasions. However, children in both groups provided significantly fewer narrative details about the event in the second interview, and the accuracy rates were lower. The findings indicate that children with ASD can provide meaningful and reliable testimony about an event they personally experienced, but several aspects of their memory reports deteriorate over time.

Keywords: autism spectrum disorders, delay, eyewitness testimony, memory

Effects of delay on episodic memory retrieval by children with Autism Spectrum Disorder

When individuals on the Autism Spectrum come into contact with the legal system as either victims or witnesses (Browning & Caulfield, 2011; Lindblad & Lainpelto, 2011; Mayes & Koegel, 2003), their distinct memory profiles, characterized by areas of diminished and areas of preserved skills (Boucher & Bowler, 2008), and their difficulties in social interaction and communication can constitute important challenges for professionals seeking their testimony. In many criminal investigations, physical evidence of the abuse does not exist (Pipe et al., 2007) and successful prosecution depends on children's eyewitness testimony (Milne & Bull, 1999; Wells et al., 2006). It is thus critical to understand the ability of children with ASD to describe past personal experiences and identify the best ways to interview them, developing interviewing strategies that complement their unique memory and behavioural characteristics.

The majority of studies exploring episodic or autobiographical memory in individuals with ASD have interviewed children or adults once after a short delay between the target event and the investigative interview. Delays in such studies have ranged from immediately after the event (20 to 60 minutes) (e.g., Henry et al., 2017a; Maras & Bowler, 2010, 2011, 2012; Maras et al., 2013; Mattison et al., 2015; Millward et al., 2000) to a few days (1 to 12 days) after the event (Maras, Gaigg, & Bowler, 2012, Experiment 1; McCrory et al., 2007).

In other studies, researchers have assessed children's or adult's memories twice, using delays that ranged from immediately and a few hours or days after the event (Gaigg & Bowler, 2008; Henry et al., 2017b; Maras et al., 2012; North, Russell, & Gudjonsson, 2008), to 8 and 12 days after the event (Bruck et al., 2007). These studies, however, have not examined changes in the amount and accuracy of information children with ASD reported about the experienced or witnessed events in the two interviews.

In criminal investigations, alleged victims or witnesses are rarely interviewed immediately after the event (Goodman et al., 1992), with delays between target events and courtroom testimony ranging from 11 to more than 24 months around the world (e.g., Hanna et al., 2010; Peixoto et al., 2017; J. Plotnikoff & Woolfson, 1995; Quas & Sumaroka, 2011). Delay is thus a crucial factor to consider when investigating eyewitness recall in children with ASD, because it has important effects on the retrieval of information from memory.

This research was primarily designed to investigate the effect of time delay on children's memories. Specifically, we examined recall and reporting of a personally experienced event by children with ASD and TD children after varying delays. To our knowledge, this was the

first study exploring how well children with ASD could recall a personally experienced event an extended period of time later and how different aspects of their episodic memory changed over time. This was also the first study to use the best practice Revised National Institute of Child Health and Human Development (NICHD) Investigative Interview Protocol (Lamb et al., 2018) to interview children with ASD about personally experienced events. The NICHD Protocol is a structured, non-suggestive, and child-directed interview protocol that has been systematically evaluated in the field and is currently used by forensic interviewers in several countries worldwide.

Most eyewitness studies suggests that, after short delays, children and adults with ASD tend to recall less information than typically developing peers (Bruck et al., 2007; Henry et al., 2017 a; Mattison et al., 2015, 2016; McCrory et al., 2007; Millward et al., 2000). However, various studies have also reported that individuals with ASD can provide as much correct information about an event as TD peers, especially when appropriate support is given at retrieval (Henry et al., 2017b; Maras & Bowler, 2010; Maras et al., 2013). With regard to the accuracy of the information recalled soon after an event, the research findings are also not consistent, with some suggesting that individuals with ASD are less accurate than non-ASD peers (e.g., Bruck et al., 2007; Maras & Bowler, 2010, 2011, 2012), while others have found that they are just as accurate (e.g., Henry, 2017a, 2017b; Maras & Bowler, 2010; Maras et al., 2012, 2013; McCrory et al., 2007). Still other researchers have reported that specific interview techniques can help children with ASD be as accurate as non-ASD peers (Mattison et al., 2015, 2016).

As demonstrated above, there are divergent findings in the relevant literature regarding the capabilities of children with ASD to provide complete, detailed, and accurate accounts of personally experienced or witnessed events. Additionally, the relevant studies conducted so far assessed the episodic memory of children with ASD shortly after the event was experienced using a variety of methods, and none has examined changes in their recall over time. Some assessed the overall completeness of the children's recall, using a checklist of relevant event features such as actions or descriptions of items and people that were present (e.g., Bruck et al., 2007; Mattison et al., 2015, 2016; Millward et al., 2000), others counted the number of unique units of information or narrative details (e.g., Henry et al., 2017a, 2017b), whether or not they were accurate. These coding procedures represent complementary ways of measuring children's recall. According to fuzzy trace theory (e.g., Brainerd & Reyna, 1990), separate memory traces of any event contain either general

information about the event (gist traces) or precise details of the same event (verbatim traces). It is thus important to explore both aspects of children's episodic memory.

To our knowledge, only one study has done so. McCrory et al. (2007) compared eyewitness recall of a 5-minute classroom event involving 11– to 14-year-old children with ASD and their typically developing peers. McCrory et al. assessed children's memory by both counting the number of correct pieces of new information reported during free and cued recall, and scoring, on a five-point scale, the five most salient or gist aspects of the experienced event freely recalled. The authors found that children with ASD freely recalled around a third less information than the TD children and were significantly less likely to freely recall the most salient or gist elements of the event, although their free reports were no less accurate. Children with ASD performed as well as typically developing peers during specific questioning, reporting just as many (and highly accurate) details about the event.

As mentioned above, no researchers have investigated how memory reports change over time in children with ASD. Studies examining the effects of delay on TD children's recall of non-stressful or staged events (as in the current study) suggest that longer delays are usually associated with less (and less accurate) information retrieval, especially during free recall (e.g., Baker-Ward, Hess, & Flannagan, 1990; Hudson & Fivush, 1991; La Rooy, Lamb, & Pipe, 2008; La Rooy, Pipe, & Murray, 2005 [Experiment 3]; Pipe, Gee, Wilson, & Egerton, 1999 [Experiments 1 & 2]; Salmon & Pipe, 1997). Yet other authors have found that children's memory reports remain unchanged or even get better over time (e.g., Bruck, Ceci, & Hembrooke, 2002; Fivush & Hamond, 1989; La Rooy et al., 2005 [Experiment 1 & 2]; Pipe, Sutherland, Webster, Jones, & La Rooy, 2004).

Discrepant findings were also obtained in studies examining the effects of delay on TD children's memory for highly salient and personally relevant events (e.g., Fivush et al., 2004; Goodman et al., 1991; Peterson & Bell, 1996; Peterson, Pardy, Tizzard-Drover, & Warren, 2005). These divergent findings are possibly related to methodological differences in how TD children's reports were measured, as different studies have assessed different aspects of children's memories (Peterson, 2011). Recent research by Peterson (2011) has demonstrated that different aspects of TD children's memory reports of a serious physical injury change in different ways over time. While children's gist recall of the event remained unchanged over time, they provided more narrative details 1 year and, particularly, 2 years later. The accuracy of their reports, however, decreased as the delay increased.

Furthermore, when children are re-interviewed about an event after a substantial delay, new relevant information that had previously been forgotten or had not been reported often

comes to light, a phenomenon known as reminiscence (e.g., Cederborg, La Rooy, & Lamb, 2008; Fivush et al., 2004; Hershkowitz & Terner, 2007; Katz & Hershkowitz, 2013; La Rooy et al., 2005; La Rooy, Pipe, & Murray, 2007; Waterhouse, Ridley, Bull, La Rooy, & Wilcock, 2016). Sometimes, especially when the delays between the event and the memory interviews are shorter, there is an increase in the amount of the information reported (i.e., hypermnesia), which tends to decrease as the delays become longer (e.g., Bruck et al., 2002; La Rooy, Pipe, & Murray, 2005). When either one or both of these phenomena occur(s), it is important, from a forensic standpoint, to ascertain the accuracy of the consistent and newly reported information, as this can influence the perceived credibility of child witnesses. Research comparing the accuracy of new and consistent information has demonstrated that newly reported information tends to be less accurate than information provided consistently in both interviews (e.g., Brown, Lewis, & Lamb, 2015; La Rooy et al., 2005, 2007; Peterson, Moores, & White, 2001; Pipe et al., 1999; Salmon & Pipe, 1997, 2000; Steward et al., 1996).

In the current study, we used both the completeness and narrative detail coding schemes as well as measures of accuracy to provide a complete assessment of how the memory reports of children with ASD changed over time. We analysed children's responses to initial open-ended recall questions and responses to more specific questions asked later in the interview and compared the children's accounts with objective records of experienced events.

Informed by research on the effects of delay on TD children's memory about similar events and theoretical conceptions of memory in children with ASD, we formulated the following hypotheses. First, regarding the effects of delay, we expected that the completeness of children's recall as well as the amount and the accuracy of the narrative details provided would decrease over time. Second, we predicted that, compared to TD peers, children with ASD would display impoverished recall in relation to the gist of the event and the number of narrative details provided but that their memory reports would be just as accurate. Finally, we expected that children would report more consistent than new information about the event after a lengthy delay and that the consistent information recalled would be more accurate than the newly reported information reported in the second interview.

Method

Sample

The current study included fifty-nine children (18 females and 41 males) between 6 and 15 years old (mean = 9 years, 9 months). Twenty-seven children had an ASD diagnosis (23 males and 4 females) and were able to verbally communicate and 32 were typically

developing children (18 males and 14 females). All children or their legal representatives provided informed consent and ethical approval for the study was obtained from the NHS Research Ethics Committee (NRES Committee East of England - Cambridge South).

The children with ASD were recruited from the Peterborough Integrated Children's Health Services and the Cambridgeshire Community Services NHS Trust. Two weeks before the first research interview, all ASD participants had received (independently of the research study) a formal autism diagnosis by an appropriately qualified clinical professional. This diagnosis was obtained using the assessment criteria of the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2; a cut-off point of 7 or 8), and the Autism Diagnostic Interview, Revised, which confirmed that the participants met DSM-V criteria for ASD (American Psychiatric Association, 2013). After diagnosis, the caregivers and the children with ASD whose intellectual and linguistic abilities were currently within the normal range (verbal quotients of 85 or above; full-scale IQ of 90 or above – measured by the clinician using the Wechsler Intelligence Scale for Children-Third Edition) were informed about the study by their clinician and given the relevant Participant Information Sheets and Consent forms. Those interested in taking part in the study were then referred to us and contacted to set up the subsequent study sessions. Although 28 children with ASD were initially recruited, one was excluded because he refused to cooperate during the second study session.

Typically developing children were recruited from local mainstream schools in Peterborough and Cambridge. They had no known psychiatric, developmental or neurological disorders, as indicated by parents/caregivers and the absence of symptomology[2]. They were included in the study if they had an overall total ADOS-2 score of less than the autism spectrum cut-off (i.e., 6 or less). TD children were matched individually for chronological age to the ASD participants. Independent *t-tests* confirmed that the groups did not differ significantly with respect to chronological age, $t(57) = -1.70$, $p = .095$ (ASD: M = 10.63, SD = 3.02, range = 6-15; TD: M = 9.38, SD = 2.66, range = 6-15). Although 34 children were initially recruited for the TD sample, two were excluded because they were unable to participate in the second study session at the appropriate time.

Materials and procedure

Event-to-be-recalled. The event-to-be-recalled was a set of activities included in the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2), about which children

[2] Practical constraints prevented us from testing verbal or full-scale IQ for the TD sample.

were later questioned. The ADOS-2 is a standardized instrument that assesses social interaction, communication, and imagination during a semi-structured interaction with an examiner (Lord, Luyster, Gotham, & Guthrie, 2012). In this session, children engaged in a series of activities involving interactive stimulus materials. For children with ASD, a qualified psychiatrist conducted the ADOS-2 as part of the child's diagnosis process, independently from the research study. This session occurred 2 weeks before children took part in the study. Typically developing children experienced the activities included in the ADOS-2 as part of the research study. A member of the research team, with prior ADOS-2 training, conducted this session either at the Peterborough Integrated Children's Health Services or at the University of Cambridge.

The activities that children engaged in during the event session corresponded to Module 3 of the ADOS-2 and remained unchanged, with the exception of seven children with ASD, who experienced Module 4, as per the clinician's decision. The same tasks and materials comprised both modules 3 and 4. The examiners strictly followed the ADOS-2 manual and always provided the same instructions and displayed the same items, in the same way, and sequence, so the duration of the sessions (M = 44.63 minutes; range 40-53 minutes) depended only on the amount of time each child took to perform each task. Bivariate correlations revealed no significant relationships between the length of the event (ADOS-2 session) and the total number of unique narrative details recalled at the two-week interview by children in the ASD $r(27) = -.03$, $p = .901$, and TD $r(32) = .16$, $p = .381$ groups; nor at the two-month interview by children in the ASD $r(59) = -.06$, $p = .773$, and TD $r(32) = .25$, $p = .161$, groups. All event sessions were video recorded, and the recordings were later used to determine the accuracy of the children's accounts.

The event-to-be-recalled included a construction task, a make-believe play, a joint interactive play, a demonstration task, the description of a picture, telling of a story from a book, telling of a story depicted in cartoons, conversations about something that happened to the child in the past, questions about a variety of topics, a break, and the creation of a story using objects provided. Table 1 provides a detailed description, with examples, of the activities experienced during the event-to-be-recalled. Parents were asked not to discuss the event with their child because we were interested in what the children themselves remembered. On each subsequent session, parents confirmed not having talked with their children about what had happened during the event.

Table 1. Event to-be-recalled

Event description and examples

Activities	Materials	Description
Construction Task	Puzzle pieces and printed design to be duplicated	Children assembled blocks to construct a design shown on a printed form.
Make-believe Play	Examples: action figures, miniature hairbrush, toy dinosaur, several pieces of miniature food, toy car, toy rocket, small ball.	Children played with some miniature objects.
Joint interactive Play	Materials from "Make-Believe" Play	Examiner joined in, making it clear that the play had become collaborative. Children helped clean up the materials.
Demonstration Task	-	Children demonstrated toothbrushing. The examiner drew with his/her finger a sink and faucet handles, a toothbrush, toothpaste, and a cup on the table in front of the participant and asked children how they brushed their teeth.
Description of a picture	Resort and U.S. scene	Children described a picture.
Telling a story from a book	2 picture storybooks	Children recounted a sequential story from a book of pictures.
Cartoons	Series A: fisherman/pelican Series B: monkey/coconut	Children saw a set of cards presenting a brief story in cartoon form, one frame per card, without any dialogue or narrative text. Children were instructed to push their chair back from the table, stand up, and tell the story.
Conversation and Reporting	-	Children were encouraged to describe an event (e.g., a non-routine episode that had actually occurred, as opposed to an account

		of a film or story, such as a birthday party, a holiday, etc.).
Questions	-	Children answered a set of questions regarding a variety of topics: emotions, social difficulties and annoyances, friends, relationships, and marriage, loneliness, responsibility and future plans and hopes.
Break	Mini game (e.g., shape puzzle), drawing paper, set of markers, pin art, spin pen, small radio, current newspaper and magazine	Children had a break during which they played freely with some objects and materials. The break could occur at any time during the session.
Creating a story	6 small objects with a definite purpose (e.g., umbrella), 6 small objects with no clear purpose (e.g., wooden block)	The examiner picked five objects from a bag and used them to make up a story. Then the children picked five different objects from the bag and made up their own story.

Interviews. Children were interviewed about the personally experienced event twice, the first time after a short two-week delay and again after a longer two-month delay. One-way ANOVAs confirmed that the groups did not differ significantly with respect to the delay (in days) between the event and the first interview, $F(1, 57) = 1.19$, $p = .281$ (ASD: $M = 12.19$, $SD = 3.41$, 95% CI [10.84, 13.53]; TD: $M = 11.06$, $SD = 4.35$, 95% CI [9.50, 12.63]); and between the event and the second interview, $F(1, 57) = 3.95$, $p = .052$ (ASD: $M = 65.00$, $SD = 13.60$, 95% CI [59.62, 70.38]; TD: $M = 73.84$, $SD = 19.47$, 95% CI [66.82, 80.86]).

One of three interviewers (the first author, a licenced forensic psychologist with experience of interviewing vulnerable witnesses using the NICHD Protocol; a graduate and a post-graduate psychology research assistant, both with previous training in the use of the NICHD Protocol and experience interviewing vulnerable interviewees) conducted the interviews, using the best practice Revised NICHD Protocol (see Lamb et al., 2018, for a full review of the Protocol). This was the first study to use the NICHD Protocol (standard or revised versions) to interview children with ASD about events they had personally experienced. The recently developed Revised NICHD Protocol helps interviewers deal more effectively with reluctant children by advising them on how to build better rapport and provide children with more support throughout the interview (Ahern, Hershkowitz, Lamb, Blasbalg, & Winstanley, 2014; Blasbalg, Hershkowitz, & Karniel-Visel, in press.; Blasbalg, Hershkowitz, Lamb, Karniel-Visel, & Ahern, in press; Hershkowitz et al., 2017; Hershkowitz, Lamb, & Katz, 2014; Lamb, Malloy, Hershkowitz, & La Rooy, 2015).

The two interviews were conducted by the same person, except in four cases where practical constraints prevented the same interviewer from conducting both interviews. One-way Analyses of Variance (ANOVA) showed no significant effect of Interviewer on the completeness of children's reports (i.e., gist recall) in the two-week interview $F(2, 56) = 1.83$, $p = .170$, or in the two-month interview, $F(2, 56) = .62$, $p = .540$; on the total number of narrative details reported by children in the two-week interview, $F(2, 56) = 1.63$, $p = .204$, or in the two-month interview, $F(2, 56) = .89$, $p = .417$; and on the accuracy of children's reports in the two-week interview $F(2, 56) = .29$, $p = .753$, or in the two-month interview, $F(2, 56) = 2.23$, $p = .117$.

All interviews (at both time points) comprised the same phases in the same order, as follows: (1) greet; (2) rapport (3) ground rules, truth and lie exercise; (4) substantive recall part of the interview (i.e., interviewers' statements or questions and children's responses that pertained to the investigated event); and (5) closure. This study focused on the information

elicited during the substantive portion of the interviews, and so only this portion of the interview is described in detail below (see Lamb et al., 2018 for the full interview protocol).

Open-ended recall phase. The substantive portion of the interview began with an *open-ended recall phase*, in which children were encouraged to provide as much information as they could remember about the event using a series of open-ended prompts (e.g., invitations, follow-up invitations). The children's words were used to frame cued invitations (e.g., "You mentioned [content mentioned by the child], tell me everything about that.") and *wh*-questions, (e.g. "You mentioned a book. Where was the book?") and these were paired with open prompts (e.g., "Tell me more about that"). More focused questions, such as yes/no and forced-choice option-posing prompts, were avoided, but used if needed to clarify unclear information and these were also followed by open prompts. Once the child had finished speaking and was waiting for the next instruction, they were once again asked: "Is there anything else you remember?". This prompt was repeatedly asked until the child could not offer further information. After children stated they couldn't remember anything else about the event, the next recall phase began.

Cued recall phase. In our study we included an additional questioning phase that is not part of the Revised NICHD Protocol, which we called the *cued recall phase*. The cued recall phase was implemented after children stated that they could not remember anything else about the event, but there was still information that was missing (i.e., only some of the activities children experienced during the event were remembered). In this phase, the interviewer probed the child for the information that was missing, asking a series of focused questions. The focused questions introduced event-related information (i.e., activities, aspects) that had not been disclosed by the child in the previous recall phase but did not imply that a particular response was expected (as in suggestive questions). All focused/contaminating questions in this study asked about events or details that had occurred (as opposed to misleading questions) and varied depending on whether they were closed, requiring a yes or no answer (e.g., "Did you see a book that time?"), or whether they were open, requiring the children to provide the response (e.g., "I heard there was a book that time."). The number and content of these questions were dependent on the activities that the child had failed to remember during the *open-ended recall phase*. These were paired with follow-up open prompts to encourage children to elaborate in their responses. For example, if in response to the focused question "Did you see a book that time?", a child responded "Oh

yeah. A book with flying frogs", the interviewer would then ask "Tell me more about the book with flying frogs".

Before ending the interview by discussing a neutral topic, the interviewer once again asked whether the child remembered anything else about the event and after that, they were thanked for their efforts and participation.

Data coding

All interviews were video recorded and transcribed verbatim. Coding focused on the part of each interview concerned with substantive information (i.e., about anything that happened during the target event), therefore excluding any non-substantive utterances, including introductory exchanges at the beginning of the interview, attempts to establish rapport with the child, digressions, and attempts at the end of the interview to discuss neutral topics. All substantive question–response pairs were coded (i.e., information provided in response to invitation, cued invitation, directive, option-posing and focused/contaminating questions).

In the current study, children's recall of the personally experienced live event was assessed using three different, but complementary, measures: (a) assessment of the overall completeness, using a checklist of relevant event features, (b) counting the number of unique narrative details, and (c) assessment of the accuracy of the narrative details recalled. This approach was used to provide a more comprehensive assessment of how the children's memory reports changed across time.

