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Episodic memory in adults with autistic spectrum disorders: Recall for self- versus other-experienced events

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Abstract

People with autistic spectrum disorders (ASD) have difficulties in recalling recently experienced events, which is dependent upon intact functioning of several aspects of 'self awareness'. The current study examined impaired episodic recall in ASD and its relationship to specific impairments in aspects of 'self awareness'.

Between-group (participants with learning disabilities with and without autistic spectrum disorder) experimental design examining free and cued recall of table-top activities that were either self-experienced by participants or observed being performed by the experimenter.

Participants with ASD did not show superiority of free recall for self-experienced events over observed events, nor for recall of other-experienced events over self-experienced events, but did demonstrate a superiority for *cued* recall of self-experienced events. The implications for theory and practice are discussed.

Keywords: Episodic memory; Autistic spectrum disorders; Semantic memory

1. Introduction

Memory involves storage and recall of different forms of information (Tulving, 2000). In addition to the distinction between working, short and long-term memory, 'semantic

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memory' (knowledge about the world) can be distinguished from 'episodic memory' (recollection of events from an individual's personal past characterised by the conscious experience of 'remembering') (Tulving, 1985). A further distinction is made between the subjective experiences of '*remembering*' (i.e. mentally returning to an event and re-experiencing it) and '*knowing*' (i.e. recognition without recall of the original experience). 'Autonoetic consciousness' is the conscious awareness of one's own existence and identity ''. . . in subjective time extending from the personal past through the present to the personal future'' (Tulving, 1985). This facilitates 'mental time-travel' to past events, which can then be re-experienced (Gardiner, 2002). The linkage of episodic recall and autonoetic consciousness has implications for understanding of the 'self' and the extent to which self concept develops from episodic experiences (Klein, 2001). Conway (2002) further proposes that the recollective experience associated with episodic memories indicates that the mental image generated is a reflection of a self-experienced event, rather than dreams or fantasy, and that 'experiences with strong self-reference may receive privileged encoding that render them highly accessible'.

If episodic memory is dependent upon autonoetic consciousness, then episodic memory requires a 'self' that is continuing through time, with past and present experiences relating to the same 'self'. Episodic recollection is dependent on recollection of specific events and recognising that the event happened in one's own past. Thus, without reference to the past and self-continuity across time, individuals would exist in a 'permanent present' (Baddeley, 1999). Self-continuity through time does not develop until the age of 4 years, when episodic memory is first observed (Perner, 1990; Welch-Ross, 1995). Klein (2001) argues that impaired self concept leads to impaired memory, rather than vice-versa, and proposes that people with autistic spectrum disorders (ASD) might experience impaired self continuity related to observed autobiographical episodic memory dysfunction (Boucher & Lewis, 1989; Klein, Chan, & Loftus, 1999; Ozonoff, Pennington, & Rogers, 1991).

Perner (1990) proposes that episodic memory in typically developing children is dependent on mentalisation abilities. Therefore, people with ASD would be expected to exhibit episodic memory deficits and children with ASD have been found to have difficulties in recalling self-participation in events (Boucher, 1981; Boucher & Lewis, 1989). Powell and Jordan (1993) explain deficits in episodic memory associated with ASD by reference to an impaired 'experiencing self' that 'encodes events as part of a personal dimension'. Without this specialised encoding, spontaneous retrieval is hindered, impairing free recall of personal episodic memories. They further posit a difference between 'knowing' that one is engaged in an event and 'experiencing' it as happening to oneself, the latter involving evaluating personal feelings about the event and the personal significance of the event.

Episodic memories can be recalled by cued recall or by spontaneous free recall, which requires re-experiencing (Conway, 2002). Powell and Jordan (1995) suggest people with ASD will not be impaired on *cued* recall of personally experienced events, only on *free recall*, as their ability to deliberately place themselves back in an experience is impaired, which results in events not being encoded as part of a personal dimension.

