Drawing the answers: How sketch reinstatement supports free and probed recall by child witnesses with ASD

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This is an author's accepted manuscript of an article published in *Autism*, doi: 10.1177/1362361316669088. Published online before print November 14, 2016. The final definitive version is available online at:

https://dx.doi.org/10.1177/1362361316669088

Abstract

The success of witness interviews in the criminal justice system depends on the accuracy of information obtained, which is a function of both amount and quality of information. Attempts to enhance witness retrieval such as mental reinstatement of context have been designed with typically developed adults in mind. In this paper, the relative benefits of mental and sketch reinstatement mnemonics are explored with both typically developing children and children with autism. Children watched a crime event video, and their retrieval of event information was examined in free and probed recall phases of a cognitive interview. As expected, typically developing children recalled more correct information of all types than children with autism during free and probed recall phases. Sketching during free recall was more beneficial for both groups in both phases in reducing the amount of incorrect items, but the relative effect of sketching on enhancing retrieval accuracy was greater for children with autism. The results indicate the benefits of choosing retrieval mnemonics that are sensitive to the specific impairments of autistic individuals, and suggest that retrieval accuracy during interviews can be enhanced, in some cases to the same level as that of typically developing individuals.

Keywords: Autism, drawing, cognitive interview, Sketch-RC

Introduction

Individuals with Autism spectrum disorder (ASD) present with a distinct memory profile of strengths and weaknesses (Bennetto, Pennington & Rogers 1996; Boucher & Bowler, 2008). Episodic memory and free recall performance are typically reduced (Boucher, 1981; Boucher & Lewis, 1989; Bowler, Gaigg, & Lind, 2011; Millward, Powell, Messer & Jordan 2000), as is memory for person-related, and personally experienced events (Boucher & Bowler, 2008; Boucher, 1981; Boucher & Lewis, 1989; Millward et al., 2000). This pattern of memorial deficits render people with ASD particularly vulnerable when asked to recall personally experienced events. Accordingly, their access to justice is severely limited, despite being over represented as victims/witnesses (Browning & Caulfield, 2011), because ‘good quality’ witness information is an important determinant of whether an offender is apprehended and prosecuted (see Kebbell & Milne, 1998; Joutsen, 1987; Milne & Bull, 1999; Milne & Powell, 2010).

All vulnerable victims and witnesses[1] (< 18 years and those of any age with deficits in social or intellectual functioning) in England and Wales must be interviewed in accordance with Achieving Best Evidence (ABE; MOJ, 2011). ABE offers a number of recommendations for supporting vulnerable witnesses; the most prominent being that interviewers adopt a phased approach to interviewing, commencing with a free recall, followed by questioning (a probed recall based upon questions about information provided in the free recall phase) (ABE; MOJ, 2011). Yet, ABE currently provides no specific guidance or tools for assisting interviewers to support witnesses with ASD, despite their well-documented memorial, social and communication needs.

ABE guidelines advocate, among other interview approaches, the use of the Cognitive Interview (CI), which is the prevalent empirically-informed technique for retrieving episodic

[1] From hereon we use the term ‘witness’ to refer to both witnesses and victims of crime.

information from cooperative witnesses. The CI is based on the premise that successful remembering depends on the similarity of encoding and retrieval operations (Tulving, 1983; Tulving & Thompson, 1973) and so includes a mnemonic designed to facilitate feature overlap between the event and the retrieval environment, known as Mental Reinstatement of Context (MRC). MRC comprises a series of verbal instructions encouraging interviewees to place themselves mentally back to the time of the to-be-remembered event, supporting witnesses to access cues that correspond to the physical and psychological context at encoding (Fisher & Geiselman, 1992; Geiselman Fisher, Geiselman & Raymond, 1987; Tulving & Thomson, 1973).

However, MRC is likely problematic for children with ASD who have difficultly engaging in the type of mental time travel demanded by MRC resulting from impaired autonoetic consciousness (Gardiner, 2001), and because they are typically more reliant upon recognising rather than actively remembering incidentally encoded context (Bowler, Gardiner & Berthollier, 2004; Bowler, Gaigg & Gardiner 2008; Jordan & Powell, 1995). The MRC technique also assumes that the physical and emotional context are bound together in an organised structure, with multiple readily accessible traces (Tulving, 1985). However, information is bound differently in people with autism (Bowler et al., 1997; Gaigg, Gardiner, & Bowler 2008). In particular, a failure to utilise categorical and relational features of information to aid recall has been found (Bowler et al., 1997; Gaigg et al., 2008; Minshew & Goldstein, 1993). Deficits in source monitoring abilities are also apparent (Bowler et al., 2004; Bennetto et al., 1996; Hala, Rasmussen & Henderson, 2005) and impairments in working memory and verbal information processing (Gabig, 2008; Goldstein, Minshew, & Siegel, 1994; Minshew & Goldstein, 1998; 2001) may result in severe difficulties processing the detailed linguistic instructions of MRC (see Mattison, Dando & Ormerod, 2015).