Recall completeness. A checklist of the key components that comprised the event was developed. Although seven children with ASD experienced module 4 of the event under study, the activities and materials used were the same and thus the checklist of components also applied to them. This measure captured memory of the event as a whole by assessing how many of the components of the overall target event were recalled. Each component of the checklist was scored as present or not (the first time they were mentioned), regardless of how much narrative detail was provided, giving a possible total score of 11.

The eleven key features of the event were defined as follows: (1) who was present, (2) where it took place, (3) the construction task in which they assembled some blocks (4) play with the miniature toys, (5) demonstration of tooth-brushing, (6) recounting a story from a book of pictures, (7) describing a picture, (8) acting out the set of cards presenting a brief story in cartoon form, (9) creating a story using five objects picked from a bag, (10) conversing with the interviewer (i.e., that they were asked and answered questions about themselves during the target event), (11) the break during which they were asked to play

freely with some objects and materials provided. Gist scores were tabulated only on the open-ended recall phase of the interview and included the information provided in response to the substantive interviewer prompts only (i.e., invitation, cued invitation, directive, and option-posing).

Narrative details. Each unique narrative detail provided by the child was counted. Details consisted of relevant words naming, identifying, or describing individual(s), object(s), event(s), place(s), and action(s) that were part of the event, as well as any of their features (e.g., appearance, location, time, duration, sound). Details expressing personal knowledge or habits (e.g., *I always wash my teeth like this*) were not counted. Each narrative detail provided in the first interview (two-week interview) was counted, but only when it was new and added to the understanding of the target event. All unique narrative details provided in the second interview were counted and coded as either *repeated* (i.e., narrative details that had already been recalled in the two-week interview) or as *new* (i.e., narrative details that had not been recalled before and were reported for the first time after two months).

In addition, the children's responses during the *open-ended recall* phase (i.e., responses to invitation, cued invitation, directive, and option-posing questions) were scored separately from their responses during the *cued recall phase* (i.e., responses to invitation, cued invitation, directive, option-posing, and focused/contaminating questions). Thus, total recall was the sum of the narrative details recalled during the *open-ended* and the *cued recall* phases and provided an assessment of all unique information provided in the entire interview.

Accuracy of narrative details. The video recordings of the event (ADOS-2 session) were searched to verify the accuracy of the information provided. Narrative details were coded as either correct or incorrect (i.e., errors of commission, such as describing a ball as red instead of blue and reporting information that did not occur within the event). Details that could not be verified using the video recordings of the event were not scored. Accuracy was determined by dividing the total number of correct narrative details recalled by the total overall number of narrative details recalled (i.e., correct + incorrect narrative details). As with the number of narrative details, the percentage accuracy was calculated for each child.

Reliability of scoring

The lead coder, who was blind to the children's diagnosis and age, scored all of the 118 transcripts. An independent rater scored twenty-four randomly selected interview transcripts (20% of the total), which included transcripts relating to children of different ages and groups (ASD, TDC). He was blind to the group membership of the children and to the aims and hypotheses of the research but familiar with the template method of scoring used. Reliability

assessments were performed throughout the duration of coding and all disagreements were resolved by discussion. Cohen's Kappa coefficients for agreement between raters for recall completeness was 1.0. Agreement was also high when identifying unique narrative details (K = .95) and verifying the accuracy of the narrative details provided by children (correct details K = .94; incorrect details K = .99).

Results

Data on children's recall of the target event are presented separately for three types of data: (1) the completeness of recall; (2) the number of narrative details recalled; and (3) the accuracy of those narrative details. Data are presented for the two interview delays – two weeks and two months – and include all 59 children. Our experimental hypotheses were investigated using a series of repeated measures analyses of variance (ANOVAs) with Group (ASD, TDC) as the between-subject factor, and Delay (two weeks, two months) as the within-subjects factor. When analysing the consistency of the information reported at two months, we conducted a series of repeated measures ANOVAs with Group as the between-subject factor, and Information type (repeated, new) as the within-subjects factor. All parametric tests were conducted with child as the unit of analysis. Effect sizes are indicated by partial eta-squared (η_p^2). Simple effects analyses (with Bonferroni corrections) were used to unpack significant interactions. All statistical comparisons were two-tailed, using $p < .05$ as the level of significance.

Preliminary results

Discriminant function analyses revealed no significant effects for gender with respect to the completeness of children's recall, the number of narrative details remembered, and the accuracy of those details and thus gender was not included in any of the analyses reported below. One-way ANOVAs with group as a fixed factor was carried out for each time point, using the total number of prompts during the *open-ended recall phase* (sum of invitations, cued invitations, directive, and option-posing questions) as the dependent variable. There was a significant main effect for group in the two-month interview, $F(1, 57) = 4.64$, $p = .035$, but not in the two-week interview, $F(1, 57) = 2.95$, $p = .091$. In the open-ended recall phase two months after the experienced event, children with autism (M = 22.93, SD = 11.42, 95% CI [18.41, 27.44]) were given significantly more prompts than TD peers (M = 17.97, SD = 5.75, 95% CI [15.41, 20.04]).

One-way ANOVAs carried out on the total number of prompts asked during the *cued recall phase* (sum of invitations, cued invitations, directive, option-posing, and

focused/contaminating questions) revealed a significant main effect for group in the two-week interview, $F(1, 57) = 12.14$, $p = .001$, but not in the two-month interview, $F(1, 57) = 3.82$, $p = .056$. In the cued recall phase two weeks after the experienced event, children with autism ($M = 30.44$, $SD = 17.58$, 95% CI [23.49, 37.40]) were given significantly more prompts than TD peers ($M = 18.06$, $SD = 9.00$, 95% CI [14.82, 21.31]).

Completeness of recall

Table 2 shows the means and standard deviations for the completeness of children's recall (i.e., Gist) for each group and each delay.

Table 2: Free recall completeness

Means and standard deviations for free recall completeness, by group and delay.

	Group			
	ASD		TDC	
Delay	*M*	*SD*	*M*	*SD*
Two weeks interview	6.19	1.78	6.69	1.78
Two months interview	6.04	2.02	6.59	2.02

Notes. ASD: Autism Spectrum Disorder; TDC: Typically Developing Children

A 2 (Delay) x 2 (Group) repeated measures ANOVA was carried out on the total number of components spontaneously recalled by children (i.e., components of the event freely recalled during the open-ended recall phase). Analysis of the completeness data revealed no significant main effect of Delay, $F(1,57) = .27$, $p = .603$, $\eta_p^2 = .01$, no significant main effect of Group, $F(1, 57) = 1.44$, $p = .235$, $\eta_p^2 = .03$, and no significant Group x Delay interaction , $F(1, 57) = .01$, $p = .907$, $\eta_p^2 = .00$.

Narrative details

First, we investigated how the overall number of correct and incorrect narrative details (summing responses in the *open-ended* and *cued* recall phases), as well as the accuracy of children's recall, changed over time. Second, we investigated how the number of correct and

incorrect narrative details and the accuracy of children's recall changed over time in each retrieval phase and for children in each group. All relevant means are provided in Table 3.

Overall recall and accuracy. There were significant main effects of Delay for the number of correct narrative details, $F(1, 57) = 26.54$, $p < .001$, $\eta_p^2 = .32$, and accuracy, $F(1, 57) = 6.88$ $p = .011$, $\eta_p^2 = .11$. Overall, children recalled significantly more correct narrative details two weeks ($M = 316.74$, $SD = 151.92$, 95% CI [277.13, 356.34]) than two months after the event ($M = 250.07$, $SD = 139.44$, 95% CI [213.72, 286.42]). Children's recall was also significantly more accurate two weeks ($M = .88$, $SD = .12$, 95% CI [.84, .91]) than it was two months ($M = .83$, $SD = .14$, 95% CI [.80, .87]) after the experienced event. There was no significant main effect of Delay for the number of incorrect narrative details, $F(1, 57) = .96$, $p = .330$, $\eta_p^2 = .02$. There was no significant main effect of Group or Group x Delay interaction on the number of correct or incorrect narrative details recalled, or for accuracy, all Fs < 1.72, all ps > .195.

Open-ended recall phase. There was a significant main effect of Delay for the number of correct narrative details provided during the *open-ended* recall phase, $F(1, 57) = 4.90$, $p = .031$, $\eta_p^2 = .08$. Two weeks after the experienced event ($M = 200.69$, $SD = 122.69$, 95% CI [168.70, 232.67]), children freely recalled significantly more correct narrative details than they did after 2 months ($M = 171.57$, $SD = 131.59$, 95% CI [137.27, 205.87]). There was no significant main effect of Delay for the number of incorrect narrative details, $F(1, 57) = 1.05$, $p = .310$, $\eta_p^2 = .02$, or accuracy, $F(1, 57) = .88$, $p = .353$, $\eta_p^2 = .02$. There was also no significant main effect of Group or Group x Delay interaction on the number of correct or incorrect narrative details recalled, or for accuracy, all Fs < 3.34, all ps > .073.

Cued recall phase. There was a significant main effect of Delay for the number of correct narrative details, and accuracy, $F(1, 57) = 18.29$, $p < .001$, $\eta_p^2 = .24$ and, $F(1, 57) = 10.89$, $p = .002$, $\eta_p^2 = .17$, respectively. When questioned during the *cued recall phase* two weeks after the experienced event ($M = 116.05$, $SD = 61.21$, 95% CI [100.09, 132.01]), children recalled significantly more correct narrative details than they did after two months ($M = 78.50$, $SD = 49.20$, 95% CI [65.68, 91.33]). Two weeks after the event ($M = .86$, $SD = .15$, 95% CI [.82, .90]), children's reports during the *cued recall phase* were also significantly more accurate than two months after the event ($M = .78$, $SD = .25$, 95% CI [.71, .84]). There was no significant main effect of Delay for the number of incorrect narrative details, $F(1, 57) = .06$, $p = .813$, $\eta_p^2 = .00$. Also, no significant main effect of Group or Group x Delay

interaction emerged for the amount of correct or incorrect narrative details recalled, or for accuracy, all *F*s < . 65, all *p*s > .351.

Table 3. Recall informativeness and accuracy

Means and standard deviations for the number of narrative details recalled (correct; incorrect) and percentage accuracy of children's recall, by group and delay.

	Group and Delay							
	ASD				TDC			
	2W		2M		2W		2M	
Narrative details	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Overall performance								
Correct	290.41	151.37	240.70	138.94	343.06	151.37	259.44	138.94
Incorrect	41.07	42.96	43.85	71.59	43.84	42.96	58.78	71.59
Accuracy %	.88	.12	.85	.14	.87	.12	.82	.14
Open-ended Recall								
Correct	170.37	122.26	165.30	131.11	231.00	122.26	177.84	131.11
Incorrect	20.82	31.21	26.89	69.05	25.75	31.21	38.72	69.05
Accuracy %	.88	.14	.88	.14	.89	.14	.86	.14
Cued Recall								
Correct	120.04	60.99	75.41	49.02	112.06	60.99	81.59	49.02
Incorrect	20.26	23.98	16.96	18.59	18.09	23.99	20.06	18.59
Accuracy %	.86	.15	.79	.25	.87	.14	.76	.24

Notes. ASD: Autism Spectrum Disorder; TDC: Typically Developing Children; 2W: 2-week interview; 2M: 2-month interview.

Repeated versus new information

Table 4 shows means and standard deviations for the number of narrative details recalled (correct; incorrect) and the accuracy of children's recall in the two-month interview, for each group and type of information recalled (repeated; new).

Overall narrative details recalled and accuracy. The 2 (Type of Information) x 2 (Group) repeated measures ANOVA revealed a significant main effect of Information Type for the number of correct narrative details, $F(1, 57) = 31.92$, $p < .001$, $\eta_p^2 = .36$, and the number of incorrect narrative details $F(1, 57) = 22.11$, $p < .001$, $\eta_p^2 = .28$. Children reported significantly more correct repeated ($M = 156.30$, $SD = 97.77$, 95% CI [130.82, 181.79]), than new information ($M = 93.77$, $SD = 61.46$, 95% CI [77.75, 109.79]) and more incorrect new ($M = 47.55$, $SD = 71.48$, 95% CI [28.92, 66.19]), than repeated information ($M = 3.76$, $SD = 5.55$, 95% CI 2.31, 5.21]).

There was also a significant main effect of Information Type for accuracy, $F(1, 56) = 94.68$, $p < .001$, $\eta_p^2 = .63$, which was qualified by a significant Information type x Group interaction, $F(1, 56) = 4.25$, $p = .044$, $\eta_p^2 = .07$. Simple effects analysis examining the effects of Information type within each Group revealed a significant main effect of Information type in both the ASD, $F(1, 56) = 26.65$, $p < .001$, $\eta_p^2 = .32$, and TD, $F(1, 56) = 77.54$, $p < .001$, $\eta_p^2 = .58$, groups. Pairwise comparisons ($p < .05$, with a Bonferroni correction) showed that, for both groups, information that was repeated in both interviews was more accurate than the information newly reported at two months. There were no other significant main or interaction effects.

Open-ended recall phase. There was a significant main effect of Information Type for the number of correct narrative details, $F(1, 57) = 29.47$, $p < .001$, $\eta_p^2 = .34$, the number of incorrect narrative details $F(1, 57) = 9.56$, $p = .003$, $\eta_p^2 = .14$, and accuracy $F(1, 57) = 59.73$, $p < .001$, $\eta_p^2 = .53$. Children reported significantly more correct repeated ($M = 111.10$, $SD = 92.08$, 95% CI [87.09, 135.11]), than new information ($M = 60.47$, $SD = 57.38$, 95% CI [46.82, 74.13]) and more incorrect new ($M = 30.20$, $SD = 68.76$, 95% CI [12.28, 48.13]), than repeated information ($M = 2.60$, $SD = 4.82$, 95% CI [1.34, 3.86]). Additionally, information that was repeated in both interviews ($M = .97$, $SD = .06$, 95% CI [.95, .98]) was more accurate than the information newly reported at 2 months ($M = .70$, $SD = .26$, 95% CI [.64, .77]). There were no significant interaction effects.

Cued recall phase. There was a significant main effect of Information Type for the number of correct narrative details, $F(1, 57) = 5.06$, $p = .028$, $\eta_p^2 = .08$, incorrect narrative

details $F(1, 57) = 42.40$, $p < .001$, $\eta_p^2 = .43$, and accuracy $F(1, 57) = 61.43$, $p < .001$, $\eta_p^2 = .54$. Children reported significantly more correct repeated information ($M = 45.20$, $SD = 35.16$, 95% CI [36.04, 54.37]), than new ($M = 33.30$, $SD = 28.31$, 95% CI [25.92, 40.68]) and more incorrect new information ($M = 17.35$, $SD = 18.70$, 95% CI [12.48, 22.23]), than repeated ($M = 1.16$, $SD = 2.59$, 95% CI [.49, 1.84]). Additionally, information that was repeated in both interviews ($M = .95$, $SD = .12$, 95% CI [.92, .98]) was more accurate than the information newly reported ($M = .65$, $SD = .29$, 95% CI [.58, .73]) after two months. There were no significant interaction effects.

Table 4. Repeated and New information

Means and standard deviations for the number of narrative details recalled (correct; incorrect) and percentage accuracy of children's recall, by group and information type (repeated; new).

	Group and information type								
	ASD					TDC			
	Repeated		New			Repeated		New	
Narrative details	*M*	*SD*	*M*	*SD*		*M*	*SD*	*M*	*SD*	
Overall Recall										
Correct	151.07	97.42	89.63	61.24		161.53	97.42	97.91	61.24	
Incorrect	4.56	5.54	39.30	71.22		2.97	5.54	55.81	71.22	
Accuracy %	.94	.08	.74	.19	*	.97	.08	.67	.19	*
Open-ended Recall										
Correct	107.67	91.75	57.63	52.19		114.53	91.75	63.31	52.19	
Incorrect	3.48	4.81	23.41	68.52		1.72	4.81	37.00	68.52	
Accuracy %	.96	.06	.72	.27		.98	.06	.69	.25	
Cued Recall										
Correct	43.41	35.03	32.00	28.21		47.00	35.03	34.59	28.21	
Incorrect	1.07	2.58	15.89	18.63		1.25	2.58	18.81	18.63	
Accuracy %	.93	.12	.69	.29		.97	.12	.62	.29	

Notes. ASD: Autism Spectrum Disorder; TDC: Typically Developing Children; 2W: two-week interview; 2M: two-month interview.

* Significant information type (repeated vs new) difference $p < .05$

Discussion

The current study investigated the impact of different delays on children with ASD's retention and forgetting of events they had experienced. Contrary to our first hypothesis, we found that for both groups of children the overall recall of the event (i.e., completeness) remained unchanged over time. As predicted, recall became less detailed and less accurate over time. By the time of the two-month interviews, children in both groups provided significantly fewer correct narrative details about the event overall and in both the open-ended and the cued recall phases of the interviews separately. The accuracy of the narrative details provided also deteriorated over time. These findings have important implications for legal contexts because they underline the degrading effects of delay on the richness and quality of eyewitness testimony by children with ASD.

Our results show some similarities to the findings obtained in studies examining autobiographical memory in children and adults (e.g., Bruck et al., 2007; Crane & Goddard, 2008; Crane et al., 2009) in that individuals with ASD appeared to have difficulties retrieving memories of past events (e.g., events that occurred in the past 6 months or in other lifetime periods). As in those studies, our findings provided further evidence that, when asked to retrieve memories of a past event, children with ASD failed to recall key aspects of that event (i.e., gist). Although, over time, recollections of the event remained stable, children with ASD failed to recall almost half of what happened during the experienced event (as did typically developing peers).

In line with our prediction, all participants' accounts of the event were significantly less detailed after two months. Our findings are consistent with research suggesting that, over delays of several months or years, there is typically a decrease in the amount of correct information retrieved and reported (La Rooy et al., 2005a, 2007; Pipe & Wilson, 1994; Ornstein et al., 1992; Pipe et al., 1999; Salmon & Pipe, 1997). We also hypothesised that the accuracy of children's recall would deteriorate over the longer delay studied. Our findings support this prediction and add to the body of research demonstrating that longer retention intervals are associated with decreases in accuracy, although the numbers of errors remained constant (Baker-Ward et al., 1990; Pipe & Wilson, 1994; Pipe et al., 1999 [except for 6-7 year-olds in experiment 2 who reported more erroneous information over time]; Salmon & Pipe, 1997). Interestingly, this decrease in accuracy after a long delay was not evident for the information elicited during the open-ended recall phase of the interview. Children in both groups maintained remarkable levels of free recall accuracy even when interviewed two months after the event. This finding has important implications for legal questioning because

it provides further evidence that freely recalled information constitutes the most accurate form of testimony (Lamb et al., 2008; Milne & Bull, 1999), including for children with ASD.

Overall, we found that the completeness of the accounts provided by children with ASD remained stable over time, but their memory reports were less detailed and less accurate after a longer delay. This finding was not unique to children in the ASD group, however. Indeed, despite substantial mean declines over time in the number of correct details recalled by and the accuracy of children in the ASD group, group differences did not reach statistical significance, suggesting that the same forgetting processes might have been at work in both groups of children.

Contrary to our second hypothesis, we found no evidence that children's with ASD accounts of the event were significantly less complete or less detailed than those of TD peers and, as predicted, they were just as accurate, even after a long delay. Specifically, we found that children in the ASD group performed as well as children in the comparison group when interviewed both soon and longer after the event (although our results show they required more prompts than TD children to recall the same amount of information). In line with previous research on both children and adults (e.g., Henry et al., 2017b [except in the RI versus BP interview comparison]; Maras & Bowler, 2010; Maras et al., 2012, 2013), we found that the memory reports of children with ASD were as complete and elaborated as that of non-ASD children in response to both open-ended and cued recall questioning. Additionally, children in the ASD and comparison groups did not differ with respect to the accuracy of their reports, replicating previous findings (e.g., Henry et al., 2017a, 2017b; Maras & Bowler, 2010; Maras et al., 2012, 2013; McCrory et al., 2007). However, our findings contrast with those obtained in studies that have shown episodic memory deficits in children with ASD (Bruck et al., 2007; Henry et al., 2017a; Mattison et al., 2015, 2016; McCrory et al., 2007). Two interpretations of the present data must be considered.

First, the lack of significant differences in recall performance between children with and without ASD during the interviews could be related to the encoding-specificity principal of memory (Tulving & Thomson, 1973). It has been argued that the way information has been encoded and stored in memory controls the ways in which this information can be retrieved, so providing specific retrieval cues about the event should facilitate recall (Tulving & Thomson, 1973). In ASD, the failure to use organising strategies to support memory leads to difficulties in remembering events (Minshew & Goldstein, 2001). Bowler et al. (2004) thus suggested that the provision of more supportive retrieval mechanisms may help individuals with ASD to recall more information.