Conway (2002) proposes experiences directly involving the self may receive 'privileged' encoding that makes them more easily searched for and retrieved, i.e. events involving the self should be more easily remembered than events observed (Baker-Ward, Hess, & Flannagan, 1990; Conway & Dewhurst, 1995). Therefore, people with ASD who have deficits in processes involving the self should *not* demonstrate this superiority for self-experienced events.

2. Concepts of 'self' in autistic spectrum disorders

Although there is limited research into concepts of self in ASD, impaired functions of 'self' can be identified, e.g. refer to self in the third person and confusion of personal pronouns 'I' and 'you' (Lee, Hobson, & Chiat, 1994). Loveland (1993) suggests that pronoun confusion results from difficulties in understanding the differing view-points of others, i.e. 'you' and 'I' are simultaneously both 'I' to oneself and 'you' to another person.

Powell and Jordan (1995) propose that self-concept comprises both a 'descriptive element', referring to factual self-knowledge (i.e. semantic autobiographical) and an 'evaluative element' (i.e. 'interpersonal self'), the latter developing through interaction with others and therefore impaired in ASD (Frith & Happé 1999). Hence, people with ASD can possess knowledge about themselves, but not the 'experience' of what it is like to be them. This is supported by the observation that although the 'interacting self' may be impaired (Lee & Hobson, 1998), people with ASD can have an intact 'self knowledge' (i.e. semantic personal knowledge about the facts of their lives) without recall of events upon which this knowledge is based. Klein (2001) proposes deficits in self awareness lead to deficits in episodic memory, which is dependent on a sense of the self continuing through time and an awareness of having had past experiences that can be re-visited. Klein also suggests that this self-continuity involves self-reflection of thought and actions and a sense of personal agency in events and of personal ownership. Klein cites evidence indicating that people with ASD have impairments in each of these components (Tager-Flusberg, 1992), which would therefore imply impaired episodic memory.

In conclusion, there is some evidence that individuals with ASD have specific impairments in their sense of 'experiencing' events as happening to themselves (Hobson, 1990), in self-continuity through time (Klein, 2001) and possibly in self-monitoring ability, which appear to be associated with impaired recall of episodic memories.

A further study of free versus cued recall by children with ASD was carried out by Millward, Powell, Messer, and Jordon (2000), with children, with and without ASD matched for verbal ability. Following engagement in various activities in the course of a walk, some of which were engaged in solely by the child, some by the researcher and some jointly, participants' recall of events was elicited through open questions and then prompted through cueing. Three separate recall scores were elicited: personal condition self-experienced ('Unaccompanied Self'), companion condition self-experienced events ('Accompanied Self') and companion condition other-experienced events ('Accompanied Other'). Participants with ASD performed significantly worse on the 'Unaccompanied Self' recall task than on 'Accompanied Other' on overall recall, i.e. other-experienced events when with another were recalled than self-experienced events when alone. There was no significant difference between recall on 'Accompanied Self' and 'Accompanied Other' or 'Accompanied Self' and 'Unaccompanied Self'. No significant differences were found between free and cued recall for any of the recall conditions cued recall between any of the recall conditions (Table 1).

Millward et al. (2000) concluded that children with ASD do not simply lack superiority of recall for self- over other- experienced events, but their ''memory processes are ... impaired when they have to process personal information'' (p. 25). They postulated that no group difference in free recall on 'Accompanied Self' tasks indicated being accompanied improves encoding of events for ASD participants, aiding later recall. Similarly to the ASD group, no significant difference was found in comparison group of children with moderate intellectual disabilities (MID) between the 'Accompanied Self' and 'Accompanied Other' tasks. In addition children with MID performed significantly better on recall of self-experienced events when alone