Some studies have found that MRC improves typically developing children's recall (e.g., Dietze, Powell, & Thomson, 2010; Goodman, & Melinder, 2007; Hershkowitz et al., 2002), while others have failed to find positive effects (e.g., Holiday, 2003; Memon, Wark, Bull & Koehnken, 1997; Roebers & McConkey, 2003). MRC has also been tested with children who have learning disabilities, and positive effects have emerged (e.g., Robinson & McGuire 2006). In contrast, for adults with ASD, MRC increased the amount of incorrect details reported and reduced the overall accuracy of accounts (Maras, & Bowler, 2010). However, adults were able to recall as much information as their matched typically developed peers when they physically (rather than verbally/mentally) returned to the encoding environment (Maras & Bowler, 2012), suggesting that contextual cues can be utilised if appropriate support is provided (e.g., the *task support hypothesis*: Bowler et al., 1997; 2008).

Sketch-Reinstatement of Context (Sketch-RC: see Dando, Wilcock & Milne, 2009; Dando Wilcock, Milne & Henry, 2009; Dando, Wilcock, Behnkle, 2011; Oxburgh & Dando, 2011) is a modification of the MRC technique originally developed for use with typically developed adult witnesses. Its purpose was to offer an alternative method by which interviewers could reap the accepted benefits of context reinstatement by addressing problems associated with i) incorrect and infrequent application of MRC (Clarke & Milne, 2001; Dando et al., 2008; 2009), ii) the complexity of the MRC instructions for some witnesses (see Dando, 2009; 2013; Mattison et al., 2015), and iii) negative effects of incompatible contextual retrieval cues (e.g., Fisher & Craik, 1977; Friestad & Thorson, 1993; Schacter, Norman, & Koutstaal, 1998). Typically, Sketch-RC has been shown to be more effective than the MRC in reducing errors, and increasing correct recall for typically developed and older adults (Dando et al., 2009[a]; 2009[b]; 2011; 2013).

Recent research has begun to investigate the efficacy of Sketch-RC for supporting children with ASD to freely recall an episodic event (Mattison et al., 2015). Benefits are believed to arise because the instructions are straightforward and brief, and the technique is reliant upon visual rather than verbal styles of information processing (Goldstein, Minshew, & Siegel, 1994); also, children are not being asked to process relational information in order to access episodic memory stores (which MRC dictates). In contrast to item-specific memory processes that are intact with autism, relational memory processes are often impaired, particularly when environmental support for retrieval is not provided (Gaigg et al., 2008). Sketch-RC encourages item-specific memory recall by asking individuals to 'draw what comes to mind', resulting in elements of the episode being broken down and recalled as separate items; therefore, demands of the task are reduced, which is likely to aid goal-directed remembering (de Jong, 2010).

Further advantages of Sketch-RC come from transferring responsibility for the creation of retrieval cues to the interviewee, which is important because incompatible retrieval cues are known to impair episodic retrieval performance (e.g., Schacter, Norman, & Koutstaal, 1998). Crucially for children with ASD, Sketch-RC does not demand that witnesses mentally place themselves back in an experience. Rather, the technique implicitly encourages mental time travel by supporting an effortful search for salient, self-generated contextual cues, which can immediately be externalised, but which remain available in the form of a visual record. As such, drawing can increase access to memory stores (Barlow, Jolley & Hallam, 2011), with reduced risk of memory contamination (Strange, Garry & Sutherland, 2003).

The current study

The research reported here examines the carry-over effects of the Sketch-RC from free recall to probed recall. ABE witness interviews comprise a number of distinct retrieval phases, the first and most prominent being the free recall, immediately followed by a probed recall. We have previously reported that Sketch-RC improves the free recall performance of children with ASD (Mattison et al., 2015). However, here the free recall retrieval was immediately preceded by the Sketch-RC technique. Probed recall does not benefit from any additional external retrieval support, but must rely on carry over effects from the primary free recall. Hence, the question that arises is do the reported benefits of the Sketch-RC for supporting episodic free recall in children with ASD carry over to the probed recall? ASD populations do not typically demonstrate deficits in cued / probed recall, but the phased nature of investigative interviews gives rise to potential deficits if erroneous information is produced during free recall. Drawings produced by children immediately prior to free recall, as in Sketch-RC, remain visible during throughout the entirety of interviews. It is our contention that these drawings not only support free recall (as in Mattison et al., 2015), but they may also act as a form of external retrieval support during probed recall.

Previous research with typically developing adults and children (e.g., Dando et al., 2009: 2011; Gentle, Powell, & Sharman, 2013), and children with ASD (Mattison et al., 2015), has reported the beneficial effects of the Sketch-RC in terms of improving performance, but not across all performance measures. For example, typically developed adults recalled more correct information, but sketching did not reduce the number of errors or confabulations albeit that percentage accuracy was improved (Dando et al., 2009). A similar pattern of results emerged for typically developing children (Gentle et al., 2013), and sketching was also found to improve the accuracy of children’s responses to suggestive questions. We formulated the following hypotheses based on the relevant empirical literature and theoretical understandings of memory in ASD (also see Boucher & Mayes, 2012). First, for children with ASD, the beneficial effect of Sketch-RC will carry over to the probed recall phase, resulting in a similar pattern of results whereby the retrieval of new episodic information in that second phase will not bring about a concomitant increase in errors of commission. Second, for children with ASD, the Sketch-RC will improve the accuracy of the new information they recall compared to children with ASD in the MRC and Control interview conditions. Finally, the accuracy of the information recalled by children with ASD in the Sketch-RC will be at least comparable to that of their typically developing peers.

