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PRELIMINARY COMMUNICATION

## Autobiographical memory. Sensitivity to age and education of a standardized enquiry\*

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**SYNOPSIS** A structured enquiry for assessing autobiographical memory is proposed. It is made up of three standardized time-cued sets of questions focusing on three life periods: adolescence, early and late adulthood, with five questions for each life period. Standardized testing procedure, checking for veracity and scoring methods are described. Normative data from 157 healthy individuals aged over 55 are converted into 'equivalent scores' for use with the enquiry and for diagnostic purposes. Education and ageing, but not sex, appear to be significant factors in the efficiency of retrieval from the autobiographic repertoire.

### INTRODUCTION

This is one of the first attempts to approach autobiographical memory (ABM) by means of a standardized instrument designed to elicit normal performance baselines. It must thus be considered a methodological experiment with scant theoretical backing and hardly any database. Nevertheless, the study of ABM must have reached the point when it has something to contribute to a general understanding of retrieval from remote memory, especially in individuals at risk of amnesic disorders (Zola-Morgan *et al.* 1983; Baddeley & Wilson, 1986; Butters & Cermak, 1986; De Renzi *et al.* 1987) since ABM may be regarded as one of the components of remote memory likely to play a crucial part in everyday coping (Fitzgerald, 1986).

Although ABM is one of the most important archival functions of memory processing, it has seldom been addressed experimentally (Rubin, 1986; Robinson, 1986). There are many diffi-

culties raised by memory assessments, the most important of which will be mentioned below.

Lacking a precise slot in a theoretical system (Baddeley & Wilson, 1986), ABM cannot yet be formally defined. In descriptive terms, ABM may be thought of as a set of phenomena related to the storage and organization of and access to traces laid down by one's life events. The mechanism of ABM retrieval is far from simple. In the wake of Bartlett (1932), Baddeley (1984) refers to 'recollection' as one of the most usual ways of extracting records from the biographical repertoire, even if completely different modes of access may sometimes be available (e.g. 'flashbulb' memories; Brown & Kulik, 1977; Winograd & Killinger, 1983). Recollection triggered by an enquiry is conceived as a two-edged activity, the purpose of which is to envisage the most appropriate plan of access and to cross-check the veracity of a biographical record when it surfaces to consciousness. In healthy persons overtraining probably turns this basically resource-consuming mechanism into an automatic activity, at least when spontaneous memories crop up. But this is unlikely to be the case in an enquiry.

Another feature of ABM is that the presentation of its output always involves language;

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this makes ABM reports rather like prose memory reports. This organized verbal performance aspect is possibly a serious interference factor in brain-damaged patients with associated language and intelligence disorders.

Lastly, there is the probably private nature of the reported memories. An enquiry does not start up a chronological lifelong movie but picks up some events rather than others, depending on their continued (and unexplained) relevance to the general structure of an individual's personality. Thus, an ABM enquiry touches on only a small fraction of the biographical traces housed on the file, namely those that have undergone selection and, for that reason, have been recalled and replayed spontaneously many times before. Most autobiographical traces therefore undergo progressive stereotyping, acquiring with time a more and more purposeful and organized nature ('personal semantic memory'; Linton, 1986).

Then there is the problem of how to elicit ABM reports amenable to *quantification*. In ABM, as in many ecological memory studies (Baddeley, 1984), the experimental worker takes note of the information retrieved but has only indirect knowledge, if any, of the type, amount, general and contextual conditions of encoding relating to the original information. Obviously different tools will evoke different amounts and types of ABM report (e.g. try comparing the memory output gained with a structured ABM enquiry with that gained in a psychoanalytical setting). The Galton (1883) word-prompting technique, with or without cueing (reviewed by Crovitz & Shiffman, 1974) seems to work reasonably well for single subject studies, allowing nicely comparable longitudinal assessments. The overall amount of ABM retrieval is, however, too closely related to the occurrence of an event which answers to the prompting word for the purpose of group study and for the acquisition of healthy baselines. Another anterograde episodic memory is the memory watching approach, but this depends on unusual conditions, such as the availability of detailed external aids to verification: notepads and written autobiographies (Linton, 1986; Butters & Cermak, 1986).

A third approach is the standardized enquiry (ABME), flexible enough to cater for the great majority of subjects likely to enter a group study and hence of possible value as a diagnostic tool

for samples of brain-damaged patients at risk to have memory disorders. Enquiries are really refined developments of the prompting technique, in which the word is replaced by a more complex stimulus (the question) encompassing several possible events. Building up an array of questions is no easy matter, since each question must tap a near-universal set of events (like primary school) and at the same time encourage personal answers (e.g. a life event connected with primary school) and not just a general statement, however plausible. How wide the 'window' should be is a matter of opinion. If it is too narrow, the harvest will be small; if it is too wide, ambiguity will creep in and the response will be too vague.