Table 1
Age and verbal abilities of participants

	ASD ($n = 12$)	ID ($n = 14$)	t	p
Chronological age (years)			6.70	0.000
Mean (S.D.)	27.7 (6.3)	49.6 (10.2)		
Range (minimum–maximum)	19.7–38.6	32.9–63.5		
BPVS score (years)			0.859	0.399
Mean (S.D.)	6.1 (1.9)	6.8 (1.5)		
Range (minimum–maximum)	4.0–9.1	4.2–9.0		
TROG score (years)			2.05	0.053
Mean (S.D.)	5.3 (1.2)	4.5 (0.5)		
Range (minimum–maximum)	4.0–8.0	4.0–5.6		
HADS-m Anxiety (maximum = 21)			0.98	0.338
Median	6	4.5		
Range (minimum–maximum)	1.0–11.0	0–9.0		
HADS-m Depression (maximum = 21)			1.14	0.265
Median	2	2		
Range (minimum–maximum)	0–6.0	0–7.0		

than when accompanied. However, Millward et al.'s study was compromised by the combining of free and cued recall scores, increased memory load in the 'personal' condition, lack of control for ID and the scoring utilised. Participants were scored on recall of locations visited, items seen and actions performed, but in accompanied recall, these were common to both self and other. If individuals with ASD are more likely to conflate or confuse self- and other-performed actions (Russell & Jarrold, 1999) and if other-performed actions are more memorable then self-performed actions (Millward et al., 2000), items or locations may be recalled well because the other person was engaged with them, but may be reported as a 'self' location or item due to source attribution difficulties. Where items or locations are common to both 'self' and 'other' the recollection would be scored as correct. Hence performance on one 'accompanied' recall task may influence performance on the other 'accompanied' recall task as participants are being asked to recall the same locations and items in each. Furthermore, the performance of children with MID on 'Accompanied Self' and 'Accompanied Other' were not significantly different and self-experienced event recall was better than other-experienced recall when alone. This suggests that recall in one accompanied task may influence recall in the other accompanied tasks. Recall of self-experienced locations and items may be used to inform recall of other experienced items and locations, i.e. if asked '*What did X do this morning?*' A person can reason '*The same things as me*.'

The aim of the current study was to address the limitations of previous research in an investigation of autobiographical memory in adults with ASD. The hypotheses examined were: (1) participants with ASD and ID will freely recall significantly less self-experienced events in both the 'Unaccompanied Self' and 'Accompanied Self' tasks, compared to the participants with ID; (2) participants with ASD will demonstrate a significant difference in their free recall of events between 'Accompanied Other' and either 'Unaccompanied Self' or 'Accompanied Self' tasks; (3) participants with ID will freely recall a significantly greater number of events in both the 'Unaccompanied Self' and 'Accompanied Self' tasks than in the 'Accompanied Other' task; (4) there will be a significant difference in the cued recall of events between and within the two groups on any of the three recall tasks.

3. Method

A 2×2 n experimental design was employed, with two groups of participants (ASD and ID, and ID only) and two experimental conditions *viz.*:

- *Personal*—participant performing a series of table-top tasks and then recalling those tasks
- *Companion*—participant and researcher taking turns to perform a series of table-top tasks and the participant then recalling those tasks and who performed each one.

Participants were recruited from 3-day services for people with moderate to severe ID and from statutory and independent services for people with ASD. Permission was obtained to contact potential participants using services for people with ID and day service managers were then approached for permission to speak with service-users. Participants were included if they had an ID, were aged 18–65 years and could understand task instructions. Participants with ASD had verifiable professional DSM-IV or ICD-10 diagnosis of ASD. Exclusion criteria were insufficient English to understand the tasks, physical disabilities precluding task performance, serious head injury, uncorrected auditory or visual impairment or little or no verbal communication. Consent procedures were in line with recent recommendations of research with people with ID (Dye, Hare, & Hendy, 2003).

Receptive language ability was assessed using the British Picture Vocabulary Scale-II [BPVS-II] (Dunn, Dunn, Whetton, & Burley, 1997) and Test for Reception Of Grammar, second edition [TROG] (Bishop, 1983). As depression and anxiety can impact on memory performance (Baddeley, 1999), the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983) was utilised as modified for people with ID, with simplified wording and response options presented as a visual analogue scale (Dagnan, 2001, personal communication).