Method

Design

A between-subjects design was employed with two independent variables, Interview, on three levels (Sketch Reinstatement of Context (Sketch-RC); Mental Reinstatement of Context (MRC); Control), and Group on two levels (Children with ASD; Typically developing children). The dependent variable was episodic memory performance measured by i) the amount of correct, incorrect, and confabulated information recalled, as a function of interview phase, ii) percentage accuracy as a function of interview phase (the number of correct items recalled divided by the total correct + erroneous + confabulated items recalled), and iii) the *type* of information recalled (person: action; surroundings) as a function of interview phase.

Participants

Ninety children participated in the research (55 males and 35 females), 45 children with an ASD diagnosis, and 45 typically developing children (control). The children with ASD were recruited from four specialist schools in England. School records indicated that all had been given a formal diagnosis by an appropriately qualified clinician according to the assessment measures of the Autism Diagnostic Observation Schedule (ADOS), which confirmed that participants met DSM-IV-TR criteria for ASD. Children without a formal diagnosis of ASD were excluded from the final data set. The typically developing children were recruited from two mainstream primary and secondary schools in England.

The clinical status difference between the two groups (ASD and typically developing children) denotes heterogeneous levels of cognitive functioning that are likely to influence the cognitive performance under study. To limit the confounding effects of this heterogeneity, the verbal mental age (VMA) and nonverbal mental age (NVMA) of the ASD group were measured using the British Picture Vocabulary Scale III (BPVS-III; Dun, Dun, Whetton & Burley, 1997), and Raven's Coloured Progressive Matrices (RCPM; Raven, Court, & Raven, 1999). We used BPVS-III scores to match (within five points of raw score) ASD participants to typically developing participants, and the RCPM scores as a covariate, which takes account of the ordinal differences in intelligence without risk of misclassification across groups[2]. The RCPM score was not used to match groups because it does not measure intelligence in individuals with ASD in the same way as it does in typically developing comparison groups (see Mottron, 2004; Mottron & Burack, 2001).

Manipulation Analysis

Analysis of the BPVS and Ravens scores across participant groups, interview conditions, and as a function of interview X Group revealed no significant main effects, or interactions, all *F*s < .765, all *p*s > .397. As expected a significant main effect of age emerged between the participant groups. ASD children were older (*M* = 14 years, 6 months; *SD* = 18.12 months) than the matched typically developing group (*M* = 10 years, 2 months, *SD* = 34.95), $F(1, 84) = 80.476$, $p = < .001$. However, there were no significant main effects of age for interview condition, or interview X group interactions, *F*s < .608, all *p*s > .547.

Interview Conditions

The research reported here was concerned with supporting the episodic remembering of child witnesses with ASD for criminal justice purposes, and as such each of the retrieval

[2] A breakdown of the raw data (*M*s and *SD*s) for the measures used to match participants is available upon request from the first author.

conditions was structured according to the current UK investigative interview model and Achieving Best Evidence advice (MOJ, 2011). Irrespective of condition, all interviews comprised the same phases in the same order, as follows: (i) greet, (ii) rapport, (iii) explain, (iv) free recall, (v) probed recall, and (v) closure. Interviews differed only in the *free recall* phase, where the experimental manipulation took place, and so it is the free recall procedure across conditions that are described below (full interview protocols are available from the first author – also see MOJ, 2011 for information on greet, rapport, and closure phases of the interviews).

Sketch reinstatement of context (Sketch-RC). The free recall component in this condition began with participants being supplied with drawing materials (pencils, pens, erasers, and paper etc.) and then being given verbatim instructions on drawing:

"What I would like you to do is draw about the video that you watched earlier. I would like you to draw as much as you can. It can be absolutely anything that you want, and anything that might help you to remember what happened. Also, if you can, I would like you to tell me what you're drawing, as you draw it."

Participants were allowed unlimited time to complete their drawing, were able to use as many pieces of paper as they wished, and could choose the pencil that they wished to use from a set provided by the experimenter. Following completion of each drawing/s the researcher waited silently for 10 seconds (to allow participants to add to/change their drawings), then when the participants had signalled that they had finished they were given the free recall retrieval instructions, as follows:

"I haven't seen the video that you watched, so I would like you to tell me everything that happened in it. Tell me everything that you remember. It is very important that you do not guess – only tell me what you really remember. It is okay to say when you don't know, or can't remember."

Mental Reinstatement of Context (MRC). The free recall component in this condition began with the interviewer giving the following verbatim instructions on the MRC to the participants:

"In a moment, I am going to ask you to tell me what you remember about the video that you watched earlier, but before you start, I would like us to have some thinking time. As I talk to you I would like you to think about each of the things I say, as I say them. Closing your eyes or looking at the wall may help you to think"

Following this introduction, MRC was then conducted (see appendix A for full protocol). The instructions given during the MRC aimed to encourage the participant to mentally reinstate both the environmental and personal context surrounding the to-be-recalled event. The instructions were delivered slowly and in between each instruction, the interviewer paused for 5 seconds, allowing time for the participant to visualise/reinstate the context as instructed. Upon completion, the same free recall instructions as in the Sketch-RC condition (verbatim).

Control. Participants were simply given verbatim instructions on free recall as in the Sketch-RC and MRC conditions.