In the current study, we used a child-directed interviewing style emphasising the use of free recall and follow-up open-ended questions based on information the child had previously provided and using the child's words as contextual cues to elicit narrative responses. We would speculate that, due to their preference for processing features (i.e., attention to detail), children with ASD placed greater reliance on "verbatim" memories, which are better tapped in open-ended tasks (Happé & Frith, 2006). Using such distinct retrieval cues in combination with open-ended prompts throughout the interview may have facilitated the recall of target-specific information. This likely resulted in the enhanced recall of information (e.g., Anderson, 1983; Tuckey & Brewer, 2003), allowing children with ASD to perform as well as children in the comparison group during the open-ended recall phase of the interviews. Henry et al. (2017b) similarly found that 6- to 11-year-old children with ASD were indistinguishable from their peers with respect to the amount of freely recalled information provided when they were interviewed using similar best-practice interview procedures, though the children with ASD did not benefit from the assistance of Registered Intermediaries like TD children did.

Following the same reasoning, the similar levels of performance by children with ASD and TD children during the cued recall phase of the interview are not surprising and are consistent with a growing body of research (Bowler et al., 2008; Maras & Bowler, 2010; Maras et al., 2012, 2013; McCrory et al., 2007). Prompting children with ASD to recall the information about the event that was missing using focused questions such as "Did you see a book that time?" and follow-up open prompts to encourage children to elaborate on their responses increased the amount of information recalled overall. This is consistent with Bowler et al.'s (2004) task support hypothesis which suggests that, when children with ASD are given more cues about the to-be-remembered information at retrieval, difficulties in performance are less evident. However, it is crucial to mention decades of findings in both field and experimental demonstrated that when children are asked questions that tap recognition memory (such as option-posing or suggestive questions) they are more likely to give erroneous answers because such questions exert greater pressure to respond (see reviews by Lamb et al., 2008, 2018). Studies involving TD children and children with ASD suggest that they show response biases when asked recognition questions (e.g., Daprati, Nico, Delorme, Leboyer, & Zalla, 2013; Lind & Bowler, 2009b), which underlines the oft-expressed concerns about using such prompts when questioning children about past experiences.

Secondly, the similar performances of children with and without ASD may be related to the event used in the current study. Although we used a neutral and standardized event, it is

possible that the session was more distinctive and perhaps emotionally arousing for children in the ASD group, as it was associated with their ASD diagnosis. Receiving a diagnosis can have a great impact on individuals and can generate a range of emotions (e.g., anxiety, confusion, anger, relief) (e.g., Calzada, Pistrang, & Mandy, 2012; Jones, Goddard, Hill, Henry, & Crane, 2014; Punshon, Skirrow, & Murphy, 2009). There is evidence that emotional processing helps children with ASD compensate for deficits in autobiographical memory and facilitate the encoding and consolidation of events (e.g., Goddard, Dritschel, Robinson, & Howlin, 2014). In adults with ASD, emotion has also been found to enhance recall by fostering more detailed accounts of dynamic eyewitness stimuli (e.g., Maras et al., 2012). Furthermore, research on TD children's memory for personally experienced events indicates that salient positive or negative events may be particularly memorable and forgotten less than neutral, non-arousing events (e.g., Burke, Heuer, & Reisberg, 1992; Fivush et al., 2004; Hamond & Fivush, 1991; Peterson, 2011).

If in fact the present findings are influenced by the effect of enhanced recall for, or attenuated forgetting of, the potentially emotionally arousing nature of the event, the implications for the legal context would be substantial because most criminal events are, at least in part, emotionally arousing. However, we did not assess the emotional impact of receiving an ASD diagnosis, so this interpretation is speculative. Moreover, there is also some evidence that recall performance in adults with ASD is not influenced by emotion (Deruelle, Hubert, Santos, & Wicker, 2008). Thus, future research exploring memory for positively and negatively arousing events by children with ASD would be valuable.

Our third hypothesis concerned the nature of the information provided after a lengthy delay. We found that most of the information provided by children in both groups in the second interview was repeated. We also found evidence of reminiscence with children recalling new pieces of information that had not been reported previously. Importantly, the information consistently reported across interviews was considerably more accurate than the new information, and these findings are in keeping with a strong body of research comparing the accuracy of new and repeated information (e.g., Brown, Pipe, Lewis, Lamb, & Orbach, 2012; La Rooy et al., 2009, 2007; Peterson et al., 2001; Pipe et al., 1999). Our results demonstrated that there were no group differences in the nature of the information recalled two months after the experienced event. Specifically, children with ASD and TD children reported similar amounts of repeated and new information, and the repeated information was more accurate than the new information reported by children in both groups.

Certainly, we cannot disregard the possibility that previous supportive interviews may have helped strengthen children's memories, allowing them to subsequently recall new information (see La Rooy et al., 2009 for a review). Recently, Brown, Lewis, and Lamb (2015) re-interviewed children with and without intellectual disabilities six months after they experienced a staged event. They found that children were more informative, more accurate, and less suggestible when they had been interviewed previously using the NICHD Protocol than when the first interview took place six months after the event. We did not examine children's recall when they had only been interviewed two months after the event, so we cannot assume that the same effect would have been evident in this study. Nevertheless, as in previous research, we too found that, when children with ASD were given a second opportunity to describe their experiences, new and accurate information that was not revealed before came to light (Cederborg et al., 2008; Fivush et al., 2004; Hershkowitz & Terner, 2007; Katz & Hershkowitz, 2013; La Rooy et al., 2005a, 2007; Waterhouse et al., 2016).

Several experimental studies have shown that the delay between interviews may affect the accuracy of new information, and that the lengthier the delay between interviews the lower the reliability of the novel information reported (La Rooy et al., 2005a). It is thus also possible that the early interview and the not-too-long delay between interviews in this study may have helped children to consolidate and preserve their memories. Additionally, their previous exposure to the interview setting may have positively contributed to the development of a trusting relationship with the interviewer, making children with ASD feel less anxious and thus more comfortable, which in turn may have promoted further disclosure of relevant information (as with typical developing children: e.g., Carnes, Nelson-Gardell, Wilson, & Orgassa, 2001; Carnes, Wilson, & Nelson-Gardell, 1999; La Rooy, Katz, Malloy, & Lamb, 2010). However, although the present findings indicated that a delayed interview can yield a substantial amount of novel accurate information about the experienced event, professionals should not injudiciously undertake second or multiple interviews because there are risks of contamination and secondary victimization (Peixoto, 2012; Quas et al., 2005; Ribeiro, 2009).

This study represented the first attempt to measure the ability of children with ASD to recall a personally experienced event following a delay of two months. However, as in most laboratory eyewitness research there are some limitations to acknowledge. Our clinical sample comprised cognitively and verbally able children with ASD, and we cannot be certain whether the same difficulties or capabilities would be observed among less intellectually capable children with ASD. It would be extremely important that future research included

individuals on the autism spectrum whose intellectual or verbal ability is below the normal range. Unfortunately, practical constraints prevented us from testing verbal or full-scale IQ, but only children with ASD and intellectual and linguistic abilities currently within the normal range (verbal quotients of 85 or above and full-scale IQ of 90 or above) were referred to us for participation, and TD children did not have any symptomology or known intellectual, developmental, or neurological disorders. Our sample size was comparable to that in previously published studies involving individuals with ASD, but we acknowledge that it is relatively small by the standards of psychology more generally. It is important to replicate our findings using a larger sample, to allow the examination of more complex interactions between variables. It is also important to note that the constraints involved in conducting a staged event for an experimental study meant that the children were questioned about a neutral standardized event, so generalising these findings to stressful real-world events must be done with caution. The event used in the current study was rich, long, and interactive. However, real criminal events are likely to be physically and/or emotionally stressful, so we cannot assume that the same memory capabilities would be observed in relation to such events.

Our findings represent one more step along the route to helping professionals improve their practices and tailor interactions to individuals on the autism spectrum. We found that this particular group of vulnerable witnesses can be reliable informants about their experiences, even when a substantial amount of time has elapsed between the event and subsequent reporting. It may be especially crucial to minimize the time gap between investigated incidents and forensic interviews for children with and without ASD because delay, as our findings illustrated, may degrade the richness and quality of their eyewitness testimony. When this is not possible, professionals should at least be aware that, as with typically developing children, cognitively and verbally able children with ASD will most likely produce less detailed and less accurate accounts of the investigated events after a substantial amount of time.

A SINGLE REFERENCE LIST IS PROVIDED AT THE END OF THE THESIS

3.2. Effects of delay, question type, and socioemotional support on episodic memory retrieval by children with Autism Spectrum Disorder

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Abstract

Twenty-seven children with Autism Spectrum Disorder (ASD) and 32 typically developing (TD) peers were questioned about an experienced event after a two-week delay and again after a two-month delay, using the Revised National Institute of Child Health and Human Development (NICHD) Investigative Interview Protocol. Recall prompts elicited more detailed and more accurate responses from children in both groups than recognition prompts. Although children with ASD recalled fewer correct narrative details than TD peers when questioned using open-ended recall prompts, they were as accurate as TD peers in response to recognition prompts. The informativeness and accuracy of children's reports remained unchanged over time. Social support was beneficial when children were interviewed for the first time but not after a longer delay.

Keywords: autism, delay, eyewitness testimony, question types, socioemotional support

Effects of delay, question type, and socioemotional support on episodic memory retrieval by children with Autism Spectrum Disorder

Research in both field and experimental contexts has demonstrated that the methods and techniques used to retrieve memories of experienced and witnessed events– in other words, the type of questions posed - affect the structure of children's responses and, particularly, the amount and accuracy of the information provided (Lamb et al., 2015). As noted below, some researchers have explored how well children and adults with ASD recall and describe events in response to a diverse range of questions soon after the events were witnessed or experienced, but it is unclear how detailed and accurate their recall is after longer delays between an event and subsequent reporting. One goal of the present research was thus to explore how well children with ASD recalled an experienced event after delays of two weeks and two months. A further goal was to determine whether the amount and accuracy of information recalled varied depending on the supportiveness of the interviewer.

Efficacy of Different Interviewer Prompts

Evidence from both field and experimental research has determined that broad open-ended prompts which tap recall memory processes, such as invitations ("Tell me everything that happened") and cued invitations (e.g., "Earlier you mentioned […]. Tell me everything about that") are associated with detailed, accurate, and uncontaminated descriptions of experienced events (see Lamb et al., 2015; Milne & Bull, 1999 for reviews). However, extensive research investigating the specific memory profiles of individuals with ASD have shown that they often have difficulties when asked to freely recall information (Bennetto et al., 1996; Boucher & Warrington, 1976; Bowler et al., 1997; Maras et al., 2012; McCrory et al., 2007). Such findings suggest that reliance on free recall prompts, as universally advocated by various protocols and professional guidelines for forensic interviewers (American Professional Society on the Abuse of Children, 2012; Home Office, 2011; Lamb et al., 2018), because they elicit elaborative narrative accounts, may be problematic for witnesses with ASD.

Some studies have shown that, soon after an event, children and adults with ASD recall less information than TD peers in response to free-recall prompts, such as "Tell me everything that happened" (e.g., Bruck et al., 2007; Henry et al., 2017a; Mattison et al., 2015, 2016; McCrory et al., 2007). In addition, individuals with ASD appear less accurate than TD peers when answering free recall questions shortly after witnessed or experienced events (e.g., Bruck et al., 2007; Maras & Bowler, 2010, 2011, 2012). In contrast, other researchers have reported that the free recall answers of individuals with ASD can be as accurate as those

of TD peers (Henry et al., 2017a; McCrory et al., 2007), particularly when they are supported by techniques such as the sketch-reinstatement-of-context (Henry et al., 2017b; Mattison et al., 2015, 2016), Verbal Labels (Henry et al., 2017b), or physical context reinstatement (Maras & Bowler, 2012) techniques. Such findings suggest that free recall prompts can elicit accurate but less detailed information from children with ASD.

Directive questions, phrased as *wh*- questions (e.g., what, how, who, when, and where) also draw on recall processes and are often used in forensic interviews and in court (Andrews et al., 2015; Waterhouse et al., 2016; Yi, Lamb, & Jo, 2015). Directive questions involve cued recall, rather than free recall, sometimes refocusing children on previously disclosed details about the event but requesting specific categories of information. Cued recall often appears to be intact in individuals with ASD (Bennetto et al., 1996; Minshew, Goldstein, Taylor, & Siegel, 1994), including when they are recalling experienced events (Bowler et al., 2008; Maras & Bowler, 2010; Maras et al., 2012, 2013; McCrory et al., 2007; Millward et al., 2000).

Children's recognition memory (i.e., the ability to decide whether a stimulus was or was not previously experienced or viewed) can be assessed using close-ended yes/no, forced-choice, multiple-choice, and leading questions that request confirmation, denial, or selection among specific interviewer-generated options (i.e., option-posing questions). Studies assessing recognition memory in individuals with ASD often show no significant differences in performance between ASD and TD individuals (Bowler et al., 2008; Lind & Bowler, 2009b, 2009a; Minshew & Goldstein, 1993; Minshew et al., 1992).

Taken together, these findings suggest that directive (i.e., cued recall) and option-posing (i.e., recognition) questions might be appropriate when interviewing children with ASD. However, it is now well-established that children provide less information in response to cued recall questions and closed questions that tap recognition memory than to free recall prompts, and that these questions are usually associated with more inconsistent and erroneous responses (Brown et al., 2013; Brown & Lamb, 2015; Cederborg et al., 2000; Lamb & Fauchier, 2001; Oates & Shrimpton, 1991; Peterson et al., 1999; Waterman, Blades, & Spencer, 2000). In addition, comparable performance between children with and without ASD is not always evident in cued recall and recognition tests (e.g., Bruck et al., 2007; Millward et al., 2000).

To our knowledge, no studies have directly explored the effects of delay on responses to recall and recognition-based prompts and questions by children with ASD. Previous studies investigating the effects of delay on TD children's recall of non-stressful or staged events (as

in the current study) have reported variability in performance over time in response to different types of prompts. Some studies have found that children's accounts remain the same or even get better over time in response to free- and open-ended prompts (e.g., Bruck, Ceci, & Hembrooke, 2002; Fivush & Hamond, 1989; La Rooy et al., 2005 [Experiment 1 & 2]; Pipe, Sutherland, Webster, Jones, & La Rooy, 2004) whereas others suggest that the amount and accuracy of the information retrieved decreases after longer delays in response to both free recall and recognition prompts (e.g., Baker-Ward, Hess, & Flannagan, 1990; Hudson & Fivush, 1991; La Rooy, Lamb, & Pipe, 2008; La Rooy, Pipe, & Murray, 2005 [Experiment 3]; Pipe, Gee, Wilson, & Egerton, 1999 [Experiments 1 & 2]; Salmon & Pipe, 1997). These divergent findings are possibly related to methodological differences in how children's reports were scored, because different studies have assessed different aspects of children's memories (Peterson, 2011).

In the course of a thorough interview, like a forensic interview, children are probed for information using a range of differently formulated recall and recognition-based prompts and questions. However, no research to date has specifically examined how children with ASD respond to different types of interviewer questions (i.e., unstructured, open-ended, free recall prompts versus specific cued recall, or close-ended and focused recognition prompts) after an extended delay, and how their responses to such types of questions change over time.

The Role of Socioemotional Support

Over the past two decades, field and laboratory research has turned attention to how socioemotional factors affect children's ability to provide evidence within legal proceedings (e.g., Goodman et al., 1991; Hershkowitz et al., 2009; Price et al., 2016). Developmental theories suggest that social support plays an important role in enhancing children's cognitive performance (e.g., Fischer, 1980) and the use of child-friendly interview techniques is currently advocated by researchers and professionals (e.g., Price et al., 2016; Saywitz et al., 2015; Vallano & Compo, 2015). Establishing rapport and being supportive is important to gain children's trust and cooperation in legal contexts (Aldridge & Wood, 1998; Goodman & Bottoms, 1993; Hershkowitz et al., 2006; Powell & Thomson, 1994).

Some analogue research studies suggest that supportive and non-suggestive interviewing techniques, such as effective rapport-building using verbal and non-verbal socioemotional support can reduce TD children's anxiety and discomfort, encouraging them to cooperate and provide elaborate and accurate accounts of past experiences (e.g., Bottoms et al., 2007; Goodman et al., 1991; Rush et al., 2014). Researchers have also demonstrated that support can decrease children's suggestibility (e.g., Carter et al., 1996; Davis & Bottoms, 2002;

Goodman et al., 1991). However, in some laboratory analogue studies researchers have failed to find an effect of support on children's responses to free recall and/or specific questions (e.g., Carter et al., 1996; Davis & Bottoms, 2002; Imhoff, 2000; Imhoff & Baker-Ward, 1999). The discrepancies may be due to methodological differences in relation to the nature of the event (stressful vs. neutral), the delay (e.g., two weeks, four weeks, one year), and the types of questions used to retrieve children's memories.

In field studies, however, the results have been more consistent. Most research investigating suspected victims' reports of child abuse suggests that interviewer supportiveness (e.g., non-suggestive positive reinforcement, addressing the child in a personal way, referring to the child's emotions, facilitators) increases the amount and/or accuracy of the information provided (e.g., Hershkowitz, 2009; Hershkowitz et al., 2006; Teoh & Lamb, 2013; but see Lewy, Cyr, & Dion, 2015).

Hershkowitz, Lamb, Katz, and Malloy (2013) explored whether supportive, non-suggestive techniques embodied in the recently developed Revised NICHD Protocol (the protocol used in the current study to retrieve children's memories of the target event) would help alleged victims of intra-familiar abuse become more cooperative and less reluctant during forensic interviews (Ahern et al., 2014; Hershkowitz et al., 2017, 2014, 2013; Lamb et al., 2015). Children interviewed using the supportive Revised Protocol by Hershkowitz et al. (2013) were less reluctant and this was, in turn, associated with increases in the number of relevant details provided. Likewise, Ahern, Hershkowitz, Lamb, Blasbalg, and Winstanley (2014) found that supportive statements in the pre-substantive part of the same interviews studied by Hershkowitz et al. (2013) promoted children's responsiveness and cooperation.

Overall, the available evidence seems to suggest that socially supportive interviewing conditions facilitate the disclosure of past experiences (especially abusive experiences) and increase the amount of information provided by children, without compromising accuracy. However, to our knowledge, no studies have examined the impact of interviewer-provided social support during investigative interviews on the memory performance of children with ASD.

The current study

In the current study, we investigated how children with ASD responded to various types of interviewer prompts incorporated into the best-practice Revised NICHD Interview Protocol and how effectively different types of questions elicited new and accurate event-relevant information from children with ASD in two interviews. We were particularly interested in comparing the efficacy, after differing delays, of open-ended recall prompts,

such as invitations and cued invitations, relative to more focused recall and recognition prompts (e.g., directive, option-posing and focused/ contaminating questions) in eliciting relevant information from children with ASD. Additionally, we examined the effects of interviewer supportiveness on the amount and accuracy of children with ASD's accounts of personally experienced events, after differing delays. We explored how effectively supportive interviewer prompts elicited new and accurate event-relevant information, relative to prompts without social support, in the course of non-suggestive, child-oriented interviews.

Based on previous findings, it was predicted that children with ASD would report fewer narrative details than typically developing children in response to invitations and cued invitations (i.e., free recall prompts), but that there would be no difference between groups in responses to directive (i.e., cued recall prompts), option-posing, and focused/contaminating questions (i.e., recognition prompts). We expected that invitations and cued invitations would elicit more and more accurate narrative details from children in both groups than directive, option-posing, and focused/contaminating questions. Because no research has specifically examined the responses of children with ASD to different types of interviewer prompts after an extended delay, we made no predictions regarding their performance relative to TD children.

Also, informed by the research reviewed above, we predicted that supportive interviewer prompts would elicit more information than prompts not containing support, without compromising the accuracy of that information. Because some experimental studies involving interviews soon after the event have shown no effects of support on recall we expected that supportive prompts would be particularly effective in eliciting more detailed responses after a longer delay when children's memory for the experienced event was less strong.

In light of the social interaction and communication deficits associated with ASD (APA, 2013) two contrasting predictions could be made regarding whether children with ASD should benefit from, or even be receptive to, interviewer-provided social support. On the one hand, some children on the autism spectrum show little interest in and get anxious around other people, especially unfamiliar persons (Hobson, 2002; Lord, 1985, 1993), thus rendering social support during interviews unhelpful.

On the other hand, it has been argued that the increased anxiety of individuals with ASD in social situations is more related to atypical amygdala structure and function (e.g., Baron-Cohen et al., 2000; Munson et al., 2006) than to the social impairments associated with the disorder (e.g., Amaral & Corbett, 2003). Furthermore, social interaction and cooperation by

cognitively able children with autism can be enhanced using intervention strategies designed to foster social competencies (e.g., Bauminger, 2002; Beaumont & Sofronoff, 2008; Hagopian, Kuhn, & Strother, 2009; Leaf et al., 2009). Thus, being supportive in uncertain and cognitively demanding situations, such as forensic interviews, could indeed help children with ASD feel more comfortable and less anxious, encouraging them to produce more complete and accurate accounts of past experiences.

Method

Sample

Fifty-nine 6- to 15-year-old children (mean = 9 years, 9 months) participated in the study (18 females and 41 males): 27 children with an ASD diagnosis who were able to verbally communicate and 32 typically developing children. The children with ASD were recruited from the Peterborough Integrated Children's Health Services and the Cambridgeshire Community Services NHS Trust. Typically developing children were recruited from local schools in Peterborough and Cambridge. All children or their legal representatives provided informed consent and ethical approval for the study was obtained from the NHS Research Ethics Committee (NRES Committee East of England - Cambridge South).