Table-top tasks used were adapted from Cohen's (1981) 'minitasks' pool with potentially harmful tasks (e.g. 'rock back in your chair) removed and were analogous to Summers and Craik's (1994) 'Subject Performed Tasks'. Twelve items made up a set (based on a pilot study), randomly allocated but with any similar tasks ('squash the plasticine'/'stretch the blu-tac') allocated to separate lists. Task instructions were read out by the researcher, thus structuring the session by emphasising whose turn it was in the shared condition. Each task was presented directly after completion of the previous task at approximately 6 s intervals. The BPVS-II and TROG were performed during a 10 min delay between completion of the final task and recall.

At the end of each experimental session, participants were asked to recall the table-top tasks; events recalled without prompting were recorded as '*free recall*', events recalled only after giving a standard prompt recorded as '*cued recall*'. In condition 1 ('personal' condition), participants were scored for free and cued recall of self-performed tasks, i.e. 'unaccompanied self' recall score. In condition 2 ('companion condition') participants were scored for free and cued recall of self-performed tasks and for free and cued recall of researcher-performed tasks (i.e. 'accompanied self' score and 'accompanied other' score). For comparison between conditions, free and cued recall scores were converted to percentages. A potential confound was identified in that good performance on free recall would lead to a low score on cued recall, producing misleading results suggesting poor cued recall. Raw scores on cued recall were converted to percentage scores for analysis to give a more accurate indication of performance. Cued recall performance was therefore calculated as a percentage of items left for recall once the free recall score had been subtracted. Scores were calculated as follows:

For 'Unaccompanied Self':

$$\text{free recall} = \left(\frac{\text{free recall raw score}}{12}\right) \times 100$$

$$\text{cued recall} = \left(\frac{\text{cued recall raw score}}{\text{12-free recall raw score}}\right) \times 100$$

For 'Accompanied Self' and 'Accompanied Other':

$$\text{free recall} = \left(\frac{\text{free recall raw score}}{6}\right) \times 100$$

$$\text{cued recall} = \left(\frac{\text{cued recall raw score}}{\text{6-free recall raw score}}\right) \times 100$$

4. Procedure

To counter-balance procedures across participants, the participants were allocated consecutive positions from a table listing all possible combinations of task list, experimental condition and verbal ability test. An alternative list, condition and test were administered in session 2. Sessions were scheduled 1 week apart to reduce retroactive interference. To minimise confounds due to different physical environments, sessions were conducted in a quiet room containing two separate tables with two chairs at each table, with a three-sided screen placed on the table on which the experimental tasks were completed. Chairs were turned to face away from windows or blinds drawn across windows to reduce distraction.

Participants performed 12 table-top tasks, either completing all tasks themselves or 'taking turns' with the researcher. Task instructions were read by the researcher from cards placed face down in a pile on the table. The researcher and participant then moved to the second table to complete the BPVS or TROG for 10 min after which, they returned to their original seats at the first table. The use of separate tables clarified which set of activities were to be recalled (i.e. the table-top tasks at 'this table', rather than the BPVS pictures seen at 'that table').

Participants were then asked to recall the table-top tasks performed earlier. A maximum of 5 min was allowed for free recall before cues were given, but were given sooner if participants clearly indicated they could not freely recall anymore. Responses were recorded as 'free' or 'cued'. At the end of the recall tasks in condition 2, participants were reminded of each task in turn, in random order, and asked to recall who had performed it. If criteria for terminating the BPVS or TROG were not achieved within the 10 min interim period, the test was completed at the end of the session. The HADS-m was administered at the end of the second session.

5. Results

A total of 12 participants with ASD and 14 participants with ID achieved age equivalent verbal ability scores of 4 years or above and completed the study. Verbal abilities were indicated as age-equivalent BPVS and TROG scores. TROG scores of five participants [three ASD; two ID] were too low to compute age-equivalent scores and were counted as missing data.

All data was normally distributed and within-group equality of variances was assumed for verbal ability ($F = 0.87, p = 0.360$) and for grammatical understanding ($F = 2.94, p = 0.103$), but not for age ($F = 5.87, p = 0.023$). Between group analysis showed the ID group to be significantly older ($t = 6.70$, d.f. = 22, $p < 0.0005$). Chronological age was not expected to impact on recall, but was considered in subsequent analyses as a co-variate. Differences between the groups on TROG scores approached significance, with the ASD group performing better than the ID group ($t = 2.05$, d.f. = 19, $p = 0.053$) and this was considered in subsequent analyses. No significant differences were found between the groups on BPVS age-equivalent scores, HADS-m anxiety or depression scores.