For all three conditions, participants were allowed unlimited time to explain what they could remember (free recall), and while they were doing so the researcher exhibited active listening but did not interrupt the child. When the child stopped speaking, the researcher waited 10 seconds before asking the participant if he/she could remember anything else about the video, or wanted to add anything. Participants were then probed for further details about the information that they produced during free recall. For instance, if a participant recalled that a man was present in the video, the interviewer asked for information about the man, using the participant's own words (e.g., "you said that there was a man in the video. Tell me more about the man that you saw.”). Thus, the number of questions asked during the probed recall phase was entirely dependent upon the information elicited during free recall, and was not controlled for.

Procedure

Participants were all tested individually on school premises. The first author, a trained investigative interviewer with extensive experience of interviewing vulnerable children, conducted all interviews for this research, thus limiting the effects of interviewer variability. Written consent was provided by each participant’s parent/guardian, and from every head teacher at participating schools prior to the researcher’s arrival. Verbal consent (which was audio recorded) was also gained from each child immediately prior to participating in the research. In addition, due to the age and capacity of the participants, assent was regularly monitored; the experimenter was sensitive to any signs, verbal or non-verbal, that a participant was not wholly willing to continue with the data collection.

Upon arrival, the researcher initially engaged each child in conversation about neutral events unrelated to the research. During this time, the experimenter introduced herself, asked questions about, for example, the paintings displayed on the classroom walls, and conversed about school-related matters such as when break times were, what the school dinners were like, etc. Participants were introduced to the research study and were informed that the researcher was trying to learn how to help people to remember things. An explanation was given as follows: “for example, if you have seen something, and you want to tell somebody what you saw, I am interested in understanding how to help you to do that.” Participants were naïve to the aims and hypotheses of the study, but given the developmental and cognitive vulnerability of participants it was deemed important to provide enough information to allow them to give informed consent verbally. It was also explained to each child that their participation was not a school test, that they did not have to take part, and that they could stop at any time and go back to their friends or classroom whenever they wished.

Each participant first viewed a stimulus film on a portable tablet computer in a different room to where the retrieval would later take place (to avoid spontaneous environmental context reinstatement). Developed by Centrex (Central Police Training and Development Authority), the film portrayed a non-violent criminal offence (a shop theft). The film opens showing a road with numerous cars passing by, and local shops in the distance. The camera pans to show two people walking down the road and going into one of the shops. Approximately 20 seconds later, the same two people are seen running out of the shop, chased by a man (implied to be the shopkeeper). The video then ends (after 58 seconds duration). Participants then moved to a second room and completed the BVPS-III and RCPM, which took approximately one hour. Participants were randomly allocated to one of the three retrieval conditions and were individually interviewed using the appropriate interview protocol for each condition. Interviews were audio recorded.

Interview coding

The interviews were transcribed and coded according to a scoring template technique (e.g., Memon, Holley, Bull and Kohnken, 1996). For all retrieval conditions, coding commenced once participants had been given the free recall instructions. Recall produced during the production of drawings in the Sketch-RC condition, and during MRC, was not included in this instance. A catalogue of 145 information items contained within the film was assembled. Each item recalled by participants was scored as (i) correct; (ii) incorrect (the reported information was relevant to the witnessed episode, but was described with some error, e.g., describing a person's jacket, but stating incorrectly that it was black instead of the actual colour brown); or (iii) a confabulation (reporting a piece of information that was not present within the film). Items recalled were only scored once. Each item was categorised as person, action or surroundings information. Person information included terms associated with persons in the video (e.g., girl; boy; brown hair; jeans; trainers etc.). Action information concerned any actions carried out by persons in the video (e.g., walking; running; driving; laughing etc.), and surroundings information concerned environmental details (e.g., trees; road; shop; post-box etc.).

Twenty interviews (10 ASD; 10 TD) were randomly selected for recoding by an independent coder who was blind to 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 the overall amount of correct, erroneous, and confabulated recall were .729, .711 and .824, respectively, all at $p < .001$, indicating a good level of agreement between raters.

Results

Means and standard deviations for Interview Condition (Sketch-RC; MRC; Control), Group (ASD; Typically developing), and Group X Interview Condition performance for correct, incorrect, confabulated recall, and percentage accuracy are displayed in Table 1. Our experimental hypotheses were investigated using a series of ANCOVAs, with Raven's Coloured Progressive Matrices as the covariate, followed by Games-Howell post-hoc tests where appropriate. We compared children with ASD to typically developing peers across the three interview conditions, analysing performance (correct; incorrect; confabulations; percentage accuracy) as a function of retrieval attempt (free recall; probed recall). Finally, we analysed type of information recalled (person; action; surroundings) as a function of retrieval attempt.

Free Recall

Correct items. There was a significant main effect of Group (ASD; Typically Developing), F (1, 83) = 11.596, p = .001, η^2 = .12. Typically developing children recalled more correct information, 95% CI [16.75, 21.87], than children with ASD, 95% CI [10.53, 15.65]. The main effect of Interview Condition and the Group X Interview Condition interaction were not significant, all Fs < 1.677, all ps > .193.