All ASD participants (23 males and 4 females) had received (independently of the research study and two weeks before the research interview) a formal autism diagnosis by an appropriately qualified clinical professional. This diagnosis was obtained using the assessment criteria of the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2; a cut-off point of 7 or 8), and the Autism Diagnostic Interview, Revised, which confirmed that the participants met DSM-V criteria for ASD (American Psychiatric Association, 2013). After diagnosis, the children and their caregivers were informed about the study by their clinician at the Peterborough Integrated Children's Health Services and given the relevant Participant Information Sheets and Consent forms. Children with ASD whose intellectual and linguistic abilities were within the normal range (verbal quotients of 85 or above; full-scale IQ of 90 or above – measured by the child clinician using the Wechsler Intelligence Scale for Children-Third Edition) and were interested in taking part in the study were then referred to us and contacted to set up the subsequent study sessions.

Thirty-two typically developing children (18 males,14 females) were recruited through local mainstream schools in Peterborough and Cambridge. For each ASD participant, one or more typically developing child of the same chronological age was selected for the comparison group. They had no known psychiatric, developmental or neurological disorders,

as indicated by parents/caregivers and the absence of symptomology to the date of the study. An independent *t-test* confirmed that the groups did not differ significantly with respect to chronological age, $t(57) = -1.70$, $p = .095$ (ASD: $M = 10.63$, $SD = 3.02$, range = 6-15; TD: $M = 9.38$, $SD = 2.66$, range = 6-15).

Materials and procedure

This study was conducted in three phases. In phase one, children personally experienced an interactive live event and in phases two and three they were interviewed about this event using a best practice structured interview protocol, the first time after a short two-week delay and again after a longer two-month delay.

Phase one: event-to-be-recalled

The event-to-be-recalled was a set of activities included in the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2). The ADOS-2 is a standardized instrument that assesses social interaction, communication, and imagination during a semi-structured interaction with an examiner (Lord, Luyster, Gotham, & Guthrie, 2012). In this session, children engaged in a series of activities involving interactive stimulus materials. For children with ASD, a qualified psychiatrist conducted the ADOS-2 as part of the child's diagnosis process, independently from the research study. This session occurred two weeks before children took part in the study. Typically developing children experienced the activities included in the ADOS-2 as part of the research study. A psychiatrist, with prior ADOS-2 training, conducted this session either at the Peterborough Integrated Children's Health Services or at the University of Cambridge.

The activities that children engaged in during the event corresponded to Module 3 of the ADOS-2, with the exception of seven children with ASD who experienced Module 4 as per the clinician's decision. The same tasks and materials comprised both modules 3 and 4. The examiners strictly followed the ADOS-2 manual and always provided the same instructions and displayed the same items, in the same way, and sequence, so the duration of the sessions ($M = 44.63$ minutes; range 40-53 minutes) depended only on the amount of time each child took to perform each task. Bivariate correlations revealed no significant relationships between the length of the event (ADOS-2 session) and the total number of unique narrative details recalled at the two-week interview by children in the ASD $r(27) = -.03$, $p = .901$, and TD $r(32) = .16$, $p = .381$ groups. The same results emerged for the two month interview with no significant relationships between the length of the event and the total number of unique narrative details recalled by children in the ASD $r(59) = -.06$, $p = .773$, and TD $r(32) = .25$, p

= .161, groups. All event sessions were video-recorded, and the recordings were later used to determine the accuracy of the children's accounts.

The event-to-be-recalled included a construction task, make-believe play, joint interactive play, a demonstration task, the description of a picture, telling of a story from a book, telling of a story depicted in cartoons, conversations about something that happened to the child in the past, questions about a variety of topics, a break, and the creation of a story using objects provided. Table 1 provides a detailed description, with examples, of the activities experienced during the event-to-be-recalled. Parents were asked not to discuss the event with their child because we were interested in what the children themselves remembered. On each subsequent session, parents confirmed not having talked with their child about what had happened during the event.

Table 1. Event to-be-recalled

Event description and examples

Activities	Materials	Description
Construction Task	Puzzle pieces and printed design to be duplicated	The examiner/ researcher asked children to perform a construction task in which they assembled blocks to construct a design shown on a printed form.
Make-believe Play	Bag 1: 2 male action figures, 1 female action figure, 3 "prop" (one for each action figure), miniature hairbrush, 2 small tools, toy dinosaur Bag 2: small spoons and plates, several pieces of miniature food, small teapot/pitcher/measuring cup, miniature book, toy car, toy rocket, small ball, hologram disk, and two pieces of "junk" (small piece of cloth and small "jewellery")	The examiner/ researcher gave children some miniature play objects and instructed them to play with these materials.
Joint interactive Play	Materials from "Make-Believe" Play (Bags 1 and 2)	After a few moments the examiner joined in, making it clear that the play had become collaborative. The examiner/ researcher then told the children it was time to move on to the next activity and allowed them to help clean up the materials.
Demonstration Task	-	The examiner/ researcher asked children to demonstrate toothbrushing. The examiner drew with his/her finger a sink and faucet handles, a toothbrush, toothpaste, and a cup on the table in front of the participant and said:

		"Now I want you to show me and tell me how to brush your teeth. Start right at the beginning. You've just come into the bathroom to brush your teeth. What do you do now?"
Description of a picture	Option 1: Resort scene; Option 2: U.S. map scene	The examiner/ researcher showed children a picture and asked them to describe it.
Telling a story from a book	2 picture storybook for Modules 3 and 4	The examiner/ researcher asked children to recount a sequential story from a book of pictures. "Let's look at this book. It tells a story in pictures. See, it starts out with [first picture in the book]. Can you tell me the story as we go along? You go first. Then, I'll take a turn."
Cartoons	Series A: fisherman/pelican series Series B: monkey/coconut series	The examiner/ researcher showed the children a set of cards presenting a brief story in cartoon form, one frame per card, without any dialogue or narrative text. The examiner placed the cards one by one on the table and offered a brief statement describing the relevant setting. Children were then instructed to push their chair back from the table, stand up, and tell the story.
Conversation and Reporting	-	During the session, children were also encouraged to describe an event (e.g., a non-routine episode that had actually occurred (as opposed to an account of a film or story) such as a birthday party, a family celebration, a holiday, etc.).
Questions	-	The examiner/ researcher asked children to answer a set of questions regarding a variety of topics. All children were asked the exact same questions about emotions (e.g., "what do you

		like doing that makes you feel happy and cheerful?"; "What about things that you're afraid of?"), social difficulties and annoyances (e.g., "Are there things that other people do that irritate or annoy you?"; "Have you even been teased or bullied? Why, do you think?"), friends, relationships, and marriage (e.g., "Do you have some friends?", How is a friend different from someone whom you just go to school with?"), and loneliness (e.g., "Do you ever feel lonely?"). The seven children with ASD who experienced module 4 of the event were asked the same questions, as well as questions about responsibility (e.g., "Who takes care of your money") and future plans and hopes.
Break	Mini game (e.g., shape puzzle), drawing paper, set of 8 markers, pin art, spin pen (spin top with pen base), small radio, current newspaper and magazine	The examiner/ researcher gave children a break during which he gave them some objects and materials and encouraged them to play freely. The break could occur at any time during the session.
Creating a story	6 small objects with a definite purpose (e.g., umbrella, car), 6 small objects with no clear purpose (e.g., piece of string, wooden block)	The examiner/ researcher asked children to create a story using a set of objects. A bag containing twelve small objects was provided. The examiner picked five things from the bag and used them to make up a story. After finishing his/her story, the examiner/researcher instructed the children to pick five different things from the bag and make up their own story.

Phases two and three: interviews

Children were interviewed about the personally experienced event twice, the first time after a short two-week delay and again after a longer two-month delay. Both interviews were conducted accordingly to the best practice Revised NICHD Protocol developed by Lamb and colleagues (see Lamb et al., 2018 for a full discussion of the Protocol), by one of three interviewers (the first author, a licenced forensic psychologist with experience interviewing vulnerable witnesses using the NICHD Protocol; a graduate and a post-graduate psychology research assistant, both with previous training in the use of the NICHD Protocol and experience of interviewing vulnerable interviewees). The two interviews were conducted by the same person, except in four cases where practical constraints prevented the same interviewer from conducting both interviews. One-way Analyses of Variance (ANOVA) showed no significant effect of Interviewer on the total number of narrative details reported by children in the two-week interview, $F(2, 56) = 1.63$, $p = .204$, or in the two-month interview, $F(2, 56) = .89$, $p = .417$.

This was the first study to use the NICHD Protocol (standard or revised versions) to interview children with ASD about events they had personally experienced. The NICHD Protocol is a structured, non-suggestive, and child-directed interview protocol and its recent revision incorporates advice for interviewers on how to build better rapport and provide children with more support throughout the interview. The NICHD Protocol has been systematically evaluated in the field, is currently used by forensic interviewers in several countries worldwide and is recommended to forensic investigators in the United Kingdom (Home Office, 2011). The positive impact of using this Protocol to interview children in several countries has been examined recently (La Rooy et al., 2015) and it has been proven effective with different populations, including children as young as 3 years old (Hershkowitz, Lamb, Orbach, & Darvish, 2008; Hershkowitz et al., 2012; Lamb et al., 2003), and children with intellectual disabilities (e.g., Brown & Lamb, 2015; Brown, Lewis, & Lamb, 2015; Brown, Lewis, Lamb, & Stephens, 2012; Brown, Lewis, Stephens, & Lamb, 2017).

All interviews (at both time points) comprised the same phases in the same order, as follows: (1) greet; (2) rapport (3) ground rules, truth and lie exercise; (4) substantive recall part of the interview (i.e., interviewers' statements or questions and children's responses that pertained to the investigated event); and (5) closure. Children were assured that there were no wrong or right answers and that there were no time limits. While children were explaining what they could remember, the interviewer exhibited active listening and did not interrupt the child. Literal and concrete thinking is common in individuals with ASD, so interviewers

framed each question/statement (for both groups of children) as directly, briefly, and clearly as possible to avoid providing too much information at once. Children were provided long wait/processing times after each question/statement to give them time to reflect on the questions and answers. This study focused on the information elicited during the *substantive portion of the interviews*, and so only this portion of the interview is described in detail below. We briefly describe the greet, truth and lie, rapport and closure phases, and the full interview protocol is available in Lamb et al. (2018).

Interviewers began by introducing themselves and establishing rapport and proceeded to clarify the children's task (the need to describe experienced events truthfully and in detail) and explain the ground rules for the interview (i.e., that they could and should say "I don't remember," "I don't know," "I don't understand," or correct the interviewers when appropriate). In the rapport-building phase, children were prompted to provide information about personally meaningful topics using open-ended invitations (e.g., "Tell me about things you like to do") and were encouraged to elaborate on their responses. They were then asked to describe in detail a recent event they had experienced (e.g., holiday, birthday party, first day at school, etc.) to practice retrieval of episodic memories and to further develop rapport. Here the interviewer introduced other types of questions that could be used when seeking information about the to-be-recalled event.

The *substantive* part of the interviews followed the structure outlined in the Revised NICHD Protocol. The interviewers used a series of open-ended recall prompts (e.g., invitations, follow-up invitations, cued invitations, *wh*- questions) to encourage children to provide as much information as they could remember about the event and children's responses were used as cues for further recall. More focused prompts, such as yes/no questions, were avoided but used if needed to clarify unclear information and these were followed by open prompts (e.g., "Tell me more about that"). Once the child had finished speaking and was waiting for the next instruction, they were once again asked: "Is there anything else you remember?". This prompt was repeatedly asked until the child could not offer further information.

In our study we included an additional questioning phase that is not part of the Revised NICHD Protocol. This questioning phase was implemented after children stated they couldn't remember anything else about the event, but there was still information that was missing (i.e., only some of the activities children experienced during the event were remembered). Here, the interviewer probed the child for the information that was missing, asking a series of focused questions. The number and content of these questions were dependent on the

activities that the child had failed to remember during the open-ended recall phase. These were paired and followed-up with open prompts to encourage children to elaborate in their responses. For example, if in response to the focused question "Did you see a book that time?", a child responded "Oh yeah. A book with flying frogs", the interviewer would then ask "Tell me more about the book with flying frogs". Before ending the interview by discussing a neutral topic, the interviewer once again asked whether the child remembered anything else about the event and after that, they were thanked for their efforts and participation.

A variety of supportive non-suggestive comments were used throughout the interviews. Interviewers expressed interest in the reported experiences (e.g., "I really want to know more about [reported experience"]), provided positive non-suggestive reinforcement (e.g., "You are really helping me understand what happened that day"), encouraged elaboration (e.g., "It is really important that you tell me everything you remember") and offered reassurance (e.g., "Don't worry. It's ok that you don't remember"). Interviewers also showed appreciation for the children's efforts (e.g., "Thank you for telling me about that") and used neutral facilitative comments (e.g., "ok", "yes", "uhuh", "go on", or repetition of the child's last words). More details about the coding and categorisation of these comments are provided below.

Data coding

All interviews were video-recorded and transcribed verbatim. Coding focused on information that pertained to the target event (i.e., the substantive portion of the interview), therefore excluding any introductory exchanges at the beginning of the interview, attempts to establish rapport with the child, and attempts at the end of the interview to discuss neutral topics.

Interviewer Prompts

Interviewer utterances were coded using the NICHD Interview Coding Scheme (Lamb et al., 2008) as invitations, cued invitations, directive, or option-posing and the total number of each type of utterances was recorded for each child. Focused/contaminating questions were also identified and totalled for each child. Each question type is described below.

Invitations referred to open-ended utterances using questions, statements, imperatives, or contextual cues to elicit narrative free-recall responses. These did not restrict the child's focus except in a general sense. Invitations could also follow-up on information just mentioned or request additional free-recall elaboration about details previously mentioned (e.g., *Tell me*

everything that happened from the beginning to the end; Tell me more about that; Then what happened?).

Cued invitations were utterances that refocused the child's attention on previously mentioned details and used them as contextual cues in open-ended invitations to elicit narrative free-recall responses. Refocusing could be related to content cues (e.g., activities, objects, people, actions) mentioned by the child (e.g., *You mentioned [content mentioned by the child], tell me about that; Tell me everything that happened from [an occurrence/action mentioned by the child] until [another occurrence/action mentioned by the child]*).

Directive questions referred to utterances that focused on event-related information mentioned by the child earlier in the interview and requested additional information (or clarification) using a category, mostly wh- questions (who, what, when, where, how). Directive questions were "cued-recall" prompts (e.g., *Where/when did it happen? What colour was the puzzle?*).

Option-posing prompts were closed-ended questions that focused the child's attention more narrowly on aspects of the event. They tapped recognition memory processes and could be formulated as yes/no or forced-choice questions (e.g., *Were the toys on the table when this happened? Were the toys inside the bag or on the table?*).

Focused/contaminating questions introduced event-related information (i.e., activities, aspects) that had not been previously disclosed by the child but did not imply that a particular response was expected (as suggestive questions would do). All focused/contaminating questions in this study asked about events or details that had occurred (as opposed to misleading questions) and varied depending on whether they were closed, requiring a yes or no answer (e.g., *Did you see a book that time?*), or whether they were open, requiring the children to provide the response (e.g., *I heard there was a book that time.*).

Interviewer supportiveness

Expressions of support in the substantive portion of the interviews were coded using an adaptation of the scheme developed by Hershkowitz and colleagues (2006). The total number of each type of utterance (supportive versus non-supportive prompts) was recorded for each child. The interviewer prompts were either supportive or neutral; thus, non-supportive prompts refer to the absence of supportive comments within interviewer utterances.

Expressions of *social support* referred to comments intended to unconditionally encourage children to be informative. These included addressing the child in a personal way, by using his/her name (e.g., *John, tell me everything about the book*); providing supportive non-suggestive positive reinforcement of the child's behaviour during the interview that was

unrelated to the content of their reports or to any other substantive issue (e.g., *You are remembering a lot*); providing comments showing appreciation for the child's efforts and collaboration during the interview, but not specific contents (e.g., *Thank you for telling me about that*); and providing comments offering general reassurance (e.g., *That's ok; Don't worry*).

Children's responses

In the current study, children's recall of the personally experienced live event was assessed by counting the number of unique narrative details provided and by assessing their accuracy (i.e., the number of correct narrative details divided by the number of correct plus incorrect details).

Each unique narrative detail provided by the child was counted. A detail consisted of relevant words naming, identifying, or describing individual(s), object(s), event(s), place(s), and action(s) that were part of the event, as well as any of their features (e.g., appearance, location, time, duration, sound). Details expressing personal knowledge or habits (e.g., *I always wash my teeth like this*) were not counted. Each narrative detail provided was counted, but only when it was new and added to the understanding of the target event. For example, the following child response contained 38 new narrative details: "Yeah. There was a man fishing and he caught a fish and put it in his bucket. Then the cat took the fish out of the bucket and sort of walked away with it. And then there was a pelican, which took the fish out of the cat's hand and put it in his mouth and flew away with it".

Narrative details were counted for each question type separately and the total number of unique narrative details was tabulated, including details provided in response to all types of questions, i.e., the sum of the narrative details elicited by invitation, cued invitation, directive, option-posing and focused questions. When analysing children's responses to supportive and non-supportive prompts the question types were collapsed and narrative details were counted for each prompt type separately (i.e., supportive prompts, non-supportive prompts) as was the total number of unique narrative details, including details provided in response to both types of prompts, i.e., the sum of the narrative details elicited by supportive and non-supportive prompts. Both the supportive and non-supportive prompts could be associated with any question type (i.e., invitations, cued invitations, directive and option-posing questions). Focused questions were not associated with supportive comments and thus this type of question was not included in any of the analyses regarding support.

We followed a child-oriented interview protocol and children chose the content of the information they wanted to provide. The number of questions of each type asked during the interviews was entirely dependent on the information previously disclosed by the child and, as a result, each child was asked a different number of each type of question. To take this into account in the analyses, the dependent variables were calculated by dividing the cell count of interest (e.g., total number of narrative details elicited using invitations in the interview) by the appropriate grouping total (e.g., total number of invitations asked in the interview), for each child. This gave us an average number of narrative details provided per prompt of each type (i.e., when an invitation was asked, children provided an average of X narrative details per prompt). This allowed us to explore whether different types of interviewer prompts were likely to elicit more information about the experienced event, regardless of how many prompts of each type were posed during the interview.

Similarly, supportive comments were included in some interviewer utterances (but not others) throughout the interview; as a result, each child received a different number of supportive or non-supportive questions. To take this into account in the analyses, our dependent variables regarding support were also calculated by dividing the cell count of interest (e.g., the total number of narrative details elicited by supportive prompts) by the appropriate grouping total (e.g., the total number of supportive prompts), for each child. This gave us an average number of narrative details provided per question of each type (i.e., when a supportive invitation was asked children provided an average of X narrative details, and so forth).

To determine the accuracy of the information supplied, we searched the video recordings of the event. Narrative details were coded as either correct or incorrect (i.e., errors of commission, such as describing a ball as red instead of blue, as well as reporting a piece of information that was not present or did not occur within the event). Details that could not be verified using the video recordings of the event were not scored. Percentage accuracy was determined by dividing the total number of correct narrative details recalled by the total number of narrative details recalled (i.e., correct + incorrect narrative details). As with the number of narrative details, the percentage accuracy was calculated for each question type and for each child.

Reliability of scoring

An independent rater scored twenty-four randomly selected interview transcripts (20% of the total). He was blind to the children's diagnoses as well as the aims and

hypotheses of the research but familiar with the template method of scoring used here. Cohen's Kappa coefficients for agreement between raters for interviewer prompt types was K = .98, as it was for interviewer supportiveness (K = .98). Agreement was also high when identifying unique narrative details (K = .95) and verifying the accuracy of the narrative details provided by children (correct details K = .94; incorrect details K = .99). One of the raters, also blind to the child diagnosis, scored the remainder of the transcripts.

Analysis plan

Research questions were addressed using a series of mixed-design analyses of variance (ANOVA), with Group entered as the between-subjects variable, and Prompt type and Delay entered as the within-subjects repeated-measures factors. For these analyses, we used the average number of narrative details recalled per question of each type. Separate analyses were carried out on the average numbers of correct narrative details, incorrect narrative details, and percentage accuracy. All parametric tests were conducted with child as the unit of analysis. Post hoc power analyses were conducted for each inferential test reported using G*Power version 3.1. When the assumption of sphericity was violated (Mauchly's test), degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity. Effect sizes are indicated by partial eta-squared (η_p^2). Simple effects analyses (with Bonferroni corrections) were used to unpack significant interactions. All statistical comparisons were two-tailed, using $p < .05$ as the level of significance.

We then examined the effects of interviewer-provided support on the amount and accuracy of the information elicited. Separate analyses were carried out on the average number of correct narrative details, incorrect narrative details, and percentage accuracy. Research questions were addressed using a series of repeated measures ANOVAs, with Group entered as the between-subjects variable, and Support entered as the within-subjects factor. All effects are reported as significant at $p < .05$. Effect sizes are indicated by partial eta-squared (η_p^2).