Table 2 shows descriptive statistics for free recall in the three recall conditions.

One-Sample Kolmogorov–Smirnoff Tests indicated that free recall scores under all recall conditions for both groups followed a normal distribution. Equality of variance held for the 'Accompanied Self' ($F = 1.9, p = 0.182$) and the 'Accompanied Other' ($F = 0.0, p = 0.988$) recall conditions. Unequal variances of the two sets of data for the 'Unaccompanied Self' recall condition was indicated ($F = 12.2$, $p = 0.002$). ANOVA procedures were used, as these are considered sufficiently robust for moderate departures from the parametric assumptions of homogeneity of variance and normal distribution (Howell, 2002). To test hypotheses 1–3, free recall data for both groups were subjected to a repeated measures ANOVA, with group as between-subjects factor and recall condition (3 levels) as the within-subjects factor. Mauchly's Test of Sphericity was significant ($W = 0.764$, d.f. = 2, $p = 0.045$). As equality of variances of the differences between pairs of scores in all combinations of comparisons between the recall tests could not be assumed, Huynh–Feldt corrections were applied. No significant main effect of group or interaction effect was found, although a there was significant main effect for recall condition ($F = 3.5$, d.f. = 1.8, $p = 0.044$).

To investigate the effect of the recall condition, post-hoc independent one-tailed t-tests were performed. No significant differences were found between any of the three recall tasks for the ASD group. In the ID group, the free recall score for 'Unaccompanied Self' condition was significantly greater than for the 'Accompanied Other' condition at the $p < 0.05$ level ($t = 2.379$, d.f. = 13), but not significant at the more conservative $p < 0.01$ level. Although differences between the two 'self' recall conditions and the 'other' recall condition were in the direction predicted, none were significant at the $p < 0.01$ level. No significant difference was found between the 'Unaccompanied Self' and 'Accompanied Self' recall conditions.

As episodic memory develops around 4 years (Perner & Ruffman, 1995), age-equivalent BPVS-II scores were taken as an indicative of developmental level. Spearman's Rho correlations

Table 2
Summary of free recall scores in each recall conditions

Free recall task	ASD ($n = 12$)	ID ($n = 14$)
Unaccompanied self		
Mean (S.D.)	29.9 (22.6)	31.5 (12.3)
Range (minimum–maximum)	0–58.3	0–50.0
Accompanied self		
Mean (S.D.)	26.3 (27.0)	34.5 (20.1)
Range (minimum–maximum)	0–66.7	0–66.7
Accompanied other		
Mean (S.D.)	20.8 (17.6)	22.6 (16.8)
Range (minimum–maximum)	0–50.0	0–50.0

between verbal ability and free recall were computed for each recall condition for each group. The ID group had no significant correlations, but verbal ability significantly correlated with free recall on the 'Accompanied Other' recall condition ($r = 0.631$, $p = 0.028$) in the ASD group. Five separate repeated measures ANCOVAs were performed, employing 'free recall condition' as the within-subjects factor and 'group' as the between-subjects factor and age, BPVS, TROG, HADS-A or HADS-D scores as co-variate. The only significant between-group effect was HADS-m anxiety scores ($F = 5.803$; $p = 0.024$).

Table 3 shows the cued recall scores for each recall condition.