Incorrect items. There was a significant main effect of Interview Condition, F (2, 83) = 4.437, p = .015, η^2 = .09. Participants in the Sketch-RC recalled fewer incorrect items 95% CI [-0.11, 0.99], than those in the MRC, 95% CI [1.38, 2.14], p = .013. There was no difference between Sketch-RC and Control, 95% CI [0.63, 1.72], p = .189, or between the MRC and Control conditions, p = .876. The main effect of Group and the Group X Interview Condition interaction were also non-significant, all Fs < .292, all ps > .748.

Confabulations. No significant main effects or interactions were found, all Fs < 2.175, all ps > .120.

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Percentage accuracy. There were significant main effects of Group and Interview Condition, F (1, 83) = 9.139, p = .003, η^2 = .10, and F (2, 83) = 7.375, p = .001, η^2 = .15, respectively. Typically developing children were more accurate, 95% CI [86.04, 95.43], than children with ASD, 95% CI [10.53, 15.65], 95% CI [75.94; 85.32], respectively. Children in the Sketch-RC retrieval conditions, were more accurate, 95% CI [88.56, 100.04], than those in both the MRC, 95% CI [73.2, 84.71], p = .001, and Control conditions, 95% CI [88.04, 89.51], p = .035, with no significant difference between the latter two conditions, p = .726.

A significant group X Interview Condition interaction effect emerged, F (2, 83) =

4.294, $p = .017$, $\eta^2 = .094$. Children with autism in the MRC condition, 95% CI [60.97, 77.20] were significantly less accurate than their typically developing peers in the MRC condition, 95% CI [80.72, 96.96], $p = .001$. Similarly, children with autism in the Control condition, 95% CI [68.71, 84.93] were also significantly less accurate than typically developed children in the Control condition, 95% CI [82.62, 98.85], $p = .018$. No significant difference in accuracy was found between children with autism interviewed in the Sketch-RC condition, 95% CI [87.80, 104.15] and typically developing children in the Sketch-RC condition, 95% CI [84.49, 100.76], $p = .567$. See Table 1 for means and standard deviations.

Probed Recall

Correct items. A significant main effect of Group was found, F (1, 83) = 33.848, $p < .001$, $\eta^2 = .29$ (see Table 2 for probed recall means and SDs). Typically developing children recalled more correct information, 95% CI [18.33, 23.43], than children with ASD, 95% CI [7.77, 12.87]. The main effect of Interview Condition and the Group X Interview Condition interaction were non-significant, all Fs < 0.754, all ps > .474.

Incorrect items. A significant main effect of Group was found, F (1, 83) = 11.093, $p = .001$, $\eta^2 = .12$. Children with ASD reported fewer incorrect items in the probed recall, 95% CI [1.74, 4.12], than typically developing children, 95% CI [4.56, 6.94]. There was no significant main effect of Interview Condition, or Group X Interview Condition interaction, all Fs < 1.590, all ps > .210.

Confabulations. A significant main effect of Interview Condition was found, F (2, 83) = 3.688, $p = .029$, $\eta^2 = .08$. Children in Sketch RC conditions, 95% CI [0.12, 4.53], confabulated less that those in MRC, 95% CI [3.80, 8.23], and Control conditions, 95% CI [3.82, 8.64], $p = .001$, with no significant difference between the latter two conditions, $p = .241$. There was no significant main effect of Group or Group X Interview Condition interaction, all Fs < 3.279, all ps > .074.

Percentage accuracy. A significant main effect of Interview Condition emerged, F (2, 83) = 10.677, p < .001, η^2 = .20. All children were more accurate in the Sketch RC condition, 95% CI [69.43, 84.49], than in the MRC, 95% CI [45.97, 61.02], and Control Conditions, 95% CI [50.98, 65.99], all ps > .001, with no significant difference between the latter two retrieval conditions, all ps < .378. The main effect of Group, and the Interview Condition X Group interactions were not significant, all Fs < 1.278, all ps > .284. See Table 2 for means and standard deviations.

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Type of Information

Means and standard deviations for type of information (person, action and surroundings) across groups, and retrieval conditions as a function of phase are displayed in Table 3.

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Free recall

Correct items. A significant main effect of Interview Condition was found for action information, F (2, 83) = 4.076, p = .020, η^2 = .089. Participants in the Sketch-RC recalled significantly more correct action information, 95% CI [7.451, 10.510], than those in the Control, 95% CI [4.375, 7.434], p = .018. There was no significant difference between the Sketch-RC and MRC, or the Control and MRC conditions, both ps >.628. A significant main effect of Group was also found for action information, F (1, 83) = 24.571, p < .001, η^2 = .21. Children with autism, 95% CI [3.862, 6.364] recalled significantly fewer correct action information items than typically developing children, 95% CI [8.281, 10.783], p < .001. No significant interaction emerged for action information, $F = .406$, $p = .668$. No significant effects were found for person or surrounding information, all *F*s < 1.335, all *p*s >.251.

Incorrect items. A significant main effect of Interview Condition for the amount of incorrect action information was found, F (2, 83) = 1.849, $p = .032$, $\eta^2 = .80$. Participants in the Sketch-RC conditions recalled fewer incorrect action items, 95% CI [-.125, .396], than those in the MRC, 95% CI [.338, .857], $p = .045$. There was no significant difference between the Sketch-RC and the Control, or between the Control and MRC, both *p*s >.110. No significant main effect of Group was found for the amount of incorrect action information recalled, nor did a significant interaction emerge between Interview Condition and Group, both *F*s < .648, both *p*s > .528. Additionally, no significant main effects or interactions for Group and Interview Condition were found for person and surrounding information, all *F*s < 2.519, all *p*s > .087.