Finally, there are two problems of management: checking the patient's report for *veracity* and *scoring* it. Given the cognitive nature of the survey, it has been decided to take account only of 'true' memories, that is, those that the examiner is prepared to accept as true, with checking for test-retest and witness consistency. Test-retest consistency is a reliable measure for severely amnesic patients but much less so for normal persons, who may well remember the answer they gave a week or so before. The witness check has other disadvantages in that it does not usually cover the lifespan of another individual. The witness is used, exactly as in a court of law, in two ways: as a direct witness of the event retrieved by the subject under study, and as a person whom the subject under study reported in past times the same event he reported when questioned for ABM. Test-retest verification compares two memory outputs of the same individual, whereas witness verification compares memory outputs of two individuals. The final consistency rating of the examiner is sometimes a compromise decision.

The ABM report matter is converted into scores amenable to statistics by means of rating scales that take account of vividness and fluency as well as of the details supplied (Baddeley & Wilson, 1986).

The aim of the present study is to provide a tool which will supply reproducible measures of ABM efficiency for use chiefly in patients at risk of memory disorders. Healthy people were studied in order to assess the importance of normal ageing, sex and education on the amount of ABM information retrieved by means

of a standardized enquiry spanning three broad life-periods. Our ultimate aim was thus to provide normative data against which to carry out ABM assessments in future.

## SUBJECTS AND METHOD

### Subjects

ABM data were collected over a 6-month period from 157 healthy subjects over the age of 55 years, of both sexes, and of variable age and education. There was no fixed plan of enrolment. About half of the subjects were relatives of in-patients in general hospitals, and through them other subjects were approached informally on the understanding that their participation was unpaid and that they were completely free to refuse participation in what was a psychological experiment. Ninety-nine of them lived in northern Italy (chiefly in and around Milan and Mantua) and the others (58) in and around Rome; 68 lived in the country and 89 in the cities of Milan, Mantua or Rome.

Criteria for inclusion were minimal literacy, neurological and mental health. The health criteria ruled out past or present disease of the brain (including psychiatric disorders and psychotropic drug taking) and of other diseases with possible metabolic or infective effects on the brain. Compliance with the health criteria was ensured by history-taking with a checklist and by gross observation of the candidate's spontaneous motor and language behaviour. Both this examination and the subsequent testing were handled by a neurologist. Twelve apparently suitable candidates had to be excluded after closer scrutiny of their neurological status. No instrumental examinations were done. In

addition to filling in the age-education-sex boxes on the experimental project, every subject had to have a reliable and healthy 'witness' available.

Distribution of the subjects by age, education and sex is given in Table 1. It reflects approximately the proportions in the Italian population aged over 55.

### Testing procedures

The subjects were tested in their homes using the list of questions shown in the appendix. The test was run twice by the same examiner with an interval of  $7 \pm 2$  days.

The examiner put the question colloquially, encouraging the subject to concentrate on what he will often say is a difficult task. The emphasis must always be on memory ('Can you remember...?') and the subject is encouraged to narrate ('Tell me about...'), any tendency to vague generalization being discouraged. The subject may have to search hard, sometimes making several attempts. There are no time constraints and each report may be completed or even radically corrected by the subject as many times as he wishes if a more accurate memory springs to mind. The subject should be reassured about the tape recorder, which is there simply to enable the examiner to do his job. All information is obviously treated in strict confidence. The examiner must make every effort to secure a definite answer to every question (generating a content score) and as much relevant detail as he can (generating a detail score, which will, on retesting, add to the consistency of the whole recollection). Sometimes different questions will elicit the same answer (i.e. the same biographical event); if so,

Table 1. *Features of the sample of healthy controls (N = 157)*

	Age groups (yrs)					
	55-60 N = 24	61-65 N = 31	66-70 N = 28	71-75 N = 30	76-80 N = 23	> 80 N = 21
<b>Education</b>						
<b>Women (N = 80)</b>						
≤ 8 yrs (N = 61)	10	11	12	11	9	8
> 8 yrs (N = 19)	3	6	3	2	2	3
<b>Men (N = 77)</b>						
≤ 8 yrs (N = 61)	8	12	10	13	10	8
> 8 yrs (N = 16)	3	2	3	4	2	2

the subject must be asked to retrieve a different event for the last question. The witness is interviewed separately, after the session with the subject. The subject's compliance will be judged after the second session: in five of our cases it was unofficially rated too low for the interview to be of any use. Each testing session took about 1 hour.

Two points have to be described in detail.