Equality of variances could be assumed for cued recall data under all recall conditions, the data was negatively skewed as up to 100% of participants in each recall condition achieved high scores. Kolmogorov–Smirnov tests revealed non-normal distribution of data in the 'Accompanied Self' task for the ID group, but ANOVA tests were considered sufficiently robust in this instance. To test hypothesis 4, a repeated measures ANOVA was used with cued recall data for both groups, with recall condition (3 levels) as within-subjects factor. Mauchly's Test of Sphericity being non-significant, equality of variances of the differences between pairs of scores in all combinations of comparisons between the recall tests could be assumed. No significant main effect of group or interaction effects were observed, but the main effect for recall test was significant ($F = 10.83$, d.f. = 2, $p < 0.0005$). Post hoc tests were applied with a conservative criterion of $p < 0.01$. For the ASD group, differences between Unaccompanied Self versus Accompanied Other ($t = 0.934$, d.f. = 11, $p = 0.018$) and Accompanied Self versus Accompanied Other ($t = 2.933$, d.f. = 11, $p = 0.014$) were in the same direction as free recall for the LD group and both approached significance at the 0.01 level. In the ID group, the difference in cued recall between Unaccompanied Self and Accompanied Other was non-significant, but in the predicted direction. Cued recall in the Accompanied Self task was significantly greater than in Accompanied Other ($t = 3.621$, d.f. = 13, $p = 0.003$). No significant difference was found between the two 'Self' tasks for cued recall.

To investigate relationships between verbal ability and free recall, Spearman's Rho correlations were computed for each recall task for each group. No significant correlations were found, although the correlation between verbal ability and the 'Unaccompanied Self' recall condition approached significance (rho = 0.574, $p = 0.051$) for participants with ASD. To examine contribution of other factors to differences in cued recall, five repeated measures ANCOVAs were performed with 'cued recall task' as the within-subjects factor. The effect of chronological age ($F = 4.255$, d.f. = 1, $p = 0.051$) approached significance at $p < 0.05$ level,

Table 3
Summary of cued recall scores in each recall condition

Cued recall task	ASD group ($n = 12$)	ID group ($n = 14$)
Unaccompanied self		
Mean (S.D.)	83.0 (17.2)	80.6 (20.8)
Range (minimum–maximum)	50.0–100.0	37.5–100.0
Accompanied self		
Mean (S.D.)	79.0 (22.7)	88.1 (23.3)
Range (minimum–maximum)	33.3–100.0	25.0–75.0
Accompanied other		
Mean (S.D.)	62.0 (31.3)	65.3 (27.3)
Range (minimum–maximum)	16.7–100.0	16.7–100.0

probably reflecting the group age difference, rather than chronological age per se. No other significant effects were found.

6. Discussion

No between-group differences were found for 'free recall' under any of the three recall conditions, providing no support for hypothesis 1. Three participants with ASD and two participants with ID scored '0' for free recall in one or both experimental conditions, indicating possible floor effects. Caution is therefore required in interpreting these findings. Hypothesis 2 was supported, as no within-group differences between the recall conditions were found for the participants with ASD. As per Millward et al. (2000), no significant difference was found between the 'Accompanied Self' and 'Accompanied Other' recall conditions. Although Millward et al. (2000) found that participants with ASD free recalled more events in the 'Accompanied Other' condition than in the 'Unaccompanied Self' condition, this was not replicated in the current study. The current study therefore indicates that being accompanied per se does not improve free recall for self-experienced events in adults with ASD, although free recall of tasks performed by another (i.e. 'Accompanied Other') significantly correlated with verbal ability.

There was limited support for hypothesis 3, as participants with ID tended to recall more tasks they had performed themselves ('Unaccompanied-' and 'Accompanied Self') than tasks performed by another. This difference was as predicted, being significant at the $p < 0.05$ level, but only approached significance at a more conservative $p < 0.01$ level. It is possible that the significance of within-group differences for the ID participants may have been underestimated.

Regarding hypothesis 4, no between-group differences were found for 'cued recall' under any recall condition. When cued, participants in both groups recalled more self-performed tasks ('Unaccompanied' and 'Accompanied Self') than researcher-performed tasks. Although participants with ID recalled when cued more self-performed tasks when alone than researcher-performed tasks when accompanied, this difference was not significant. Moreover, the within-group differences in cued recall for the ID group were in the same direction as the differences in the ASD group. These observations suggest that cued recall for self-experienced events is superior to cued recall of other-experienced events for both groups of participants.