Confabulations. Significant main effects of Group and Interview Condition for the amount of confabulated surrounding information emerged, F (1, 83) = 5.355, $p = .023$, $\eta^2 = .16$ and F (2, 83) = 3.191, $p = .046$, $\eta^2 = .71$, respectively. Children with autism confabulated more surrounding information, 95% CI [.397, 1.006], than typically developing children, 95% CI [-.155, .514], $p = .023$, but all participants in the Sketch-RC condition, 95% CI [-.310, .508], confabulated fewer surrounding items than those in the Control condition, 95% CI [.423, 1.241], $p = .041$. No significant differences were found between the MRC, Sketch-RC and Control conditions, all *p*s > .532. A significant Group X Interview Condition interaction emerged, F (2, 83) = 3.209, $p = .045$, whereby children with autism in the Control condition, 95% CI [.951, 2.110], confabulated more surrounding information than typically developing children in Control condition, 95% CI [-.446, .716], $p = .001$. There were no other significant differences as a function of Group in the Sketch-RC condition, $p = .894$ or the MRC conditions, $p = .630$. Further, no significant main effects or interactions were found for the number of confabulated action or person items recalled in the free recall, all *F*s < .282, all *p*s > .229.

Percentage accuracy. Significant main effects of Interview Condition and Group emerged for accuracy of person information, F (2, 83) = 5.842, p = .004, η^2 = .19; F (1, 83) = 6.695, p = .011, η^2 = .13, surrounding information, F (2, 83) = 5.505, p = .006, η^2 = .24; F (1, 83) =11.884, p = .001, η^2 = .15 and action information, F (2, 83) = 4.076, p = .020, η^2 = .11; F (1, 83) = 6.695, p = .011, η^2 = .13, respectively (see Fig. 1 below). All children in the Sketch-RC were more accurate when recalling i) person information, 95% CI [80.892, 100.340], than those in both the MRC, 95% CI [61.559, 81.038], p = .020, and control, 95% CI [59.440, 78.887], p = .008, with no significant difference between the latter two conditions, p = .981, ii) surrounding information, 95% CI [89.461, 102.897], than those in the MRC, 95% CI [74.328, 87.785], p = .007, and control, 95% CI [77.747, 91.182], p = .049, with no significant difference between the latter two conditions, p = .967, and iii) action information, 95% CI [80.73, 19.919], than those in both the MRC, 95% CI [69.849, 85.294], p = .019, and control, 95% CI [75.777, 94.957], p = .010, with no significant difference between the latter two conditions, p = .761.

Children with ASD were significantly less accurate when recalling action information, 95% CI [71.428, 85.595], surrounding information, 95% CI [74.991, 85.979], and person information, 95% CI [61.548, 79.345], than typically developed children 95% CI [84.487, 98.654], p = .011, 95% CI [88.487, 99.475], p = .001, and 95% CI [74.707, 92.504], p = .001, respectively. There were no significant Interview Condition X Group interactions, all *F*s < 2.707, all *p*s > .073.

----- INSERT FIGURE 1 HERE -------

Probed Recall

Correct items. Significant main effects of Group were found for person, action and surrounding information, F (1, 83) = 30.843, $p < .001$, $\eta^2 = .271$; F (1, 83) = 6.200, $p < .015$, $\eta^2 = .07$; F (1, 83) = 19.878, $p < .000$, $\eta^2 = .193$, respectively. Children with autism, 95% CI [2.228, 4.664], 95% CI [1.505, 3.125], 95% CI [3.199, 5.913] recalled fewer correct person, action and surrounding items during the questioning phase than typically developing children, 95% CI [7.047, 9.483], 95% CI [2.942, 4.562], 95% CI [7.510, 10.223]. No significant main effects or interactions involving Interview Condition emerged for the amount of correct information, all Fs < 1.145, all ps > .530.

Incorrect items. A significant main effect of Group was found for person items, F (1, 83) = 12.034, $p = .001$, $\eta^2 = .127$. Children with autism, 95% CI [.630, 1.935] recalled fewer incorrect person items during the questioning phase than typically developed children, 95% CI [2.243, 3.548]. No significant main effects or interactions were found involving Interview Condition, all Fs < 3.175, all $p > .078$.

Confabulations. A significant main effect of Group was found for person items, F (1, 83) = 20.442, $p < .001$, $\eta^2 = .198$. Children with autism, 95% CI [-.117, 1.326] made fewer person confabulations than their matched typically developed peers, 95% CI [2.207, 3.650]. No other significant effects or interactions were found, all Fs <2.515, all $p > .087$.

Percentage Accuracy. Significant main effects of Interview Condition were found for accuracy of person items, F (1, 84) = 4544.339, $p = .008$, $\eta^2 = .106$, surroundings, F (1, 84) = 5.095, $p = .027$, $\eta^2 = .56$, and actions, F (1, 84) = 6.183, $p = .003$, $\eta^2 = .078$ (see Fig. 2 below).