(i) Check on *veracity*. A recollection is accepted as a 'true memory' (hence, scoring more than 0) if: (a) it is repeated on retest, preferably spontaneously, otherwise with cautious cueing by the examiner; and/or (b) a witness confirms either the event or that the subject's account of it is consistent with previous accounts (i.e. out of the setting) given by the subject. A recollection is rejected as untrue if the subject does not represent it at the second session or a witness cannot confirm either its truth or its consistency with previous reports. Thus, a recollection that appears at first to be true sometimes has to be rejected. General (semantic, ethical, aesthetic, etc.) statements (such as, 'I was happy at school because education is important for life') or a highly probable situation unsupported by a convincing context (such as, 'During the war I was frightened to death of bombing and tried always to reach a shelter as quickly as possible') are not scorable recollections, even when presented again on retest. When an event emerges only during the second session, its acceptance depends on the witness. The percentage of answers which could not be scored because of ambiguity was low, at a guess, less than 10% of all 2355 answers.

(ii) *Scoring*. This is the controversial aspect of the ABM assessment. The following guidelines may not, in fact, cover all of the circumstances that may arise when evaluating answers, particularly when – as in a study in progress (Dall'Ora *et al.* 1989) – the ABME will be used in brain-damaged patients. There is thus a margin of arbitrariness that gives rise to inter-rater inconsistency. The score is always based on the nonstop full tape recording of both sessions, the first (test) and the second (retest). The content and related details of a report of a biographical event whose veracity has been accepted are scored separately, the content scores being: 0, 1 or 2 and the corresponding detail scores arbitrarily half-weighted, i.e. 0, 0.5 or 1.

'Content' here means the actual event around which the recollection revolves, which may be either a single event with personal, spatial, temporal and contextual constraints (such as: 'The day my wallet was stolen on cable car number 9') or a broader, maybe repetitive, event in which the subject may not himself have taken part (such as: 'When I was a boy my father used to go to the Alba fair every spring and buy a month-old calf, which we fattened for sale in the autumn'). An accepted content scores 1 or 2 according to the fluency (ease and immediacy of response to the question) and vividness of narration (Baddeley & Wilson, 1986). A 'detail' is either a direct consequence of the event narrated (e.g. the circumstances in which a wounded person was taken to hospital) or a marginal element (weather, cloth colour and so on). Names, dates and places are valuable details. As a rule, a detail is scored only if the corresponding content is scorable. Sometimes an event may not be clearly recognizable and yet called to mind a detail (e.g. in answering the question on events connected with primary school, a subject said, '... Yes, the school was in Col Moschin Street... it was a yellow building... I do not remember anything particular happening to me there'). In such cases the detail score is 0.5 or 1 (according to fluency and vividness), even though the content score is 0. On retesting, a content (or a detail) report may be more fluently and vividly remembered and scores 2 *versus* a previous score of 1. In such cases the better score is taken as valid. Content and detail scores are then added. Thus, with a score of 0 to 3 for each question and 5 questions for each life period, the maximum period score is 15 and maximum ABME score is  $15 \times 3 = 45$ .

The scoring of the tape recorded test and retest sessions took about 1 hour. Any uncertainties were discussed collectively.

The essential features of ABME, which is given in full in the Appendix, may be summarized as follows. The past life of an individual aged over 54 years is arbitrarily divided into three periods, namely childhood and adolescence (up to age 15), early adulthood (up to age 40) and late adulthood (up to 2 years before testing). The last period is thus of varying length according to the subject's age. Each period was investigated by means of five questions, the most constrained having one or more alternatives.

There were, when appropriate, sex-differentiated questions. Alternative questions had, as a rule, a wider 'window' than the corresponding first-rank question. They were resorted to in only 18% of the 157 subjects in the study.

All subjects were also assessed for prose memory, following the procedures described elsewhere (Barigazzi *et al.* 1987). The prose memory test (i.e. 'logical' memory), devised for Italian subjects by Barigazzi *et al.* (1987), consists of a structured story of a traffic accident in 174 words, lasting 3 minutes, to be read aloud by the examiner. It includes 11 principal and 15 secondary events, and 25 details. Healthy age-education adjusted baselines were made available (Barigazzi *et al.* 1987). The subject under study is asked to give a tape-recorded account of the story as soon as it has been read and 1 hour later, the interval being filled with distracting activity. Weighted scores are awarded on the principal and secondary events. A hierarchical scoring method is adopted whereby lower-order reports are taken into account only when higher-order reports have been supplied. In this ABM study the immediate and delayed scores were combined, because no forgetting measure was needed. The combined score ranges from a worst of 0 to a best of 150.