In the current study, raw cued recall scores were converted to percentages to more accurately indicate performance. Hence, cued recall performance was presented as a percentage of those items left for recall following subtraction of the free recall score. This may introduce further error, as items not recalled freely by the highest performing participants may be the most difficult to recall, resulting in a subsequent poor cued recall score. Therefore, cued recall scores may be misleading and must be interpreted with caution. Visual inspection of the data indicated both groups achieved high scores on cued recall tasks, suggesting that the results may be partially due to ceiling effects.

The experimental procedures may have affected performance of the participants with ASD, due to attention shifting between the component tasks and the 'Companion' condition and between participant and researcher actions. People with ASD perform poorly in tasks requiring cognitive shifting (Teunisse, Cools, van Spaendock, Aerts, & Berger, 2001) and therefore recall task performance may reflect attention shifting difficulties rather than impaired cognitive processing of self-experienced events. However, the performance of participants with ASD was not significantly greater on free recall in the 'Unaccompanied Self' task compared to free recall in either of the 'Accompanied' recall tasks, even though attention-shifting demands were reduced. Another potential influence on performance was task novelty, as people with ASD can be anxious in novel situations and high arousal negatively affects memory performance (Baddeley, 1999). Counter-balancing and using two sessions may have reduced such anxiety, but inclusion of an initial un-scored practice condition would have been advisable. Similarly, several participants with ASD known to be anxious when alone with unfamiliar people had a familiar person sitting in with them, but this may have introduced distraction. Finally, the findings indicated level of anxiety (HADS-A score) impacting on free recall performance, suggesting that attempts to reduce participant anxiety may have a differential impact on memory functioning.

No between-group differences were found for 'free recall' for any recall conditions, which does not support Powell and Jordan's (1995) prediction of impaired performance by people with ASD on free recall tasks. Caution must be exercised, as the comparison group of people with ID would be expected to demonstrate memory impairments per se (Farrant, Blades, & Boucher, 1998). Thus, impaired free recall in participants with ASD may remain non-significant when compared with individuals who already experience memory problems. However, this is unlikely as the groups were well matched for ID level, as measured by verbal ability. If a significant ASD-specific deficit in free recall were present, this should have been detectable over and above memory impairment due to ID. One way to confirm this would be to compare the performance of the participants with ASD with a group of typically developing participants matched for verbal ability, but as such comparison group would have to be children, differences in memory performance might be attributable to experience, development of compensatory strategies, etc. Due to limitations in drawing conclusions from direct between-group comparisons in the current study, comparisons of patterns of within-group differences are likely to be more informative.

In the current study, participants with ID showed superior free recall of self-experienced over other-experienced events, as per Conway's (2002) proposal that self-experienced events receive more elaborate encoding, facilitating later retrieval. No within-group differences between the recall conditions were found for the participants with ASD, which supports Millward et al.'s (2000) proposal that individuals with ASD lack the superiority of *access* to personal episodic memories for self-experienced events. A more conservative interpretation of these findings is that engaging in similar events as another person in the company of that person, may aid later recall of shared experiences. This does not necessarily mean that individuals with ASD encode those events as being 'self-experienced' or that being accompanied improves encoding of self-experienced events. If this were the case, it would be expected that recall for self-experienced events when accompanied would be significantly greater than recall for self-experienced events when alone. This was not found in the current study or in Millward et al. (2000) and may explain the lack of significant difference between the two 'Accompanied' conditions for participants with ASD, but cannot fully account for significantly greater recall of other-experienced events over self-experienced events when alone (Millward et al., 2000). This was not replicated in the current study, i.e. participants with ASD showed no significant difference between recall in the 'Unaccompanied Self' and 'Accompanied Other' conditions. As noted, in the current study 'self-' and 'other-' performed tasks in the 'Companion' experimental condition were entirely separate. All objects manipulated and actions performed were distinct for each performer. This suggests that recall for the experiences of others is greater than recall of self-experienced events *only when engaged in some common or shared tasks*. This supports Russell & Jarrold's (1999) proposal that the greater 'memorability' of another's actions in a task may only occur in relation to the individual's own actions within that same task. Thus, greater recall of other-experienced events in shared tasks would improve scores in recall in the 'Accompanied Self' condition, without improving actual *personal episodic* recall of those events.