----- INSERT FIGURE 2 HERE -------

Children in Sketch-RC conditions were more accurate when recalling person 95% CI [55.767, 77.551], surrounding, 95% CI [66.638, 87.879], and action information, 95% CI [55.237, 81.88], than those in the MRC (MRC person 95% CI [32.767, 45.535], $p = .010$; MRC surrounding 95% CI [52.889, 74.130], $p = .026$; MRC action 95% CI [31.134, 59.784], $p = .048$) and Control conditions (Control person 95% CI [37.039, 58.823], $p = .046$; Control surrounding 95% CI [54,316, 75.552], $p = .032$; Control action 95% CI [18.690, 56.379], $p = .003$), with no significant differences between the MRC and Control conditions, all *p*s > .146. There were no significant Group main effects or interactions for the accuracy of person, action, or surrounding information, all *F*s < 2.469, all *p*s > .159.

Discussion

Using a mock witness paradigm we investigated the efficacy of the Sketch-RC technique for children with ASD during ABE structured interviews, analysing episodic performance in each of the recall phases of an interview, asking whether the beneficial effects of the Sketch-RC (see Mattison et al., 2015) carry over from the free recall to the probed recall phase. We formulated a series of hypotheses around which we have structured our discussion. Our first hypothesis was that for children with ASD the beneficial effect of Sketch-RC would carry over to the probed recall phase. In ABE interviews the probed recall is immediately preceded by a free recall, which guides the topics and questioning structure of the probing phase, and so we mirrored this by applying the MRC, the Sketch-RC or offering no support (control condition) as a function of group at the start of the formal free recall retrieval. Children with ASD recalled less correct information than typically developing children in this phase, but *all* children in the Sketch-RC made fewer errors, and children with ASD were 25% more accurate in the Sketch-RC interviews than their ASD peers in the MRC condition, and 20% more accurate than those in the Control. Moreover, children with ASD in the Sketch-RC condition were just as accurate as typically developing children, whereas those in both the MRC and Control conditions exhibited much reduced accuracy (also see Mattison et al., 2015). That free recall performance can be significantly improved using the Sketch-RC in terms of reduced incorrect recall, and improved accuracy performance in line with the performance of typically developing children is exciting because it offers a population appropriate method for supporting and improving episodic free recall.

Returning to our first hypothesis concerning the carryover effects of context support provided prior to free recall to the probed recall, as expected we found that irrespective of retrieval condition, typically developing children recalled far more correct information than children with ASD. However, children with ASD recalled significantly fewer items of incorrect information in this probed phase compared to typically developing children. While there were no consistent significant effects of condition on correct information recalled, all children in the Sketch RC confabulated less than those in both the MRC and Control. Hence, our hypothesis was partially supported in that children with ASD in the Sketch-RC made fewer errors than the typically developing children, and confabulated less. This finding is reflected in the percentage accuracy data, which revealed that while all children were significantly more accurate in the probed recall of the Sketch-RC condition than in either of the other two interview conditions, children with ASD in this condition were equally as accurate as their typically developing peers. This pattern of findings supports our second and third hypotheses, that the Sketch-RC would improve the accuracy of the new information reported by children with ASD, and that the accuracy of the information recalled would be comparable to that of their typically developing peers. However, it is also worthy of note that the Sketch-RC resulted in more accurate recall across both groups of children compared to the other two conditions.

Special populations such as children with ASD offer unique challenges for researchers, in that they display greater variability in performance than other populations. However, despite substantial mean performance differences across the three interview conditions not always reaching statistical significance, clearly these differences are important because they have incrementally accumulated to significantly improve percentage accuracy for ASD children in the Sketch-RC condition across both retrieval attempts. Accordingly, the positive effects of drawing in the Sketch-RC condition do carryover from the free recall phase.

While children with autism do not typically demonstrate deficits in cued recall, the verbal cues presented during the second probed recall of this study were directed by information produced by during the first (free) recall attempt, only. Thus, if incorrect and/or confabulated information was produced in the first instance, the information produced during probed recall would likely be affected, which may account for mean differences across conditions, and why Sketch-RC produced more accurate recall than MRC during the probed retrieval attempt. Similarly, MRC may have caused retrieval interference, disrupting free recall performance in the first instance (e.g., Craik, 1981; Flashman, O'Leary & Andreasen, 2001), which continued during probed recall. Because interviewers do not know which information items are correct and which are not, all verbalised information, including incorrect and confabulated information, from the first account is further probed during the second retrieval.

It is our contention that the process of drawing may support children with autism to engage in a more strategic, perceptual search processes right from the start. Thus, compensating for retrieval deficits that are traditionally associated with this group, and therefore aiding goal-directive remembering throughout *both* recall attempts (de Jong, 2010). As children draw salient aspects of an event, they are naturally supported to access item-specific memory, as opposed to relational memory system/s (the latter is often impaired in people with ASD, e.g., Gaigg et al., 2008). That is, asking children to draw what they can remember, encourages them to process the individual details of an event, as demonstrated by the higher number of correct items recalled, and the increased accuracy by children in the Sketch-RC condition during free recall. Similarly, Sketch-RC simultaneously allows children to engage in perceptual representation processes, utilising their enhanced spatial abilities and visual processing style by depicting recall of events onto a picture (Eames & Cox, 1994; Lee & Hobson, 2006).