Results

Preliminary results

We analysed the substantive portions of the 118 interview transcripts. In total, an average of 49.47 (*SD* = 4.13, *n* = 5838) question-response pairs were identified in each transcript. Of these, an average of 36.00 (*SD* = 13.18, *n* = 4248, 72.76%) were substantive prompts, and 13.68 (*SD* = 9.49, *n* = 1587, 27.18%) were non-substantive prompts (i.e., procedural prompts or questions not related to the target event). Of the substantive prompts per interview, an

average of 13.14 were invitations (*SD* = 3.95, *n* = 1551, 36.51%), 5.75 were cued invitations (*SD* = 2.48, *n* = 661, 15.56%), 1.26 were summary statements (*SD* = .93, *n* = 39, 0.92%), 6.70 were directive prompts (*SD* = 6.07, *n* = 771, 18.15%), 4.86 were option posing (*SD* = 3.98, *n* = 501, 11.79%) and 6.14 were focused/contaminating questions (*SD* = 3.12, *n* = 725, 17.07%).

The total number of prompts (invitations, cued invitations, directive, option-posing and focused/contaminating questions) given was totalled for each child. One-way ANOVAs with Group as the fixed factor were carried out for each time point, using the total number of prompts as the dependent variable. There was a significant main effect for Group in the two-week interview, $F(1, 57) = 14.39$, $p < .001$, and in the two-month interview, $F(1, 57) = 10.53$, $p = .002$. Two weeks after the experienced event, children with autism (*M* = 53.67, *SD* = 21.77, 95% CI [45.05, 62.28]) were given significantly more prompts than typically developing peers (*M* = 37.75, *SD* = 8.74, 95% CI [34.60, 40.90]). Two months after the experienced event, children with autism (*M* = 45.85, *SD* = 13.89, 95% CI [40.36, 51.35]) were also given significantly more prompts than TD peers (*M* = 36.16, *SD* = 8.85, 95% CI [32.96, 39.35]).

Next, one-way ANOVAs with Group as a fixed factor was carried out for each time point, using the total numbers of each type of prompt as the dependent variables. For directive questions, there was a significant main effect for Group in the two-week interview, $F(1, 57) = 14.05$, $p < .001$, and in the two-month interview, $F(1, 57) = 12.39$, $p = .001$. No significant main effects for Group were found for the remaining question types (invitations, cued invitations, option-posing, and focused questions), at both time points, all *F*s < 14.05, all *p*s > .077. In both interviews, children with autism (two weeks: *M* = 9.93, *SD* = 7.37, 95% CI [7.01, 12.84]; two months: *M* = 8.85, *SD* = 7.51, 95% CI [5.88, 11.82]) were given significantly more directive prompts than TD peers (two weeks: *M* = 4.44, *SD* = 3.48, 95% CI [3.18, 5.69]; two months: *M* = 3.81, *SD* = 2.81, 95% CI [2.80, 4.83]).

In total, 27% (n = 1289) of the interviewer prompts were supportive and 73% (n = 3535) were neutral/non-supportive. Of the supportive prompts, children with ASD received an average of 6.78 (*SD* = 3.56, range = 1-17) supportive prompts per interview and typically developing children (TDC) received an average of 8.06 (*SD* = 3.05, range = 2-15) supportive prompts per interview.

Two 5 (Prompt: invitations, cued invitations, directive, option-posing) x 2 (Group: ASD, TDC) repeated measures ANOVAs were carried out on the number of supportive prompts for each delay. Mauchly's test indicated that the assumption of sphericity had been violated for

the main effect of Prompt in the two-month interview, $\chi 2$ (5) = 12.65, $p < .028$, so degrees of freedom were corrected using Greenhouse–Geisser estimates of sphericity ($\varepsilon = .66$). There was a significant main effect of Prompt in the two-week interview, $F(3, 45) = 4.70$, $p = .006$, $\eta_p^2 = .24$, but not in the two-month interview, $F(3, 27) = 1.16$, $p = .336$, $\eta_p^2 = .11$. At both time points, there was no significant main effect of Group and no significant Prompt x Group interaction, all Fs < 1.44, all ps > .245. In the two-week interview, children were given more supportive invitations ($M = 3.79$, $SD = 2.30$, 95% CI [2.60, 4.98]), than supportive directive prompts ($M = 1.82$, $SD = 1.11$, 95% CI [1.25, 2.39]). No other significant differences were found.

Next, a 2 (Delay) x 2 (Group) repeated measures ANOVA was carried out on the number of supportive prompts. There was a significant main effect of Group, $F(1, 56) = 5.02$, $p = .029$, $\eta_p^2 = .08$, with TD children receiving more supportive prompts ($M = 7.50$, $SD = 2.98$, 95% CI [6.72, 8.28]) than children with ASD ($M = 6.19$, $SD = 3.33$, 95% CI [5.32, 7.06]) but there was no significant main effect of Delay $F(1, 56) = 3.81$, $p = .056$, $\eta_p^2 = .064$, and no significant Delay x Group interaction, $F(1, 56) = .19$, $p = .668$, $\eta_p^2 = .003$.

Discriminant function analyses revealed no significant effects for gender with respect to the number of narrative details remembered and the accuracy of those details and thus data were collapsed across gender for further analyses.

Main results

Analyses of the effects of interviewer prompts

Table 2 shows means and standard deviations for the average number of narrative details recalled per question asked (correct; incorrect) and the percentage accuracy of children's recall, for each group and each prompt type (invitations, cued invitations, directive, option-posing, and focused questions).

Table 2. Recall informativeness and accuracy per question type

Means and standard deviations for the average number of narrative details reported per question asked and percentage accuracy of children's recall in response to each type of prompt by group and information type.

	Narrative Details and Group												
	Correct					Incorrect				% Accuracy			
	ASD		TDC			ASD		TDC		ASD		TDC	
Prompt type	*M*	*SD*	*M*	*SD*		*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Invitation	6.45	7.93	9.62	7.28	*	0.78	1.80	1.62	1.65	.88	.11	.87	.11
Cued Invitation	14.08	16.87	22.21	15.49	*	1.94	5.48	3.84	5.04	.88	.17	.86	.15
Directive	5.14	10.07	9.61	9.25	*	1.36	2.00	1.45	1.83	.84	.19	.84	.18
Option-posing	2.27	2.93	1.98	2.69		0.30	0.64	0.52	0.59	.74	.26	.74	.24
Focused/contaminating	5.34	3.36	4.60	3.08		1.30	1.21	1.02	1.11	.83	.19	.84	.18

Notes. ASD: Autism Spectrum Disorder; TDC: Typically Developing Children.

* Significant group difference $p < .05$

Correct narrative details

A 5 (Prompt) x 2 (Delay) x 2 (Group) mixed-design ANOVA was carried out on the number of correct narrative details recalled per question asked. Degrees of freedom were corrected using Greenhouse–Geisser estimates of sphericity for the main effect of Prompt, $\varepsilon = .49$ and the Prompt x Delay interaction, $\varepsilon = .61$. There was a significant main effect of Prompt, $F(1.94, 110.49) = 68.21$, $p < .001$, $\eta_p^2 = .55$, with cued invitations (M = 18.64, SD = 11.45, 95% CI [15.66, 21.63]) eliciting significantly more correct narrative details per prompt than any other prompt type. Invitations (M = 8.18, SD = 5.38, 95% CI [6.78, 9.59]) and directive prompts (M = 7.18, SD = 6.84, 95% CI [5.40, 8.97]) did not differ from each other and elicited more correct narrative details per prompt than option-posing questions (M = 1.99, SD = 1.99, 95% CI [1.47, 2.50]). Focused/contaminating questions (M = 5.07, SD = 2.28, 95% CI [4.48, 5.67]) did not differ from directive questions and elicited significantly more correct narrative details per prompt than option-posing questions, but significantly fewer than invitations and cued invitations.

There was a significant main effect of Delay, $F(1, 57) = 8.02$, $p < .006$, $\eta_p^2 = .12$. Children provided significantly more information per question asked two weeks (M = 8.89, SD = 4.52, 95% CI [7.71, 10.07]) than two months (M = 7.54, SD = 4.21, 95% CI [6.44, 8.64]) after the event. There was also a significant main effect of Group, $F(1, 57) = 7.35$, $p = .009$, $\eta_p^2 = .11$, and a significant Prompt x Group interaction, $F(4, 228) = 5.46$, $p < .001$, $\eta_p^2 = .09$. Simple effects analyses examining the effects of Group on each prompt type revealed a significant Group effect on invitations, $F(1, 57) = 6.24$, $p = .015$, $\eta_p^2 = .10$, cued invitations $F(1, 57) = 7.09$, $p = .010$, $\eta_p^2 = .11$, and directive questions, $F(1, 57) = 4.26$, $p = .044$, $\eta_p^2 = .07$. Pairwise comparisons ($p < .05$, with a Bonferroni correction) showed that children with ASD reported significantly fewer correct narrative details per question asked in response to invitations, cued invitations and directive questions than did age-matched TD peers. Post hoc power analyses were conducted, which indicated that the mixed-design ANOVA had adequate power for all main effects and interactions (>.80).

Incorrect narrative details

A 5 (Prompt) x 2 (Delay) x 2 (Group) mixed-design ANOVA was carried out on the number of incorrect narrative details recalled per question asked. Degrees of freedom were corrected using Greenhouse–Geisser estimates of sphericity for the main effect of Prompt, $\varepsilon = .37$ and the Prompt x Delay interaction, $\varepsilon = .34$. There was a significant main effect of Prompt, $F(1.48, 84.43) = 7.30$, $p < .003$, $\eta_p^2 = .11$, but no significant main effects of Group or

Delay and no interactions. Children reported significantly fewer incorrect narrative details per question asked when prompted using option-posing questions (M = .41, SD = .44, 95% CI [.24, .58]) than when prompted using invitations (M = 1.20, SD = 1.81, 95% CI [.73, 1.67]), directive (M = 1.41, SD = 2.00, 95% CI [.88, 1.93]) or focused/contaminating questions (M = 1.16 SD = .82, 95% CI [.84, 1.47]). Post hoc power analyses indicated that the mixed-design ANOVA had adequate power for the main effects of Prompt, Group and interaction (>.80), but not for the main effect of Delay and interactions (<.80).

The effects of Delay on responses to each type of question was analysed further using a series of repeated measures ANOVAs, with Group entered as the between-subjects variable, and Delay entered as the within-subjects repeated-measures factor. The analyses revealed a significant main effect of Delay, $F(1, 57) = 5.19$, $p = .027$, $\eta_p^2 = .08$ for the amount of incorrect narrative details recalled per option-posing question asked, but not for the remaining types of questions. Children provided significantly more incorrect narrative details per option-posing question asked two months (M = .22 SD = .36, 95% CI [.13, .31]) after the experienced event than they did after two weeks (M = .60 SD = 1.23, 95% CI [.28, .92]). No significant Delay x Group interactions emerged, all Fs < 5.177, all ps > .072.

Percentage accuracy

A 5 (Prompt) x 2 (Delay) x 2 (Group) mixed-design ANOVA was carried out on the accuracy (percentage) of children's recall for each of the questions asked. Degrees of freedom were corrected using Greenhouse–Geisser estimates of sphericity for the main effect of Prompt, $\varepsilon = .77$, and the Prompt x Delay interaction, $\varepsilon = .62$. There was a significant main effects of Prompt, $F(3.06, 174.61) = 7.41$, $p = .001$, $\eta_p^2 = .115$, but no significant main effects of Group or Delay and no interactions[3]. The narrative details elicited using invitations (M = .88 SD = .08, 95% CI [.85, .91]) and cued invitations (M = .87 SD = .10, 95% CI [.83, .91]) were significantly more accurate than those elicited using option-posing questions (M = .74 SD = .16, 95% CI [.68, .80]). Post hoc power analyses indicated that the mixed-design ANOVA had adequate power for the main effects of Prompt, Delay and interactions (>.80), but not for the main effect of Group and the Prompt x Group interaction (<.80). The effects of Group on the accuracy of children's responses to each question type was analysed further in a 5 (Prompt) x 2 (Group) repeated measures ANOVA. The analyses also revealed a significant

[3] The same results emerged when the percentage accuracy scores were subjected to arcsine transformations.

main effect of Prompt, which was described above, but no significant main effect of Group and no interaction[4].

Analyses of the effects of support

The effects of Group on recall were already reported in the previous analyses, thus we only report the effects of Support (as a within-subjects variable). Table 3 show the means and standard deviations for the average number of narrative details recalled per question asked (correct; incorrect) and the percentage accuracy of children's recall, for children in each group (ASD; TDC) and each type of prompt (supportive prompts; non-supportive prompts).

Correct narrative details

Two 2 (Support) x 2 (Group) repeated measures ANOVAs were carried out on the number of correct narrative details recalled per prompt, one for each time point. There was a significant main effect of Support, $F(1, 57) = 7.02$, $p = .010$, $\eta_p^2 = .11$ in the two-week interview, but not in the two-month interview, $F(1, 57) = .77$, $p = .383$, $\eta_p^2 = .01$. Supportive interviewer prompts (M = 13.00, SD = 11.52, 95% CI [9.99, 16.00]) elicited significantly more correct narrative details per prompt than non-supportive prompts (M = 9.48, SD = 6.76, 95% CI [7.72, 11.24]) when the children were interviewed after two weeks. There were no significant interactions at either time point.

Incorrect narrative details

Two 2 (Support) x 2 (Group) repeated measures ANOVAs were carried out on the number of incorrect narrative details recalled per prompt, one for each time point. The analyses revealed no significant main effects of Support in the two-week interview, $F(1, 57) = .85$, $p = .360$, $\eta_p^2 = .02$, or the two-month interview, $F(1, 57) = .39$, $p = .534$, $\eta_p^2 = .01$. Also, no significant Support x Group interactions were found.

Percentage accuracy

Two 2 (Support) x 2 (Group) repeated measures ANOVAs were carried out on percentage accuracy of the information provided, one for each time point. The analyses revealed no significant main effects of Support in the two-week interview, $F(1, 57) = .26$, $p = .609$, $\eta_p^2 = .01$, or the two-month interview $F(1, 57) = .75$, $p = .392$, $\eta_p^2 = .01$, and no significant Support x Group interactions[5].

[4] The same results emerged when the percentage accuracy scores were subjected to arcsine transformations.

[5] The same results emerged when the percentage accuracy scores were subjected to arcsine transformations.

Table 3. Recall informativeness and accuracy in response to support

Means and standard deviations for the average number of narrative details reported per question asked (correct; incorrect) and accuracy of children's recall, by group and interviewer supportiveness

	Group and Interviewer Supportiveness							
	ASD				TDC			
	Support		No-support		Support		No-support	
Details and Delay	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Two-week interview								
Correct	8.69	11.48	7.45	6.73	17.30	11.48	11.51	6.73
Incorrect	1.05	2.97	1.08	1.42	1.96	2.96	1.28	1.42
Accuracy %	.87	.17	.89	.12	.90	.17	.89	.12
Two-month interview								
Correct	7.65	9.06	6.62	7.12	11.74	9.06	10.89	7.12
Incorrect	1.30	8.89	0.97	2.56	3.27	8.89	2.40	2.56
Accuracy %	.81	.21	.87	.12	.86	.21	.84	.12

Notes. ASD: Autism Spectrum Disorder; TDC: Typically Developing Children.

Discussion

This study revealed the remarkable capacities of children with ASD to recall and report information regarding personally experienced events when interviewed using a structured and child-directed best-practice interview protocol. Our findings add to previous research demonstrating the effectiveness of using certain prompts, particularly open-ended child-led recall prompts, to elicit accurate accounts from vulnerable interviewees (Brown & Lamb, 2015; Brown et al., 2015, 2017; Brown, Lewis, et al., 2012; Lamb et al., 2003). We showed that such prompts were also beneficial when interviewing cognitively and verbally able children with ASD about their experiences. The present findings indicated that recall prompts elicited more detailed and accurate responses from children than recognition prompts. In particular, cued invitations elicited more detailed accounts than all other types of prompt, followed by invitations and directive prompts, which elicited similar amounts of information. Option-posing and focused/contaminating questions were the least effective for eliciting information about the event from children in both groups. Option-posing questions elicited significantly more errors after a longer delay.

A primary goal of the present study was to examine how children with ASD would respond to various types of interviewer prompts and how effectively such prompts elicited new and accurate event-relevant information. In line with best practice recommendations, the Revised NICHD Protocol encourages interviewers to make extensive use of broadly open-ended prompts. Prompts such as invitations require episodic retrieval and involve autonoetic consciousness, i.e., the ability to use self-involvement to re-experience a past event in its full spatio-temporal context and mentally travel back in subjective time (Tulving, 1985). There is evidence that autonoetic consciousness (i.e., self-knowing) is reduced in ASD, due to a poorly developed level of self-awareness, which leads to difficulties in remembering personally experienced events (Lind & Bowler, 2008). Thus, based on the empirical observations of impaired episodic memory (Boucher, 1981; Lind & Bowler, 2008; Loth, Gómez, & Happé, 2011; McCrory et al., 2007), difficulties in the free recall of information (Bennetto et al., 1996; Boucher & Warrington, 1976; Bowler et al., 1997; Maras et al., 2012), and difficulties in the recall of personally experienced events (Crane & Goddard, 2008; Hare, Mellor, & Azmi, 2007; Klein et al., 1999; Lind & Bowler, 2010; Maras & Bowler, 2012, 2013) we expected that children with ASD would find it more difficult than TD peers did to recall what happened in response to broadly open-ended prompts, such as “Tell me everything that happened”.

As anticipated, children with ASD recalled fewer correct narrative details about the experienced event than TD children in response to input-free recall based-prompts (i.e., invitations and cued invitations). A possible explanation for their poorer free recall is that children with ASD found it difficult to conduct the cognitively demanding task of mentally traveling back in time to search for information about the event, as required to access episodic memory (Tulving, 2002), whilst also having to determine what aspects of the past event were relevant to the demands contained in open-ended free recall prompts such as "tell me *everything* that happened" (Loth, Gómez, & Happé, 2008). Deficits in executive functioning and working memory in individuals with ASD are well established (e.g., Bennetto et al., 1996; Hill, 2004) and can influence children's ability to perform in cognitively demanding and complex tasks (Minshew & Goldstein, 2001; Poirier, Martin, Gaigg, & Bowler, 2011; Williams et al., 2006), particularly when unsupported at retrieval (Bowler et al., 2008).

On the other hand, and contrary to our predictions, we found that invitations elicited just as many correct narrative details per prompt from children with ASD as open-ended directive prompts. Similarly, the information recalled by children with ASD in response to open-ended invitations was just as accurate as that recalled in response to more specific (directive) questions. The questions coded as *directive* in this study refer to focused recall questions, based on previously disclosed details, that requested specific categories of information (e.g., "Where was the ball?"). These questions have been named differently in laboratory studies of individuals with ASD, typically as "cued recall" or "specific/guided" questions, and the information provided in response to such questions by ASD individuals has been associated with equivalent levels of accuracy as that provided by TD peers (Bowler et al., 2008; Maras & Bowler, 2010; Maras et al., 2012, 2013; Millward et al., 2000). We too found that children with ASD were indistinguishable from TD peers with respect to the accuracy of their recall in response to directive questions.

Most noticeably, our study demonstrated the particular effectiveness of *cued invitations*, which are a distinctive feature of the NICHD Protocol, when interviewing children with ASD about their experiences. Cued invitations are follow-up open-ended prompts that refocus the child's attention on previously mentioned details (in their own words) and use them as contextual cues to elicit narrative or multiword responses ("Earlier you mentioned that you read a book with flying frogs. Tell me everything about the book with flying frogs."). The usefulness of this specific cuing strategy has been demonstrated in field and laboratory analogue studies with vulnerable children (Brown et al., 2013; Cederborg et al., 2008;

Cederborg & Lamb, 2008; Lamb et al., 2003) and our study provides further evidence of its effectiveness.

Although children with ASD recalled fewer details than TD peers in response to cued invitations, the information elicited using such prompts comprised core and accurate details about their experiences, even when a substantial amount of time had elapsed between the event and the interview (91% accurate in the two-week interview and 86% in the two-month interview). Moreover, when prompted using cued invitations, children with ASD recalled more (and more accurate) information than when prompted using any other type of prompt. It has been argued that more supportive retrieval techniques may aid witnesses with ASD to recall more information, possibly because their recall impairments are more related to retrieval than to encoding mechanisms (Maras & Bowler, 2013). The current findings supported the notion that cued invitations constitute effective ways of triggering the recall of information and enhance the capacity of children with ASD to elaborate upon their narrative accounts, by structuring recall of experienced events, associating them with pre-disclosed actions, and breaking them into smaller units.

Our results offered further evidence that open-ended recall-based prompts, particularly cued invitations, promote complete and accurate eyewitness recall in cognitively and verbally able children with ASD by fostering further elaboration of previously disclosed information. They also suggested that cognitively and verbally able children with ASD were as capable as TD children, with respect to the elaboration and accuracy of their recall, when they were questioned in a supportive manner, and in accordance with best practice recommendations.

We found no evidence that children with ASD were more likely to report erroneous information than TD peers. However, although children reported few incorrect narrative details overall, these were more frequently included in children's responses to recall-based prompts (invitations, cued invitations and directive prompts). Thus, all those involved in the criminal justice system should be aware that the use of such prompts might elicit extremely valuable and uncontaminated information about an event but might also lead children to include a small amount of incorrect information in their detailed responses.