The lack of differences between ‘Accompanied Self’ and ‘Accompanied Other’ recall conditions in the current study may relate to task-specific factors. For example, the need to switch attention by participants with ASD might have reduced any advantage in recall of other-experienced events. This could be investigated by including an additional experimental condition with all tasks researcher-performed and observed by participants, which would obviate any memory processing difficulties associated with attention-shifting.

The current study used direct verbal instruction, which was cued by the researcher picking up a card. Hill and Russell (2002) suggest that verbal instruction enables a deeper memory trace of the action to be encoded, thus facilitating both verbal *and* action memory to recall the action. Free recall of the researcher-performed tasks was found to be significantly related to verbal ability for the participants with ASD in the current study. While participants were verbally and non-verbally prompted to attend to particular key events or objects, no cues were provided that a prompt was about to be given. Therefore, this suggests that recall of other-performed actions in the current study may have been verbally mediated, i.e. participants may be recalling instructions rather than actions. No such correlation was found for self-experienced events, suggesting that encoding of action is more important or significantly superior to encoding of verbal instruction. This concurs with individuals with ASD showing superior recall of self-performed tasks over verbal information (Summers & Craik, 1994) and suggests that individuals with ASD will show superior recall of self-performed tasks and could be investigated further by including a third condition in the study in which the participant and researcher alternate task performance but no verbal instructions are given with the researcher’s tasks.

For participants with ID, recall for self-experienced events (alone or accompanied) was greater than recall for other-experienced events. Millward et al. (2000) also reported participants with ID as better at recalling self-experienced events when alone (‘Unaccompanied Self’) than other-performed events in the ‘Companion’ condition (‘Accompanied Other’). They found no significant difference across the ‘Accompanied Self’ and ‘Accompanied Other’ recall conditions for participants with ID. This may again be because performance in one ‘Accompanied’ recall condition enhances performance on another ‘Accompanied’ recall condition, as participants are being asked to recall the same information each time. The ID group in Millward et al. (2000) may have recalled more self-experiences in the ‘Companion’ experimental condition than of those of their partners. However, if they reasoned that they both the same places, they could have reported these as common experiences, regardless of any episodic memory of their partner’s actions. Hence, performance in the ‘Accompanied Other’ condition may reflect episodic memories of self-experienced events rather than episodic memories of another person’s experience. Differences in recall scores for the two ‘Accompanied’ recall conditions would therefore be lost.

The findings on cued recall may explain the lack of superiority of recall for self- over other-performed actions in people with ASD. Due to the limitations in the accuracy of the cued recall scores already discussed, the possible interpretations of the findings obtained are necessarily tentative and further research is required to confirm these findings.

The findings of the current study suggest that cued recall for self-performed actions may actually be superior to cued recall for actions performed by others for both the participants with ASD and the participants with ID. This implies that self-performed actions receive privileged encoding, but for individuals with ASD, this privileged encoding facilitates cued recall of self-experienced events over other-experienced events, which disappears in free recall. This supports Powell and Jordan (1995) proposal that people with ASD will be impaired on free recall, but not on cued recall. The current findings suggest that self-experienced events do still receive privileged encoding, such that impairments in recall are associated more with processes which aid *spontaneous* search and retrieval of those memories.

Participants in the ID group were found to be significantly better at recalling with cueing, tasks they had performed themselves when accompanied than tasks they had observed the researcher perform. Although when cued, they recalled more self-performed tasks when alone than researcher-performed tasks, this difference was not significant. Within-group differences in cued recall for the ID group were in the same direction as the differences in the ASD group, which suggests that cued recall for self-experienced events may be superior to cued recall of other-experienced events.

In conclusion, findings from the current study indicate that individuals with ASD do not demonstrate the superiority of free recall for self-experienced events over events merely observed as has been demonstrated in non-autistic individuals. In addition it was found that individuals with ASD do appear to demonstrate this superiority of recall of self-experienced events when recall is cued.

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