Neuropsychologia 72 (2015) 105–118

Contents lists available at ScienceDirect

Neuropsychologia

journal homepage: www.elsevier.com/locate/neuropsychologia

Severely deficient autobiographical memory (SDAM) in healthy adults: A new mnemonic syndrome

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ARTICLE INFO

Article history:
Received 13 January 2015
Received in revised form
7 April 2015
Accepted 12 April 2015
Available online 17 April 2015

Keywords:
Episodic memory
Autobiographical memory
Hippocampus
Case study

ABSTRACT

Recollection of previously experienced events is a key element of human memory that entails recovery of spatial, perceptual, and mental state details. While deficits in this capacity in association with brain disease have serious functional consequences, little is known about individual differences in autobiographical memory (AM) in healthy individuals. Recently, healthy adults with highly superior autobiographical capacities have been identified (e.g., LePort, A.K., Mattfeld, A.T., Dickinson-Anson, H., Fallon, J. H., Stark, C.E., Kruggel, F., McGaugh, J.L., 2012. Behavioral and neuroanatomical investigation of Highly Superior Autobiographical Memory (HSAM). Neurobiol. Learn. Mem. 98(1), 78–92. doi: 10.1016/j.nlm.2012.05.002). Here we report data from three healthy, high functioning adults with the reverse pattern: lifelong severely deficient autobiographical memory (SDAM) with otherwise preserved cognitive function. Their self-reported selective inability to vividly recollect personally experienced events from a first-person perspective was corroborated by absence of functional magnetic resonance imaging (fMRI) and event-related potential (ERP) biomarkers associated with naturalistic and laboratory episodic recollection, as well as by behavioral evidence of impaired episodic retrieval, particularly for visual information. Yet learning and memory were otherwise intact, as long as these tasks could be accomplished by non-episodic processes. Thus these individuals function normally in day-to-day life, even though their past is experienced in the absence of recollection.

1. Introduction

Current theoretical accounts of human episodic memory emphasize the subjective "re-living" that accompanies the retrieval of events (Eichenbaum et al., 2007; Tulving, 2002). In naturalistic contexts, this entails the recovery of spatial, perceptual, and mental state details associated with temporally-specific events in one's own past (i.e., episodic autobiographical memory; AM). These details engender a subjective sense of re-experiencing that is not present for factual or semantic knowledge, which can be accomplished in the absence of autobiographical recollection (see Renoult et al., 2012 and Tulving, 1985 for review).

Recently, a new AM syndrome has been identified in healthy adults, initially termed "hyperthymestic syndrome" (Parker et al., 2006) and more recently referred to as "highly superior autobiographical memory" (HSAM; LePort et al., 2012), which refers to individuals with the uncanny ability to recall a vast amount of episodic AM details (Ally et al., 2013; LePort et al., 2012; Parker et al., 2006; Patihis et al., 2013). For example, when given randomly selected dates or event cues from their past, HSAM individuals can effortlessly recall many details of what happened, even if trivial (e.g., what they had for dinner) without the use of mnemonic aids. They are neither savants nor calendar counters (although they possess extensive calendar knowledge from their own lifespan) and they are distinct from other types of superior memorizers who possess vast learning and retention of meaningless information (e.g., digit strings; Maguire et al., 2003). Notably, performance on laboratory-based memory tasks is not necessarily superior in HSAM, which highlights the specificity of their ability to the domain of AM as well as the importance of utilizing both laboratory and naturalistic stimuli in the context of assessing mnemonic abilities. While only a small group (approximately 20 cases) has been reported in the literature, many more individuals with claims to this ability have emerged since (see LePort et al., 2012; Patihis et al., 2013).