All types of prompts elicited forensically relevant and accurate information from children, and our findings indicated that accuracy remained high even when the interviewer used prompts associated with higher error rates, such as option-posing prompts (Home Office, 2011; Lamb et al., 2018, 2008). In line with our initial prediction, when questioned using prompts tapping recognition memory, children with ASD provided less erroneous information than TD peers, which supports earlier reports of undiminished recognition

memory (e.g., Lind & Bowler, 2009b). This finding should, however, be interpreted with caution because recognition-based (option-posing) questions were the least productive prompts and were associated with a significant increase in the amount of erroneous information reported by children in both groups during the two-month interview. These findings are consistent with empirical evidence demonstrating that closed prompts (e.g., yes/no or multiple choice questions) elicit less detailed, coherent and organized responses, as well as more errors and inconsistent statements than any of the other types of prompts (Cederborg et al., 2000; Feltis et al., 2010; Korkman et al., 2006; Lamb & Fauchier, 2001; Waterman et al., 2000).

Furthermore, our results showed that accuracy remained high when interviewers asked focused/contaminating questions. After a two-month delay, the accounts provided by children with ASD were no less accurate in response to focused/contaminating prompts than after a two-week delay and were no less accurate than those provided by TD children. This is consistent with other reports that, when asked focused questions, cognitively and verbally able children and adults with ASD were no more suggestible than their typical counterparts (e.g., Bruck et al., 2007; Maras & Bowler, 2011; McCrory et al., 2007; North et al., 2008). However, our study did not directly assess suggestibility and the focused questions asked in the present study did not include questions as risky as suggestive confrontational (e.g., “Are you lying?”), or tag questions (e.g., “She told you to assemble a puzzle, didn’t she?”), which, if used, might have had a more damaging effect on accuracy.

Additionally, children in our study were not exposed to misinformation about the event and did not, according to their parents, discuss what happened during the event with other people. Individuals with ASD show impairments in executive function (Hill, 2004) and language comprehension (e.g., Henderson, Clarke, & Snowling, 2011; Jolliffe & Baron-Cohen, 1999; Norbury, 2005), which might make them more suggestible and vulnerable to contamination. Further research on this would thus be valuable.

Although children with ASD provided significantly fewer correct narrative details in response to each open-ended question asked than typical counterparts, their accounts at two weeks were as complete, and their overall informativeness and accuracy were the same as those of TD peers. These findings suggest that children with ASD may require more prompts than TD children to elicit the same amount of information, but these prompts do not need to be, and should not be, more specific, restrictive, or closed.

For children in both groups, supportive interviewer prompts elicited significantly more correct narrative details than non-supportive prompts, but, contrary to our predictions, social

support was particularly beneficial when children were interviewed for the first time and not after a longer delay. After a delay of two months, social support did not seem to affect children's responses. Importantly, there was no evidence that social support adversely affected children's accuracy either.

Empirical evidence generated in laboratory and field research has demonstrated that supportive interviewing techniques are associated with decreases in children's anxiety and, as a result, increases in children's responsiveness, cooperation, and the amount of relevant information provided (e.g., Hershkowitz, 2009; Hershkowitz et al., 2006; Rush et al., 2014). We too found that, after a short delay, children were more informative when the interviewer prompts contained supportive comments, without a concomitant increase in errors or decrease in accuracy. The first interview corresponded to an unfamiliar situation outside children's usual routine and the supportive behaviour of the interviewer (e.g., calling the child's name, thanking him/her for the information provided), might have helped to mitigate possible feelings of anxiety and discomfort that could otherwise have adversely affected children's performance during the interview.

However, whereas Bottoms et al. (2007) found that social support increased the amount of correct and decreased the amount of incorrect information reported by children one year after an experienced event, our results demonstrated that interviewer support did not have an effect on children's responses after a two month delay. This is in keeping with Imhoff's (2000) findings that interviewer support did not affect children's responses after a four-week delay. The lack of effect of social support during the second interview may be partially explained by children's previous exposure not only to the interviewer, but also to the interview setting, which progressively became a less strange, unfamiliar situation. Interviewers can build trust across repeated interviews and, as a result, lessen children's anxiety (Pipe et al., 2007).

Although we found no significant group differences in the effects of support during the two-week interview, there were substantial mean performance differences, suggesting that children in the two groups might have been differentially affected by supportive interviewing. Our findings do not clearly demonstrate whether children with ASD benefit from the same improvements to memory performance in response to social support as that reported by previous research for TD children. Our results clearly demonstrated that interviewer-provided social support did not adversely affect children's accuracy and, soon after the event, increased the amount of correct information recalled. These findings have important practical implications for the legal system, amongst others, suggesting that, by employing a more

supportive attitude during questioning, interviewers may help make the interview process more tolerable for children, without negatively affecting the quality of their testimony. Of course, whether or not interviewer-provided social support actually changes children's memory performance can only be fully demonstrated in experiments that include supportive and non-supportive control conditions and thus, further research would be valuable.

As in most laboratory eyewitness research there are some limitations to acknowledge. Our clinical sample comprised cognitively and verbally able children with ASD, and we cannot be certain that the same tendencies would be observed among less intellectually capable children with ASD. It is extremely important that future research include individuals on the autism spectrum whose intellectual or verbal ability is below the normal range. Unfortunately, practical constraints prevented us from testing verbal or full-scale IQ, but only children with ASD and intellectual and linguistic abilities within the normal range (i.e., verbal quotients of 85 or above and full-scale IQ of 90 or above) were referred to us for participation, and the typically developing children did not have any symptomology or known psychiatric, developmental, or neurological disorders.

Our sample size was comparable to that in previously published studies involving individuals with ASD, but it is relatively small by the standards of psychology more generally. It is important to replicate our findings using a larger sample, to allow the full examination of more complex interactions between variables. It is also important to note that the constraints involved in conducting a staged event for an experimental study meant that the children were questioned about a neutral standardized event, so generalising these findings to stressful real events (such as abusive incidents) may not be warranted. However, although we used a neutral and standardized event, it is possible that the session was more distinctive and potentially emotionally arousing for children in the ASD group, as it was associated with the moment of their ASD diagnosis. Future research exploring memory for both positively and negatively arousing experienced events by children with ASD would be valuable.

Most of the interviews were carried out in a different room, and in some cases in a different building, from the event-to-be-recalled, thereby avoiding context reinstatement, but this was not always possible. Previous research has suggested that returning to the same physical environment where the target event took place can enhance recall in adults with ASD (Maras & Bowler, 2012). Repeated interviews can also provide effective reinstatement for typically developing children because they foster systematic and detailed recall of a target event (La Rooy et al., 2005a), so it would be valuable to explore this issue in future research involving children with ASD.

Our research was a first step toward understanding the effect of interviewer supportiveness on the amount and accuracy of children with ASD's accounts of personally experienced events, after two-time delays. However, it did not include the necessary experimental conditions to fully test the effects of interviewer supportiveness. In future research, it would be important to include "intimidating", "neutral" and "supportive" interview conditions to fully test the effects of social support. With the exception of four cases, the same interviewer conducted both interviews as well, and this may have diluted the effects of supportive behaviour in the second interview. Further research should also consider possible carry-over effects of interviewer support from previous questions. Finally, we used a modification of the Revised NICHD Protocol to accommodate the social communication deficits often displayed by children with autism, and it remains to be seen whether other supportive strategies would have similar effects.

Notwithstanding these limitations, the current study showed that although cognitively and verbally able children with ASD may require more prompts than TD children to provide the same amount of information, they can provide meaningful and reliable accounts of their experiences, when appropriately questioned, even after lengthy delays. The findings reported above show that the best-practice principles embodied in the Revised NICHD Protocol, an open-ended child-oriented interview guide, effectively promote accurate remembering and responding by children on the autism spectrum. It is essential to continue investigating valid strategies and empirically validated retrieval support tools that can aid young witnesses with ASD to freely recall as much information as possible about past experiences when they come into contact with the criminal justice system. As previously highlighted, it is critical to explore ways to accommodate the sensory needs of children with autism in court, develop appropriate techniques to help them feel more comfortable and less anxious in legal settings, and encourage them to give elaborate and reliable accounts of past experiences.

Ethical approval

All procedures involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study. Ethical approval for the current study was obtained from the NHS Research Ethics Committee (NRES Committee East of England - Cambridge South).

A SINGLE REFERENCE LIST IS PROVIDED AT THE END OF THE THESIS

Chapter IV

4.1. General discussion

I begin this chapter with a summary of the key findings from the three approaches adopted here to investigate children's recall. These findings were discussed in-depth in each of the two core papers presented in chapter III, as were the limitations, which are not reiterated in the current chapter. In this final chapter, I broadly reflect on the implications of the findings and suggest some recommendations for practice.

In recent years, the body of knowledge about eyewitness recall by autistic individuals has grown considerably, reflecting advances in the field and demonstrating positive developments towards increasing the opportunities for these vulnerable witnesses to provide their best evidence in criminal proceedings (e.g., police or forensic interviews, court testimony). The focus has largely been on the reliability of that evidence, with researchers investigating the effectiveness of several techniques and procedures for enhancing recall without compromising the accuracy of the information retrieved. Despite these advances, we did not know how well autistic children could recall information regarding personally experienced events after a long delay, or how their reports changed over time. The studies described in this dissertation yielded a number of important findings in this regard, illustrating that intellectually and verbally able autistic children recall experiences after long delays, and that the accuracy with which they do so and the amount of information recalled changes over time and as a function of the way in which recall is elicited.

The first study presented in this thesis illustrated that autistic children did not differ from typically developing peers in all aspects of their overall memory performance, regardless of delay. Specifically, children in both groups provided equivalently complete, detailed, and accurate accounts on both occasions. The passage of time was, however, particularly detrimental for the richness and quality of the eyewitness reports of both groups of children. After a long delay, intellectually and verbally capable autistic children produced less details and less accurate accounts of past experiences, as did TD peers. Autistic and typically developing children reported similar amounts of consistent and new information when they were interviewed two months after the event. And, as expected, the information consistently reported in both interviews by children in both groups was more accurate than the newly reported information. These findings suggested that this particular group of vulnerable witnesses could act as reliable informants about their experiences, even when a substantial

amount of time has elapsed between the event and subsequent reporting, although several aspects of their memory reports deteriorate over time.

The second study demonstrated that recall prompts elicited more detailed and more accurate responses from children in both groups than recognition prompts. Particularly, cued invitations elicited more detailed accounts than all other types of prompt, followed by invitations and directive prompts, which elicited similar amounts of information. Option-posing and focused/contaminating questions were the least effective for eliciting information about the event from children with and without autism. Furthermore, option-posing questions elicited significantly more erroneous information from children in both groups after a longer delay. Our findings thus demonstrated that intellectually and linguistically competent autistic children required more prompts than TD children to provide the same amount of information, but these did not need to be more specific, restrictive, or closed. Furthermore, interviewer-provided social support did not adversely affect the children's accuracy and, soon after the event, increased the amount of correct information recalled.

The findings obtained in this dissertation have significant practical implications for a particularly vulnerable group of children who are at a clear disadvantage in many social contexts, including the criminal justice system. As pointed out earlier, children on the autism spectrum face developmental and neurological challenges which serve to further this disadvantage. It is imperative that all of those involved in the criminal justice system are aware of the idiosyncrasies of this especially vulnerable population and are offered evidence-based recommendations for practice. Over the past 70 years, the understanding of ASD has evolved considerably on the basis of a rapidly growing body of scientific evidence. It is urgent to find effective ways to disseminate this valuable scientific knowledge to the professionals conducting criminal investigations in the field to ensure that empirical findings appropriately inform investigative practice.

Governments and societies have come a long way toward recognising the vulnerabilities and needs of children with developmental disorders and in many countries have made it a priority to address those needs. Many advances have been made internationally to raise public awareness of autism, including the introduction of specific autism legislation, such as the Combating Autism Act of 2006 and the Combating Autism Reauthorization Act of 2014 in the USA, the Autism Act 2009, the Equalities Act 2010 and Children and Families Act 2014 in the UK, the Scottish strategy for autism 2011 in Scotland, the Autistic spectrum disorder (ASD) strategic action plan for Wales 2008 in Wales, the Autism Act (Northern Ireland) 2011 and the Autism Strategy and Action Plan 2013 in Northern Ireland.

In England and Wales, for example, autistic children are automatically deemed vulnerable under the Youth Justice and Criminal Evidence Act (1999: YJCA) and have to be interviewed with reference to Achieving Best Evidence guidance by specially trained interviewers (Home Office, 2011). Other positive developments have been made in recent years, such as the introduction of the Witness Intermediary Scheme in 2004 (Cooper, 2015). Currently, in Northern Ireland, England, and Wales, vulnerable witnesses, including children on the autism spectrum, can be supported during criminal proceedings by an impartial, trained professional "Registered Intermediary", responsible for facilitating communication between them and professionals in the justice system (Cooper & Wurtzel, 2015; Cooper & Allely, 2017; Cooper & Wurtzel, 2014). Other countries such as Australia, Canada, New Zealand, and South Africa have also adopted or have shown interest in this scheme (Henderson, 2015; Plotnikoff & Woolfson, 2015).

Despite the noteworthy legal and practical advances, professionals in the field continue to struggle to implement best-practice recommendations and to make the adaptations needed to elicit best evidence from autistic individuals (Crane et al., 2016). There are still several concerns to be addressed, some of which are undoubtedly challenging to tackle, namely minimizing the typically long delays between the alleged incidents and subsequent testimony (Lamb et al., 2015), but others can more easily be achieved, such as improving the ways in which children with ASD are questioned about their experiences. Many professionals have recognized their vulnerabilities and expressed the need for specialized training, information, and more organisational support (Adebowale, 2013; Crane et al., 2016), which is crucial to ensure that professionals respond effectively and fairly to autistic individuals within the legal system (Bradley, 2009; Department of Health, 2010, 2014; Equality Act, 2010).

Our findings represent one more step along the route to helping professionals improve their practices and tailor interactions to individuals on the autism spectrum. It may be especially crucial to minimize the time gap between investigated incidents and forensic interviews for autistic children, because delay, as our findings illustrated, may degrade the richness and quality of the eyewitness testimony provided by autistic children. When this is not possible, professionals should at least be aware that, after longer delays, even intellectually and linguistically able autistic children may produce less complete accounts of their past experiences, and some important aspects of the event may have been forgotten. As with typically developing children, autistic children who do not have concomitant language and/or intellectual impairments will also most likely produce less accurate accounts of the investigated events.

Our first study suggests that autistic children who are not intellectually and linguistically impaired can perform as well as their typically developing counterparts if they are provided with appropriate support during interviews--that is, if they are interviewed using effective questioning strategies, which maximize the reliance on recall memory by offering open-ended prompts so as to minimize the risk of eliciting erroneous information, especially when a substantial amount of time has passed since the witnessed or experienced event. These findings are encouraging for legal professionals who conduct forensic interviews and have direct implications for managing expectations about how much autistic children are able to tell about their experiences. Once autistic children in this study began to recall and verbalized their experiences, their abilities were notable and comparable to those of typically developing children, a finding that can be (somewhat) reassuring when professionals rely on the testimony of autistic children for evidence. It is important to note, though, that although favourable, these findings should be interpreted with caution when formulating conclusions for the wider autism spectrum. The autistic children that participated in this study did not have accompanying intellectual disabilities, linguistic impairments, or broader memory difficulties on top of their ASD-specific memory deficits (Boucher, Mayes, & Bigham, 2008; Boucher et al., 2012). As a result, we cannot be certain whether the same remarkable capabilities would be observed among less intellectually and/ or verbally competent autistic children, who might have poorer memories of the event.

What was at first glance surprising, considering the theoretical conceptions of memory in autistic individuals and previous findings of deficient episodic recall (e.g., Bruck et al., 2007; Henry et al., 2017a; Mattison et al., 2015, 2016; McCrory et al., 2007), was that, compared to TD peers, autistic children did not display impoverished recall in relation to the gist of the event. Comparable performance by autistic and typically developing children with respect to narrative details recalled about an experienced event has been found before (e.g., Henry et al., 2017b), but McCrory et al. (2007) found evidence of diminished gist recall by autistic children after a one-day delay. They argued that the poor gist memory of autistic children might have been a product of weak central coherence. Other studies similarly suggested a diminished drive or ability to extract the overall meaning or gist of experienced events by autistic individuals (see Happé & Frith, 2006 for a full review).

The central coherence theory (Frith, 1989), as originally proposed by Frith in 1989, referred to the ability of typical individuals to extract meaning or gist from incoming information, but failure to pay attention to details. In typical development, the ability to use gist representations to encode the most salient information about an event improves during

childhood (Odegard, Cooper, Lampinen, Reyna, & Brainerd, 2009). In contrast, autistic individuals show ‘‘weak central coherence’’, because they fail to extract global form or gist, while showing superior detail-oriented focus (Frith, 1989). This theory has since undergone some revisions (Happé & Booth, 2008; Happé & Frith, 2006) and the “weak coherence” found in autism is currently viewed as independent from the social-cognitive deficits associated with the disorder with the reduced global processing in individuals with ASD interpreted as a possible secondary effect of superior local or detail-focused processing. However, Happé and Booth (2008) have argued that the existing evidence does not clearly tap global and local processing independently, suggesting that the reduced tendency to integrate information (global processing) and increased local bias (detail-focused processing) may actually be two separable dimensions.

Thus, from a theoretical perspective, one would expect that autistic children in this study would have demonstrated poorer gist memory than typically developing peers (even in the absence of impoverished recall of narrative details) as a result of weak central coherence (Happé & Frith, 2006). Specifically, according to fuzzy-trace theory (Brainerd & Reyna, 1990) gist memory (i.e., memory for meanings, concepts, and interpretations) and verbatim memory (i.e., memory for item-specific information) are encoded separately and function independently. This makes it possible that the gist representation of events is impaired in autistic children while verbatim memory is relatively intact (Happé & Frith, 2006; McCrory et al., 2007). Indeed, central coherence theory suggests that individuals with ASD are characterised by superior processing of features rather than global elements (Happé & Frith, 2006). This detail-focused processing style may lead to weak memory representation of gist by autistic children, as earlier proposed by McCrory et al. (2007), with superior detail-focused processing coming at the expense of global processing. There is evidence that the mechanism underlying weak coherence effects may operate at the perceptual level, because superior discrimination and diminished generalization have been reported (Plaisted, 2000, 2001). Consequently, gist representations of the event would have decayed more rapidly than verbatim representations for autistic children, thus ensuring that their memories were based more heavily on verbatim memory (i.e., specific details about objects used or activities that occurred during the event) rather than gist memory than would typically be the case (Brainerd & Reyna, 1990).

In contrast, in the current study, we found that autistic children did not differ from typically developing peers on any dimensions of memory, including gist memory. As we argued earlier in the thesis, the use of a cognitively supportive child-directed interviewing

style emphasising the use of retrieval cues in combination with open-ended prompts may have facilitated the recall of target-specific information and likely resulted in the enhanced recall of information (e.g., Anderson, 1983; Tuckey & Brewer, 2003). Various studies have also reported that autistic children and adults can provide as much correct information about an event as TD peers when they are questioned in an appropriate manner - that is, when appropriate support is provided at retrieval (e.g., Henry et al., 2017b; Maras & Bowler, 2010; Maras et al., 2013). Nevertheless, we should also raise the possibility that, given a larger sample size we might have detected a significant group difference. Our sample size was comparable to that in previously published studies involving autistic individuals, but it was relatively small by the standards of psychology more generally. Thus, as previously acknowledged, it is important to replicate our findings using a larger sample, to fully detect the existence or absence of an autism-specific deficit in this regard.

Many professionals (Crane et al., 2016) and researchers (Bennetto et al., 1996; McCrory et al., 2007) have argued that broad open-ended interview mnemonics that elicit free recall, such as “Tell me everything that happened” may be problematic for autistic children. This is undoubtedly true for many children on the spectrum, particularly those with limited or no verbal abilities and/or moderate to severe intellectual disabilities (Kasari, Brady, Lord, & Tager-Flusberg, 2013; Lerner, Mazefsky, White, & McPartland, 2018; Tager-Flusberg & Kasari, 2013). Open-ended prompts require episodic retrieval and involve the ability to use self-involvement to re-experience a past event in its full spatio-temporal context and mentally travel back in time (Tulving, 1985). As previously mentioned, autonoetic consciousness (i.e., self-knowing) is reduced in ASD, due to a poorly developed level of self-awareness, which leads to difficulties in remembering personally experienced events, particularly in response to free recall prompts (Lind & Bowler, 2008).

Because the event used in the present study involved the encoding of multiple complex stimuli (requiring high-level information processing), it comes as no surprise that our findings illustrated that even cognitively and verbally competent autistic children did recall fewer correct narrative details about the experienced event than TD children in response to input-free recall based-prompts, namely invitations and cued invitations. They also required more prompting than TD children to provide the same amount of information overall. These findings are consistent with the suggestion that recall by autistic children is adversely affected by the complexity of the materials to be remembered because they fail to spontaneously develop and automatically use organizing strategies to support memory (Williams et al., 2008).