Crucially, the pictures produced by each child remained visible/present throughout the probed recall phase. It is likely that the presence of the picture served as a bespoke visual cue when children were probed for further details, thereby allowing for perceptual representation processing to continue into the second probed recall. No such visual cue was available during the probed recall phase for children interviewed in the MRC and Control conditions. Rather, MRC only provides cues *prior* to free recall, and these are verbal in nature. This is likely problematic for two reasons. First, MRC relies solely upon verbal styles of processing in order to access episodic memories, which can be challenging for children with ASD (Ben Shalom, 2003; Minshew & Goldstein, 1998; Whitehouse, Maybery, Dirkin, 2006). Second, no further retrieval support is provided during the remainder of the interview, again, possibly accounting for the increased amount of incorrect and confabulated information produced during MRC across both recall attempts. Sketch-RC is unique in that it offers discrete, appropriate, and non-invasive retrieval support before, and during, both retrieval attempts. The positive carryover effects of Sketch-RC to the probed recall are important because the probed recall phase of witness interviews present an increased risk of inaccurate information being generated, due in part, to demand characteristics, and the risks associated with repeated recall attempts (see Quas et al., 2007).

We did not hypothesise regarding the type of information recalled by children with ASD, largely because the applied empirical and theoretical literature does not support any such hypotheses. However, given our findings it is appropriate to draw attention to a number of results. In the first free recall the Sketch-RC technique improved the recall of person information by children with ASD by 25% and resulted in more correct action information and fewer erroneous action information items than children with ASD in both the control and MRC conditions. Good quality information about persons, and their actions, supports the investigation of crime. We believe that improved person remembering occurred because, from the offset, sketching focuses witnesses on event-specific contextual cues. The MRC technique was originally designed to ‘recreate the general context associated with the event’ (Fisher and Geiselman, p. 149), rather than the context of the event itself. Hence, MRC instructions cue witnesses to focus their retrieval efforts on the environment and personal context of the witnessed event rather than the event itself. This would account for the increased surrounding information recalled by children in the MRC condition.

Turning to the probed recall, all of our children with ASD, irrespective of interview condition recalled fewer correct items of all the types of information (person; action; objects), during this second retrieval. However, they recalled significantly fewer incorrect and confabulated person details, and our children with ASD when interviewed using Sketch RC method were no less accurate than their typically developing peers across all of the information types. Accordingly, the positive carryover effects of Sketch-RC method to the probed recall have revealed themselves in two ways. First, the accuracy of the types of new information verbalized by children with ASD during this recall is on a par with their typically developing peers, and second the Sketch-RC method has continued to scaffold their recollection of person information by supporting children with ASD to recall extra new person information without a concomitant increase in the number of errors or confabulations, out performing their typically developing peers.

These results provide further evidence for the Task Support Hypothesis (Bowler et al., 1997), which argues that individuals with autism can utilise context, but that in order to do so task support tools must be developmentally appropriate. Developing a tool that can support accurate remembering, while also minimising the risks associated with probed recall during witness interviews is of fundamental importance if increased access to justice is to be achieved. Sketch-RC is the first to offer tailored support that can be utilised in the criminal justice system.

Eyewitness research with special populations rarely considers the type of information recalled, yet this is important from an investigative perspective. Future research should build on our findings by perhaps also analysing recall with reference to the investigative relevance of the items presented in the stimulus material and the position of those items, and whether directed event sketching might be appropriate to help steer recall towards investigation important information, for example. Similarly, eyewitness research does not typically screen control group participants for atypical / clinical diagnoses; future research should consider the benefits of such screening, where appropriate, in order to increase the reliability of findings that impact upon practice with special populations.

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Appendix

Mental Reinstatement of Context Protocol

"In a moment I am going to ask you to tell me what you remember about the video that you watched on the iPad, but before you start I would like to spend some time helping you to remember as much as you can… As I talk to you I would like you to think about each of the things I say, as I say them… Closing your eyes or looking at a blank wall may help you to think… To begin I would like you to try to think back to when you saw the video…"

Five second pause…

"Thinking really hard, just as you would do if you had lost something and were trying to remember the last time you saw it…"

Five second pause…

"Think about earlier today…"

Five second pause…

"What had you been doing this morning… Who had you seen or spoken to…"

Five second pause…

"Think about what had you been doing just before coming up to see the video on the iPad…"

Five second pause…

“Now I would like you to think about the place where you watched the video…”

Five second pause…

“Try and get a picture of that place in your mind…”

Five second pause…

“What did it look like? ...Did you smell anything…”

Five second pause…

“…or did you notice anything about it…”

Five second pause…

“Think about where things were in the place that you watched the video…”

Five second pause…

“Think about where the iPad was…”

Five second pause…

"…And where you sat to watch the video…"

Five second pause…

"Try to remember if anyone else was there with you…"

Five second pause…

"Where they were sitting..."

Five second pause…

"What were they doing…"

Five second pause…

"Think about whether you spoke to anyone…"

Five second pause…

"Now think about how you felt as the video started…"

Five second pause…

"What did you think you were going to see…"

Five second pause…

"Now think about the video…"

Five second pause…

"Think about what you saw on the video…"

Five second pause…

"When you feel ready, I would like you to tell me everything that you can remember about what happened on the video, starting from the beginning…"