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http://dx.doi.org/10.1016/j.neuropsychologia.2015.04.012

Turning to the other extreme, deficits in episodic AM have been well documented in the context of brain disease, with serious functional consequences (e.g., Kapur, 1999; Spiers et al., 2001). In this paper, we report three cases of healthy individuals with a lifelong, selective impairment in episodic AM, essentially the reverse syndrome to that of HSAM, here dubbed "severely deficient autobiographical memory" (SDAM). Specifically, they report an inability to re-experience personal events. Although their ability to learn and retain factual (i.e., semantic) information is normal on the basis of everyday functioning and performance on linguistic measures, they fail to subjectively re-live past events. While these SDAM cases in some ways resemble individuals with developmental amnesia, who sustain early hippocampal damage as a result of perinatal hypoxia, resulting in a severe deficit in episodic memory and relative sparing of semantic abilities (Cooper et al., 2011; Kwan et al., 2010; Vargha-Khadem et al., 1997, 2003), there is neither any history of brain insult nor neuroimaging evidence of neuropathology in the cases presented here.

Given the novelty associated with this mnemonic profile, we completed a comprehensive assessment of the SDAM cases' cognitive and brain function in comparison to carefully matched control participants. In addition to standardized assessments of memory and other cognitive functions, we conducted a detailed assessment of memory. This battery included measures of recognition memory that parcels out the specific contribution of recollection (Eichenbaum et al., 2007; Yonelinas, 2001), a naturalistic measure (the Autobiographical Interview; AI) designed to separate retrieval of episodic from non-episodic (e.g., semantic) autobiographical information using text-based analysis (Levine et al., 2002), and an adaptation of this measure for future events (Addis et al., 2008).

Table 1
Demographic and neuropsychological data for SDAM cases ($N=3$).

	A.A.	B.B.	C.C.
Demographic			
Age	52	40	49
Education	16	12	20
Sex	F	M	M
Handedness	A	R	R
General cognitive ability			
WASI; Wechsler Abbreviated Scale of Intelligence (Wechsler, 1999), *standard score*			
Verbal	121	110	117
Performance	119	107	115
Full scale	124	110	118
Language			
WRAT-3; Wide Range Achievement Test (Wilkinson, 1993), *standard score*			
Reading	114	100	118
Attention, working memory, processing speed			
WMS-III; Wechsler Memory Scale (Wechsler, 1997), *scaled score*			
Digit span	13	14	16
Forward longest digit, raw score	8	8	8
Backward longest digit, raw score	6	7	6
Symbol digits (Smith, 1976), *z-score*	1.78	−0.46	−0.58
Motor functioning			
Finger tapping (Bornstein, 1985), *z-score*			
Right	2.53	−0.83	1.72
Left	1.20	−0.22	1.64
Grooved pegboard (Bornstein, 1985), *z-score*			
Right	−0.07	1.60	1.60
Left	0.41	1.32	1.01
Dynamometer (Bornstein, 1985), *z-score*			
Right	0.20	0.70	−3.86
Left	−0.31	−0.18	−3.12
Executive functioning			
WCST; Wisconsin Card Sorting Test (Heaton et al., 1993), *z-score*			
Categories	0.40	0.39	0.39
Set loss	−0.64	−0.39	−0.39
Perseveration to response	0.06	−0.19	−0.46
TMT; Trail Making Test (Spreen & Strauss, 1998), *z-score*			
Part A	−1.31	−0.76	0.03
Part B	−1.73	−0.84	−0.51
Verbal and visual memory			
CVLT-II; California Verbal Learning Test (Delis et al., 2000), *T-score & standard score*			
Immediate recall	64	46	53
Short delay free	2.0	−1.0	−1.5
Long delay free	1.5	−1.0	−1.5
Recognition number correct	0.0	−1.5	1.0
WMS –III (Wechsler, 1997), *scaled score*			
Logical memory	16	11	9
BVMT-R; Brief Visual Memory Test-Revised (Benedict, 1997), *T-score*			
Total recall	58	40	39
Delayed recall	65	58	49
RCFT; Rey Complex Figure Test (Meyers and Meyers, 1995), *z-score*			
Copy	−2.50	0.38	−0.18
Immediate	−1.84	−1.49	−3.13
Delay	−2.83	−2.21	−2.36

Note: For each test, data are expressed using age-corrected (and where available, education-corrected) normative scores derived from standardized test data.
A: ambidextrous; R: right.