Specifically, the complex information-processing model (Minshew & Goldstein, 1998) suggests that autistic individuals present coexisting deficits in complex tasks dependent on higher-order abilities across multiple domains (e.g., complex memory, complex language, abstract reasoning), but intact or even enhanced function on simpler abilities within the same domains (e.g., simple memory, simple attention, abstract reasoning) (e.g., Just, Keller, Malave, Kana, & Varma, 2012; Libero & Kana, 2013). The pattern of memory impairments in intellectually and verbally able persons on the autism spectrum is thought to be associated with a failure to spontaneously organize incoming information, suggesting that the organizational strategies are not effectively applied at the time of encoding and, consequently, are not available or used later to aid memory retrieval (Smith & Gardiner, 2008; Williams, Minshew, & Goldstein, 2008). The higher the complexity or difficulty of the material to be recalled, the more memory performance will be impaired. The implication is that adverse life experiences often involve a great deal of complex information to encode and organize into memory (e.g., the causal chain of events, relationships between persons and agents, the temporal order of details). This reported failure to apply organizational strategies at the time of encoding and subsequently use them to aid memory retrieval by autistic individuals can significantly impair their performance when they are later questioned about such experiences by legal professionals.

Another important finding is that, before the interviewer introduced any information about the event (i.e., during the open-ended recall phase), autistic children did not differ from TD peers in the overall numbers of narrative details freely recalled. Furthermore, like TD children, autistic children maintained remarkable levels of free recall accuracy, even when interviewed two months after the event. This finding has important implications for legal questioning because it provides further evidence that freely recalled information is the most accurate form of eyewitness remembering (Lamb et al., 2008; Milne & Bull, 1999), including for autistic children. Thus, professionals should not injudiciously deem these strategies as unsuitable for all children on the autism spectrum.

Our results offered further evidence that open-ended recall-based prompts, particularly cued invitations, promote complete and accurate eyewitness recall in autistic children without concomitant language and/or intellectual difficulties by fostering further elaboration of previously disclosed information. They also implied that intellectually and linguistically able children with ASD were as capable as TD children, with respect to the elaboration and accuracy of their recall, when they were questioned in a supportive manner, and in accordance with best practice recommendations. This suggests that extensive use should be

of more cognitively supportive but still open-ended prompts, such as cued invitations, rather than to dismiss the possible informativeness of this group of witnesses.

The present findings also provided further evidence for the task support hypothesis (Bowler et al., 1997) demonstrating that the best-practice principles embodied in the Revised NICHD Protocol, a supportive, open-ended, and non-suggestive child-oriented interview guide, effectively promote accurate remembering and responding in cognitively and verbally able children on the autism spectrum. It is important to note at this point that communicating expectations clearly and motivating children to provide as much information as they could might have influenced their performance as well. As mentioned before, literal and concrete thinking is common in autistic individuals, so framing each question/statement as directly and clearly as possible and explaining the specific level of detail that was expected of them likely helped ensure that children understood the unique demands of the interview context (Sternberg, Lamb, Esplin, Orbach, & Hershkowitz, 2002). As research demonstrates, the complexity of the language and questions addressed to children can strongly dictate the course and outcome of investigative interviews (Lamb et al., 2015).

Of course, in the course of forensic interviews or court testimony, more specific questions, such as directive *wh*- prompts, are often required and these are useful to elicit information that children might not produce in response to invitations and cued invitations (Snow, Powell, & Murfett, 2009). Directive prompts, especially what/how questions about actions, can elicit relevant information from children, particularly if paired with follow-up recall questions (e.g., cued invitations) (Ahern & Lyon, 2013; Andrews, Ahern, Stolzenberg, & Lyon, 2016). Furthermore, directive *wh*- prompts can effectively elicit informative responses from younger children (Kulkofsky & Klemfuss, 2008) and from autistic children (McCrory et al., 2007), because they make specific requests that demand less retrieval effort. We would advise professionals to make careful use of more specific (directive) questions (i.e., what, where, when, how), however, particularly if the interviews occur after a lengthy delay, because research demonstrates that *wh*- questions typically elicit single-word or -phrase responses and result in more errors (Brown et al., 2013) than broader open-ended prompts.

Investigative professionals might also benefit from adopting a supportive attitude and establishing rapport during interviews with unfamiliar autistic witnesses, especially in their first approach, in order to help them calmly focus on their memories and elicit the most detailed, yet accurate, testimony from them. Our findings do not clearly demonstrate whether autistic children benefit from social support as much as TD children and even suggest that

children with and without autism might have been differentially affected by supportive interviewing. Nevertheless, it was clear that interviewer-provided social support did not adversely affect autistic and typically developing children's accuracy and, soon after the event, increased the amount of correct information recalled. This has important practical implications and warrants further examination using the necessary experimental conditions.

Legal professionals should make considerable efforts to establish rapport with autistic or typically developing children early on and before addressing the substantive issue under investigation (Sternberg, Lamb, Esplin, & Baradaran, 1999) because this likely facilitates communication and encourages them to disclose adverse experiences (Aldridge & Wood, 1998; Goodman & Bottoms, 1993). Research examining the dynamics of interviews with reluctant children (Ahern, Hershkowitz, Lamb, Blasbalg, & Winstanley, 2014; Blasbalg, Hershkowitz, & Karniel-Visel, in press; Blasbalg, Hershkowitz, Lamb, Karniel-Visel, & Ahern, in press; Hershkowitz et al., 2017; Hershkowitz, Lamb, & Katz, 2014) has demonstrated that they typically avoid establishing rapport with interviewers and signal their reluctance verbally and nonverbally early in the interview, with manifest reluctance increasing as the interviews progress. The revision of the NICHD Protocol was formulated to emphasise the importance of rapport with suspected but uncooperative victims of abuse (Hershkowitz et al., 2014, 2013). The usefulness of the Revised version of the NICHD Investigative Interview Protocol was tested in a study involving 1,424 interviews with 4- to 13-year-old suspected victims of intrafamilial abuse in Israel (Hershkowitz et al., 2014). The authors found that the use of the Revised Protocol reduced reluctance during the interview and increased the numbers of children who reported abuse by family members.

As for autistic children, it would be an overstatement to state that interviewer-provided social support definitely enhances their recall because such an inference would be based on one laboratory study. We currently know that social interaction and cooperation by intellectually able autistic children can be enhanced using intervention strategies designed to foster social competencies (e.g., Bauminger, 2002; Beaumont & Sofronoff, 2008; Hagopian et al., 2009; Leaf et al., 2009). For example, Hagopian, Kuhn, and Strother (2009) demonstrated that the use of differential reinforcement with autistic children increased appropriate interactions with others (verbal and non-verbal) and reduced the amount of inappropriate behaviour (e.g., inappropriate comments and social withdrawal). Likewise, reinforcement and verbal prompting techniques improve conversation, emotion-regulation, and social competency in children with ASD (e.g., Beaumont & Sofronoff, 2008; Leaf et al., 2009). Thus, being supportive in uncertain and cognitively demanding situations, such as

forensic interviews, could indeed help decrease autistic children's anxiety, encouraging them to produce more complete and accurate accounts of past experiences. Although our findings do not provide definite answers concerning the effect of social support during investigative interviews with autistic children, they provide a platform on which future work could build.

Another noteworthy finding relates to the relationship between the age of the children in this study and the amount and accuracy of the information reported. As explained earlier, the study did not have enough power to analyse age differences between the participant groups nor to include age as a covariate in the individual analyses conducted (but the samples were individually matched for chronological age). Our intent was to use the most powerful and efficient approach possible for the research questions being addressed, as recommended by many scientists and grant review panels (Murray, Barrett, Brock, & Bevins, 2017).

Nevertheless, because our study included children of diverse ages, we investigated whether the recall scores were related to chronological age using bivariate correlations. These revealed that, for both autistic and typically developing children, the volume and accuracy of recall improved with age. These findings are consistent with previous research showing that age is a strong determinant of both typically developing (Brown & Lamb, 2015; Burgwyn-Bailes et al., 2001; Chae, Kulkofsky, Debaran, Wang, & Hart, 2016; Odegard & Toglia, 2013) and autistic (Bruck et al., 2007; Henry et al., 2017a) children's eyewitness memory abilities. Recent research has even demonstrated that age, because of its relation to many cognitive abilities in children, was a better predictor of eyewitness memory in autistic children than most standardised measures of memory, language, and attention (Henry et al., 2017a). Our findings provide further evidence that, with increasing age, autistic children gradually remember more about their past experiences. Investigative professionals can thus rely on age as a general indicator of performance in children with and without autism, provided they have adequate levels of intellectual functioning, as earlier proposed by Henry et al. (2017a).

To conclude, our findings regarding the capabilities of autistic child witnesses imply that intellectually and linguistically able children are capable of recalling as much and as accurately from previously experienced events as typical developing children. Future research should replicate and extend these findings, particularly by including less intellectually and/or linguistically able children on the wider autism spectrum. In this thesis, we have seen how autistic children's special development in a variety of domains can profoundly affect their participation in legal contexts and how recognition of these factors can be used to optimize professionals' practices and reach legal outcomes that give priority to

autistic children's needs. As previously highlighted, it is critical to explore ways to accommodate the sensory needs of autistic children in court or forensic interviews and develop appropriate techniques to help them feel more comfortable and less anxious in legal settings, encouraging them to give elaborate and reliable accounts of their past experiences. It would also be important to replicate our findings using a larger sample to allow the examination of more complex interactions among variables and future work is needed to fully test the usefulness of interviewer supportiveness during interviews with autistic children.

The development of educational resources for legal professionals is also important, to ensure that the credibility of autistic children is not unfairly undermined. Legal professionals need appropriate training to be able to fully comprehend the myriad manifestations of ASD and organizational support to ensure that investigative practices are evidence-based. Finally, considerably more research is needed to explore the effects of delay on the memory accounts of autistic children and to understand how they forget. It is essential to continue investigating valid strategies and empirically validated retrieval support tools that can aid autistic child witnesses to freely recall as much information as possible about past experiences when they come into contact with the criminal justice system, especially when a substantial amount of time has elapsed between their experiences and the interviews.

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Appendix 1

The impact of Autism Spectrum Disorders on event memory and accuracy

Revised NICHD Investigative Interview Protocol
Version 2014

Telma Sousa Almeida & Michael E. Lamb

A. Introduction

Hello, [child's name], I am glad to meet you today, How are you?

My name is _____ and my job is to talk to children about things that have happened to them.

As you can see, we have a video-camera here. It will record us talking so I can remember everything you tell me. Sometimes I forget things and the recorder allows me to listen to you without having to write everything down.

In the introduction, gestures of goodwill are appropriate:
Are you comfortable?
Can I do anything to make you more comfortable?

B. Rapport building and narrative training

B.1 Now, [child's name], I want to get to know you better. Tell me about things you like to do.
Wait for child to respond

If the child responds, express appreciation and reinforcement:
Thank you for sharing that with me, it helps me get to know you.
I am glad I am starting to get to know more about you.

Then skip to B.3, if you think the child should go directly into narrative training from here.

If the child does not answer, gives a short answer, or gets stuck, you can say:
I know this is the first time we have met and I really want to know about you.
I am glad I can talk to you today [Child's name].

Skip to B.2, if you think more rapport building is necessary.

B.2 I really want to know you better [child's name]. I would like you to tell me about things you like to do at school, during recess, after school].

Wait for an answer

I heard you like [activity, hobby]. Tell me about [activity, hobby].

B.3 Now, [child's name], Tell me more about [activity the child already mentioned]. *Avoid TV shows, videos or fantasy.*

Wait for an answer.

B.4 [Child's name], Tell me about something fun that has happened to you [at school, kindergarten]?

B.5 Tell me about [something the child mentioned]. *Use various invitations to ask about different topics.*

B.6 You told me about something [happy, pleasant, fun] that has happened to you. Now, tell me about something unpleasant that has happened to you [at school, kindergarten].

Important! Do not mention the location in which the alleged abuse may have taken place.

B.7 Please tell me about [Something the child has mentioned]. *Ask various invitations to elicit richer information about a variety of topics.*

B.8 [child's name], you told me about [pleasant event already described] and about [unpleasant event already described], and shared your [emotions, thoughts] with me (if s/he did). Thank you for letting me know. It's important that you know you can talk to me about anything, both good things and bad things.

C. Explaining and Practicing Ground Rules

Adjust the questions according to the child's developmental level.

C.1 [Child's name], I'm interested in you and I'll be asking you all kinds of questions today. If I ask a question that you don't understand, just say, "[interviewer's name], I don't understand." Okay, [child's name]?

Pause

If I don't understand what you say, I'll ask you to explain.

Pause

If I ask a question, and you don't know the answer, just tell me, "I don't know." So, [child's name], if I ask you, [e.g. what did I have for breakfast today], what would you say?

Wait for an answer

If the child says "I don't know," say: Right. You don't know, [child's name], do you?

If the child offers a guess, say: No, [child's name], you don't know me and [e.g., you weren't with me when I had my breakfast this morning], so you don't know. When you don't know the answer, please don't guess, just say that you don't know.

Pause

But if you do know or do remember, it is very important that you tell me, okay, [child's name]?

C.2 And if I say things that are wrong, you should tell me. Okay, [child's name]?

Wait for an answer

So if I said that you are a 2-year-old girl [when interviewing a 5-year-old boy, etc.], what would you say?

If the child only denies and does not correct you, say: What would you say if I made a mistake and called you a 2-year-old girl [when interviewing a 5-year-old boy, etc.]?

Wait for an answer

Reinforce the child if s/he gives the right answer: That's right, [child's name]. Now you know you should tell me if I make a mistake or say something that is not right.

Pause

Correct a wrong answer: No, [child's name], you are not [wrong age], you are [real age]. So if I say you are [wrong gender], what would you say?

Reinforce the child if s/he gives the right answer, correct a wrong answer and practice again:

So if I said you were standing up, what would you say?

Wait for an answer

OK.

[Child's name], now you understand that if I say something incorrect, you need to correct me and tell me what is right.

C.3 Part of my job is to talk to [children, teenagers] about things that have happened to them. I meet with lots of [children, teenagers] so that they can tell me the truth about things that have happened to them. [child's name], it is very important that you tell me the truth today about things that have happened to you.

D. Further Rapport Building and Episodic Memory Training

I am glad to meet with you today, [child's name], and I would like to get to know you even better.

D.1 *Main invitation*

A few [days, weeks] ago was [a holiday, birthday party, other event]. Tell me everything that happened [during the event], from the beginning to the end, as best as you can.

In case an event wasn't identified previously, ask: Did you do something special recently, like did you get to go somewhere or go to a birthday party?

If the child doesn't identify a suitable event, say: So, I want you to tell me everything that happened [today, yesterday], from the time you woke up.

D.2 *Follow-up invitations*

Please repeat the first action that started the event. Then ask:

And then what happened, [child's name]?

Use this question as often as needed throughout this section until you have been given a full account of the event.

Thank you, [child's name], you have told me many things (if s/he did). I want to ask you some more questions about what just you told me.

D.3 *Time segmentation invitations*

Try to use three time segmentation invitations, although you may adjust the quantity and type of invitations to the child's capabilities and reactions.

[Child's name], I would like you to tell me everything about [the event].

Please tell me everything that happened from the moment [an activity the child mentioned] to the moment [a subsequent activity].

If the child has difficulty understanding delineated segments, say:

Please tell me everything that happened from the moment [an activity the child mentioned] began.

Thank you, [child's name], for telling me that. You speak/express yourself very clearly, and that helps me understand what you are saying.

D.4 *Cued invitations*

Try to use three cued invitations, but you may adjust the number depending on the child's capabilities and reactions. Please focus on thoughts and feelings as well.

Cued invitations can be used in one of two formats:

Tell me more about [activity, object, thought, feeling].

Earlier you spoke about [activity, object, thought, feeling]. Tell me more about that.

D.**5** [Child's name], thank you for telling me about [title of the event]. When we talk today, it is very important that you tell me everything about things that have really happened to you.

D.6 [Child's name], how are you feeling so far in our conversation?

E. Substantive Phase

E.1 *Transition to Substantive Issues*
Now that we know each other a little better, I want to talk about why [you are, I am] here today.

At any stage, if the child talks about the event, skip to section E.2,
If the child reports an irrelevant event, say: I hear what you are saying to me, [child's name]. If you want, we can talk about that later. Right now though, I want to know about something else that may have happened to you.

1. I understand that you may have been at [place of the event]. Tell me everything that happened from the beginning to the end.

2. As I told you, my job is to talk to children about things that might have happened to them. It is very important that you tell me if you [came/went to place of the event].

3. *If the child doesn't talk about the event and looks avoidant or resistant, you may address him/her with general supportive statements which do not refer specifically to him/her, and do not mention abuse:*

a. [Child's name], my job is to listen to children about things that happened to them.
b. [Child's name], I really want to know when something happens to children. That's what I am here for.
c. [Child's name], here kids can talk about good things and bad things that have happened to them.
d. My job is to try to help kids.

4. I've heard that you talked to [a doctor] at [location]. Please tell me what you talked about.

5. I [saw, heard] that you have/had been [in place of the event]. Tell me everything about [that].

6. [Child's name], has anything happened to you at [location, time of the event]?

If the child doesn't talk about the event and looks avoidant or resistant, you may use some of the supportive statements above (a-c) or one of the following statements, which refer specifically to the child, but still do not mention the event:

d. You told me a lot about yourself. I feel I know you better and you can tell me more [about things, about both good things and bad things] that have happened to you.
e. You told me a lot about yourself, thank you for letting me know. When you talk to me today please go on and tell me about other things that have happened to you.
f. [Child's name], if there is anything you want to tell me, [I want to know/listen, It's important for me to know/listen].

Proceed through the transitional prompts gradually if the child does not talk about the event:
7. [child's name], did someone do something with you at [place of the event]?
8. [child's name], did somebody play with you in this building before?
9. [child's name], did someone [briefly summarize the ADOS session *without* specifying names or providing too many details]?

If the child doesn't talk about the event but looks avoidant or resistant you may use the above supportive statements (a-f) or one of the following:

10. [child's name], I understand [you] were at [place of the event] [briefly summarize the ADOS session *without* specifying names or providing too many details]. I want to find out if something happened that day.

E.1.a Supportive statements to help manage overt refusals.
If the child has explicitly expressed difficulty or reluctance to talk about the event, you may use the supportive statements above (a-k) and the following statements dealing with overt refusals to engage:

[Child's name], I understand you are [difficulty the child mentioned]. Let's start talking and I'll try to help you with it. Many children are [difficulty the child mentioned] and I try to help them.
I understand you are [difficulty the child mentioned], tell me more about that.
If the child expressed lack of confidence: I'm sure you can talk about it well.

E.2 *Exploring the Event*
Throughout the entire substantive part it is important to preserve and enhance the rapport established with the child, continue providing supportive statements, and address expressed inhibitions, distress and conflicts.

E.2.a *Free Recall Invitations*
10.a. Invitation for a first narrative about the event.

If the child mentions a specific activity:
[Child's name], you told me that [briefly summarize the allegation the child has made]. Tell me everything from the beginning to the end.

If the child mentions a number of incidents:
[Child's name], you told me that [briefly summarize what the child described about ADOS]. Tell me everything about that from the beginning to the end.

If the child gives a generic description and you cannot determine the number of activities:
[Child's name], you told me that [briefly summarize what the child described about ADOS]. Did you do that during the whole time? *Depending on the answer please invite a first narrative (10.a).*

If the description is still generic, please say:
[Child's name], you told me that [briefly summarize the generic description]. Tell me everything from the beginning to the end.

10.b. *Follow-up invitations*
Please repeat the child's description of the action/occurrence that started the event. Then ask
And then what happened?

Use this question as often as needed until you have a complete description of the alleged incident.

10.c. *Time segmenting invitations*

You have told me many things and helped me understand what happened. Now, [child's name], I want to ask you more questions about [event]**.**

[child's name], Think back to that time [day] and please tell me everything that happened from the moment [an activity the child mentioned] to the moment [a subsequent activity the child mentioned].

You may use this question as often as needed to ensure that all parts of the event are elaborated.

10.d. *Cued invitations*

Cued invitations can have two formats:

-Tell me more about [activity, object, feeling, thought].

- [Child's name], you mentioned [activity, object, feeling, thought]. Tell me more about that.

Use this question as often as needed throughout this section.

Important! Free-recall invitations should be exhausted before proceeding to directive questions.

E.2.b *Directive questions*

If some central details of the event are still missing or unclear after the exhaustive use of open-ended questions, use directive questions.

11. [Child's name], you said that/ mentioned [activity, object, feeling, thought]. [How, when, where, who, what, which, how many, what did you mean]?

It is important to pair open-ended invitations with directive questions whenever possible:

Tell me more about that.

E.2.d Break

[Child's name], now I want to make sure I have understood everything you said and see if there's anything else I need to ask. I will take a couple of minutes to think about what you told me/ go over my notes.

During the break time, review the information you have received, see if there is any missing information, and plan the rest of the interview. Be sure to formulate option-posing questions

in writing and consider replacing them with open-ended or directive prompts.

E.2.e *Option-Posing Questions – Eliciting Information that has not been mentioned by the child.*
You should ask these focused questions only if you have already tried other approaches and you realize that some important information is still missing. It is very important to pair option-posing questions with open invitations ("Tell me all about that") whenever possible.

13. [child's name], when you told me about [specific activity] you mentioned [object, feeling, thought]. [Did, have, has, is, are] [a detail for child to confirm or deny]? *Example: Sarah, when you told me about reading a book, were there pictures in it?*

Whenever appropriate, follow with an invitation:
Tell me everything about that [activity, object, feeling, thought].
Before you move to the next activity, make sure you have obtained all the missing details about each specific activity.

F. If the child fails to mention information you expected

You should ask these focused questions if important information is still missing. Pair focused questions with open invitations ("Tell me all about that") whenever possible.

Focused/contaminating questions can have two formats:
I heard that [activity the child failed to mention]. Tell me about that.
Did [activity the child failed to mention] that time?

G. Ending the Interview

You have told me lots of things today, and I want to thank you for helping me. You've told me why you came to talk to me today. You've given me [lots of] information and that really helps me to understand what happened.
Is there anything else you think I should know? Is there anything you want to tell me?
Wait for an answer.
[Child's name], what are you going to do after we finish talking?
Talk to the child for a couple minutes about a neutral topic.

Appendix 2

The impact of Autism Spectrum Disorders on event memory and accuracy

Codebook

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Coding Scheme

1. Descriptive Information

1.1. Participant Number
1.2. Interview Number (Interview 1 [2-weeks] or Interview 2 [2-months])
1.3. Interviewer (Interviewer 1, Interviewer 2 or Interviewer 3)
1.4. Diagnostic Group (Autism Spectrum Disorder or Typical Developing Children)
1.5. Gender (Male or Female)
1.6. Age (in years)
1.7. Participant date of birth
1.8. Date of the event
1.9. Date of the first interview
1.10. Length of the first interview (in minutes)
1.11. Date of the second interview
1.12. Length of the second interview (in minutes)

2. Interviewer utterance types[6]

An interviewer utterance is defined as a "turn" in the discourse or conversation.

2.1. Non-substantive utterances (NS)

Non-substantive utterances (NS) consist of interviewers' statements or questions and children's responses that are not focused on the investigated event. Mark as (NS) statement or questions about topics that aren't related to the investigated event and are not introductory comments.

2.1.1. Introductory comment (IC)

Interviewers' comments, statements, or questions, concerning procedural aspects of the interview, rapport building or communication rules interjected within the substantive part of the interview (e.g., *I can't hear you; Speak up; You have to come here otherwise the camera can't see you.)*. Also use this code when the interviewer corrects what the child said (e.g., *No, that's not the reason*).

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[6] To code the interviewer utterance types I used the NICHD Codebook - Quality of Interview: Content Analysis of Investigative Interviews (Unpublished), developed by Lamb and colleagues at the National Institute of Health and used in previous studies (e.g., Lamb et al., 1996)

2.2. Substantive utterances

Substantive utterances consist of interviewers' statements or questions and children's responses that are focused on anything that happened during the investigated event.

Substantive investigative utterances are coded using the following eight main categories:

2.2.1. Invitation (I)

Open-ended utterances using questions, statements or imperatives to elicit free-recall responses. Code as Invitation (I), main code, any of the following variations:

a. General Invitation – open-ended utterances introducing the substantive part of the interview (trying to get the child to talk about the event under investigation) – e.g., *I want to talk to you about why you're here today; It's important to me to understand why you came to talk to me; Do you know why…; Tell me why…; Tell me why [ ] brought you today.* AND utterances asking about a whole activity - e.g., *Tell me everything that happened from the beginning to the end* (following a disclosure) or about one of multiple activities – e.g., *Tell me everything about the first/ last/ best remembered* [child's label] *time*.

b. Follow-up Invitation - Utterances asking about the last content mentioned by the child - e.g. *Tell me more about that,* or about the content of events occurring after the last point in time mentioned by the child - e.g., *Then what happened?*

c. Refocusing Invitation - Utterances that refocus on previous content and request elaboration - e.g., *Think back to the last time (or any other disclosed content) and tell me everything about that.*

d. Closing Invitation - Use this code for non-substantive closing questions aiming for the child to disclose more information about the event. e.g., *Is there anything else you remember about that day?; Is there anything else you want to tell me?; Is there anything you think I should know?; Are there any questions you want to ask me?.*

2.2.2. Cued Invitations (CI)

Utterances that refocus the child's attention on previously mentioned details and use them as contextual cues in open-ended invitations to elicit free-recall responses.

- *You mentioned [content mentioned by the child], tell me about that;*
- *Tell me everything about [a content mentioned by the child];*
- *You said [occurrence/action mentioned by the child], and then what happened?;*
- *What was the very first thing that happened before [an occurrence/action mentioned by the child]?;*

- *Tell me everything that happened from [an occurrence/action mentioned by the child] until [another occurrence/action mentioned by the child]*.

When a Cued Invitation is interrupted by an insertion of a clarification by the child, before its completion by the interviewer, the continuation of the investigator's utterance following the child's insertion receives the same coding as the initial utterance.

I: *You said that you did a puzzle.* [CI]

C: *Do you mean the green one?*

I: *Yes. What happened after that*? / *And then what happened?* [CI]

2.2.3. Summaries (SM)

Correct interviewer's summaries of what the child had said earlier, without requesting additional information about the event.

- *You said/mentioned* [a summary of what the child had mentioned];
- *Just to see if I understood. You said/mentioned that* [a summary of what the child had mentioned].

2.2.4. Directive (D)

Directive utterances focus on event-related information (details) mentioned by the child earlier in the interview, and request additional information using a category, mostly wh-questions (who, what, when, where, how). Directive questions are "cued-recall" prompts. The different types of directive prompts are coded using the following three sub-categories:

a. Directive Open (DO) - A request for information about an intrinsic feature of a disclosed content, using a wh question (who, what, when, where, how, why), allowing a multi-word response.
   What did you do exactly?
b. Directive Narrow (DN) - A request for information about a specific attribute of a disclosed content.
   What colour was the puzzle? (When the child mentioned earlier that there was a puzzle)
   Where were the toys? (When the child mentioned earlier that there were toys).
c. Directive Clarification (DC) - Utterances asking for clarification about what the child mentioned. This type of clarification only refers to the wording of the child, not to the facts or content of the child's statement.
   You said [child's words]. *What do you mean?; What?; Hum?*; etc.

An important note when coding Directive questions is to pay special attention to interviewer prompts such as *Do you know* or *Do you remember*. These types of questions are in fact coded depending on the word that follows, i.e., *Do you know if* is (OP) (because it actually request an yes/no answer), and *Do you know what* is coded as Directive (D) (when it is clear that the interviewer wants to request information about an intrinsic feature or specific attribute of a disclosed content e.g., *Do you know what you said?*; *Do you know what colour was the puzzle?*).

2.2.5. Option-posing (OP)

Interviewer's utterances that focus the child's attention more narrowly on aspects of the event that the child did not previously mention, but do not imply that a particular response is expected. The different types of option-posing prompts are coded using the following three sub-categories:

a. Option-posing Yes/No - Prompting yes/no responses and introduce contents not yet mentioned by the child. E.g., *Did you have to assemble the puzzle?; Did you play alone?*
b. Option-posing Forced choice - Request the selection of undisclosed forced-choice options. E.g., *Were the toys inside the bag or displayed on top of the table?*

Again: an important note when coding these Option-posing yes/no questions is to pay special attention to interviewer prompts such as *Do you know* or *Do you remember*. These types of questions are in fact coded depending on the word that follows, i.e., *Do you know if* is (OP) (because it actually request an yes/no answer), and *Do you know what* is coded as Directive (D) (when it is clear that the interviewer wants to request information about an intrinsic feature or specific attribute of a disclosed content e.g., *Do you know what you said?*; *Do you know what colour was the puzzle?*).

2.2.6. Unclear Utterance (UC)

If either person makes an incomprehensible vocalization, it will be coded as (UC).

2.2.7. Unfinished Utterance (UF)

Interviewer's utterance that could not be categorized as any other types because it is incomplete. Incomplete interviewer's utterances (e.g., *"So, do…"*) should be coded as (UF). However, if it is clear what the interviewer was beginning to ask ("How long did you…"), it

will be coded as if it was complete. If an unfinished utterance follows a facilitator (e.g., *"Hum-hum. So, do…"*) it should be coded as (F).

2.2.8. Focused/contaminating (FC)

Focused/contaminating questions introduce event-related information (i.e., activities, aspects) that has not been previously disclosed by the child, but do not imply that a particular response is expected.

Focused/contaminating questions can vary in format:

- Closed: requiring a yes or no answer (e.g., *Did you see a book that time?*).
- Open: requiring the children to provide the response (e.g., *I heard there was a book that time*.).

3. Interviewer supportive comments[7]

Interviewer's supportive comments inserted within any type of utterance are coded as Supportive. These include comments intended to unconditionally encourage children to be informative. The different types of supportive comments include the following:

a. Supportive name - each time the interviewer refers to the children by their name. E.g., *John, tell me everything about the book.*
b. Supportive reinforcement - each time the interviewer gives a non-suggestive positive response to the child's behaviour during the interview that is unrelated to the content of their reports or to any other substantive issue. Eg., *You are telling very well; Very nice; Very well; You are remembering a lot; Well done; etc.*
c. Supportive collaboration - each time the interviewer provides support for the child's efforts and collaboration during the interview. E.g., *Thank you for telling me about that; Thank you for helping know everything about that time you were here; You've told me a lot of things today.*
d. Supportive reassuring - each time the interviewer reassures the child during the interview. This usually appears when the child mentions they don't know the answer or don't remember, but not always. E.g., *That's ok; Don't worry; No worries; That's not a problem.; etc.*

[7] To code the supportive interviewer comments we used an adaptation the coding procedure used by Hershkowitz, Orbach, Lamb, Sternberg and Horowitz (2006).

4. Child's response types

4.1. Responsive (R)

Children's responses (verbal or action [e.g., points, shrugs, nods, shakes head, etc.]) related to the interviewer's previous utterance. Utterances can be assigned this category even if they do not contain informative details, or when their meaning is unclear. A responsive child utterance can follow any interviewer utterance type.

4.2. Uncertain Reponses (UR)

If any of the following examples appear on a response use the main code Uncertain and then specify which type of uncertainty is present.

4.2.1. Don't want to talk/cooperate (DW) - Use this code each time children expresses they don't want to talk to the interviewer or don't want to cooperate. E.g., *I don't want to talk to yo"; I want to go home*.

4.2.2. Don't know (DK) - Use this code each time children expresses they don't know the response to the interviewer's question.

4.2.3. Don't remember (DR) - Use this code each time children expresses they don't remember the information requested by the interviewer. E.g., I: *What colour was the puzzle?* C: *I don't remember. That's all I can remember.*

4.2.4. Not sure (NtS) - Use this code each time children expresses they are not sure about the information requested by the interviewer. E.g., I: *Tell me everything about the puzzle.* C: *I'm not sure.*

4.2.5. Deny (D) - Use this code each time children denies a certain activity/aspect of the event happened. E.g. I: *Did you have to pretend to wash your teeth* C: *No*; I: *Did you use your hands?* C: *No.*

4.2.6. Nothing else (NE) - Use this code each time children mentions nothing else happened during the event. E.g., *There is nothing else to say about it; I didn't do anything else.*

4.2.7. No answer (NA) - Use this code when the child provides no verbal or action responses to any type of question.

4.3. Clarification (C)

Children's responses requesting clarification or restatement of the previous utterance, e.g., *What do you mean?; Hum?; What?; I don't understand.*

4.4. Digression (DG)

A child response which initiates non-substantive content, not related to the interviewer's previous utterance nor to the substantive topic of the interview. If, however, a non-substantive utterance (like a discussion of a non-immediate disclosure) follows an earlier chain of NS material then it is coded as NS. Also, code as digression acting out by the child, which is clearly not related to the event(s) under investigation.

4.5. Unclear (UC)

A statement of the child's that is unclear and is indicated by the transcriber (usually indicated by [imp 00:00']).

4.6. Unfinished (UF)

A child response that stops short of producing a meaningful statement (e.g., *Ahm, Well…, Hum*).

4.7. Non-substantive (NS)

Children's responses, within the substantive part of the interview, that do not contain information about the event.

5. Richness of Children's Substantive Responses

5.1. Completeness of recall

This measure captures memory of the event as a whole, by assessing how many of the features of the overall target event are recalled. Each component of the checklist is scored as present or not (the first time they are mentioned), regardless of how much narrative detail was provided. The event is comprised by eleven (11) main features and therefore, *completeness* will be scored on an 11-point scale. One mark is accorded for each aspect reported, giving a possible total score of 11. The 11 most salient aspects of the event are defined as follows:

- Who was present
- Where it happened
- Construction task
- Make believe play
- Demonstration task
- Description of picture
- Telling a story from a book
- Cartoons

- Conversation (answering and responding to questions)
- Break
- Creating a story using objects from bag

5.1. Identifying and counting narrative details

A detail is defined as any information pertaining to the event that was conveyed by the interviewee during an investigative interview. More specifically, a detail consists of the naming, identification, or description of individual(s), object(s), event(s), place(s), action(s), emotion(s), thought(s), and sensation(s), that are part of the event, as well as any of their features (e.g., appearance, location, time, duration, temporal order, sound, smell, and texture). Details expressing personal knowledge or habits are considered as non-substantive and are not counted. Count only new details and generally not repeated words: Only new details are counted. Details that were presented and counted earlier in the interview are not counted again when they reappear. Repeated words are generally not counted twice, unless the repetition appears intentional (as for emphasizing).

5.2.1. Detail counting

The meaning of a sentence is conveyed partly by the meaning of the CONTENT (lexical) words and partly by the relationship between content words (grammatical structure), conveyed by FUNTION words.

a) Content words – convey information: **nouns**, **verbs**, **adjectives** and **adverbs**. Each has a meaning that can be understood fully in and of itself.
   - **Nouns** – **counted as detail once per utterance**, provided that it appears in conjunction with new information.
   - **Pronouns** – a word used as substitutes for nouns.
     - Personal pronouns subject form – *I, you he, she, it, we, they* – **counted once per utterance.**
     - Personal pronouns object form – *me, you, him, her, it, us, them* – **counted once per utterance and with each verb.**
     - Personal pronouns compound form – *myself*, *yourself, himself, herself, itself, ourselves, themselves.* **NOT counted as a detail** when it is intensive – for emphasis. **COUNTED as a detail** when it is reflexive – expressing an action turned back on the subject (e.g., *"he undressed himself"*).

- **Repeated person words within a clause** - when a person word appears twice in an utterance (e.g., once as a subject and once within a "because" clause: *"she played with me because she wanted to"*), **count both words as details** (although normally we only count each person as a detail once per utterance).

- **Relative pronouns** – *who, what, which, whom, whose* – words that connect two clauses, or relate back to a noun or a pronoun in a preceding clause – **NOT counted as details.**
- **Identifying pronouns** – words that describe "which" without referring to a definite person, object, event or place – *somebody, both, each, many, one, other* – co**unted as details once per utterance,** in conjunction with each noun.
- **Verbs**
  - *Push*, *run*, *came*, *throw*, *hit*, etc. – **all are counted as details.**
  - *Was* is **only counted as a detail** when it is the **main verb**.
  - Verbs such as *try* and *want*, which modify other verbs, are **counted each time they appear with a new verb**. E.g., in "*she tried to teach me and she tried to help me*," *tried* would be counted as a detail both times.
  - *Said* is counted **once per person per utterance** (not just once total per utterance).
  - *Wasn't, isn't, doesn't* – **counted as two details** = verb + not.
- **Auxiliary verbs** – *have, do, will* – precede main verbs and determine the tense or aspects of another verb in a verb phrase, link a subject to an adjective or a noun and/or is used with another verb to form a verb tense – **NOT counted as details.** E.g., *"I ~~was~~ scared", "He ~~was~~ mean", "I ~~felt~~ sick", "She ~~became~~ furious", "He ~~had~~ hit me several times", "I ~~used~~ to live with my mother", "My dad ~~was~~ touching me in the wrong places", "He ~~started~~ putting his finger there".*
- **Adverbs** – *forcefully, quickly, very, extremely, soon, fully* – **counted as details once per utterance,** in conjunction with a particular action.

b) Function words (grammatical word) – words that express grammatical or structural relationship with other words in a response. Function words have little or no meaningful content and can be understood completely only when occurring with other words in a sentence.

- **Determiner** – a word or a group of words that are used in front of a noun and introduce it, including: *articles, demonstrative pronouns, quantifiers and possessives.*
    - **Articles** – *the, a, an* – **NOT counted as details**.
    - **Demonstrative pronouns** – point out a particular person, object, place or event – *this, that, these, those* – **counted as detail once per utterance** in conjunction with a particular noun. E.g. "*That man".*
    - **Quantifiers** – *all, most* – may also function as pronouns – **counted as detail once per utterance.** E.g., "*All have returned".*
    - **Possessives** – *my, mine, your, his, her, our, ours, their, theirs* - **counted as detail once per utterance** in conjunction with a particular noun.
- **Prepositions** – *by (via), like, as… as, to, toward, through, at (location), by (location), on, of, for, from, out of, at (time), before, on* - **counted as detail ONLY when indicating location, position or direction**. E.g., *"at home", "in the bedroom", "under my dress", "towards me", "on Sunday", "by train", "on/in my head".*
- **Complex preposition** – a word/group that functions like a simple preposition – **counted as detail.** E.g., *"in front of", "on top of".*

- **Non-verbal cues - counted as details.** E.g., "*points", "nods", "demonstrates".*
- **Verbal content** - all details included in verbal content (quotations) **are counted as details.** Verbal's (or verbatim speech replication) are coded as **one detail per word** (they follow different rules to normal detail coding). E.g., I: *"What questions did she ask you?"* C: "*She, **do I ever get annoyed** or anything. **What annoys me**. **What makes me happy**. Stuff like that."* = **12 details**.
- **False starts** and "Ahm's" **- NOT counted as details**. E.g., "*I, they went …*"
- Generic responses – **counted as details**.
- If a *general detail* is followed by a *more specific one* (on the same issue) **- both are counted as details**. E.g., *"She was seating at the table with me. And that's when she took notes, when I was seating at the table in front of me*."
- **If it is unclear if a detail is relevant or not, the detail is counted.**

- **Spontaneous corrections** - when the child corrects himself immediately – **ONLY corrected detail is counted**.
- **Contradictions** - contradictions in different portions of the interview - **all details are counted**.
- **Units accompanying figures** - number of times **counts as one detail** (e.g., "two times" is one detail) but order counts as **two details** (e.g., "second time we did it" – second time is two details).
- **Measurements** - **counted as one detail** since none of the words convey meaningful information independently. (E.g., "*5 centimetres*")
- *"When"* - **counted as detail** when it conveys temporal information of a simultaneous occurrence of two actions (or of two event components). E.g., *"She started to take notes when I was playing with the radio"*.
- *"Where"* - **counted as detail** when it conveys location/body part information. E.g., *"She took me to the room where the toys were."*
- **Adjectives** – *tall, old, first* – **counted as detail on their first appearance** in conjunction with a particular noun.
- **Adjectives** – *first time, last time, each time, every time, all the time* - **counted as separate details the first time they appear** in conjunction with **time indications**.
- **Articles** – *the, a, an* – **NOT counted as details.**
- **Conjunctions** – *and, or, but, however, because* – **NOT counted as details,** except when because indicates causality.
- **Action responses** – **counted as details.** New details included in interviewer's verbalization are counted as details only if they add to the total number of details awarded to the child's verbal response accompanying his/her action. The details from the interviewer's verbalization would be added to the child's detail count in the last utterance before the interviewer's verbalization (the utterance that contains the child's action response). Any overlapping details in the child's utterance and the interviewer's verbalization would be subtracted. (e.g. C : "Two minutes here." I : "I see you are pointing to your teeth."; The child's "here" detail would be subtracted from the interviewer's verbalization of it ("your teeth"=2 details) and 1 detail will be added to the child's utterance. When the interviewer doesn't verbalise all of the child's actions we count as details those actions the interviewer verbalized and those that he didn't

verbalise (e.g., C: *"He touched me here and here",* I: *"He touched you on your leg").*

- **Child's present mental/emotional state** – **NOT counted as details** statements that express the child's present mental or emotional state (e.g. "*I know*," "*I am scared*", "*I think*", "*Maybe*"), as words and phrases like "maybe" or "I think" suggest the level of confidence of the interviewee during the interview and do not report his thoughts during the investigated event.
- N**egative response** – a response that claims lack of knowledge / ignorance is **NOT counted as details**. E.g., *"I don't know," "I don't remember".*
- **Response "No"** to a Yes/No question - **counted as a detail**.
- When the interviewer asks *"Was the puzzle red?"* and the child answers *"Yes". "Yes"* is counted as **one detail**, even though it's referring to two aspects of the event *"puzzle"* and *"red".*

5.2. Verifying accuracy of details

Each unit of information supplied by children is coded against the video recording of the event. Credit is given to all the information that can be confirmed on the video recording of the event. One utterance can, therefore, be scored in several categories.

i. **Correct narrative details**

ii. **Incorrect narrative details**: Only commission errors are counted, such as describing a ball colour as red instead of blue, as well as reporting a piece of information that was not present or did not occur within the event.

iii. **Ambiguous:** This code is used when it is unclear what the children are referring to, or if the statement cannot be deemed as correct or incorrect using the available records.

5.3. Repeated versus New details

i. **Repeated –**All narrative details about the event provided by the child on the second interview that is not considered new information because it was previously disclosed in the first interview is marked as *Repeated.* Follow the instructions aforementioned to code the details but mark as repeated.

ii. **New -** Follow the instructions aforementioned and mark as new.