## RESULTS

### The ABM score

It was pointed out in the previous section that the use of our ABME involves some arbitrariness in the scoring. To measure this we calculated an inter-rater reliability coefficient (Pearson's product-moment coefficient) on the tape recordings of 23 randomly selected subjects. The concordance proved to be  $r = 0.70$  ( $P < 0.001$ ).

Table 2 gives the ABME score for each of three life periods considered together with the frequency of the ceiling score of 15 being reached. There is an apparent consistency of means and standard deviation across life periods. Fig. 1 shows the degree to which the overall ABME

Table 2. Mean ABME rough scores obtained by the control group ( $N = 157$ ) in the three life periods. Score ranges from 0 to 15

Life periods	Means	s.d.	Range	Percentage of subjects at score 15
0-15 yrs	12.12	2.87	0-15	18
16-40 yrs	12.89	2.32	3-15	28
41-(a-2) yrs*	12.66	2.47	3.5-15	28

\* Where  $a$  = subject's age.

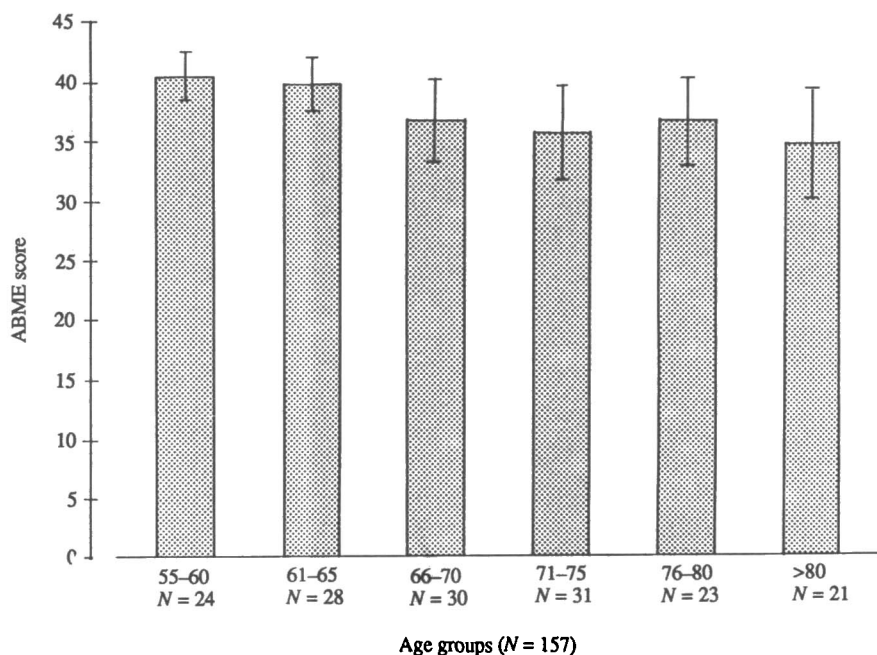


Fig. 1. Overall mean ABME rough scores across age-classes

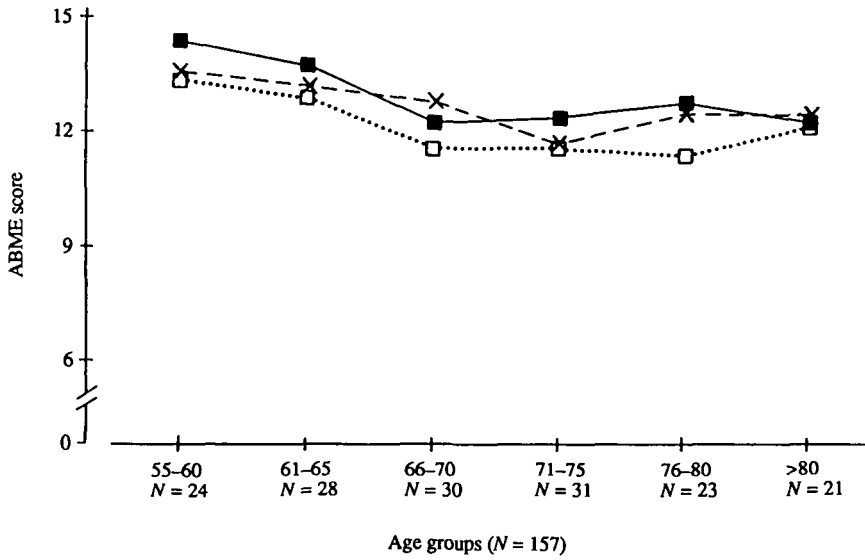


FIG. 2. ABME rough life-period scores across the age-class. (Life periods: □ = 0-15 yrs; ■ - 16-40 yrs; × - 41 (a-2) yrs.)

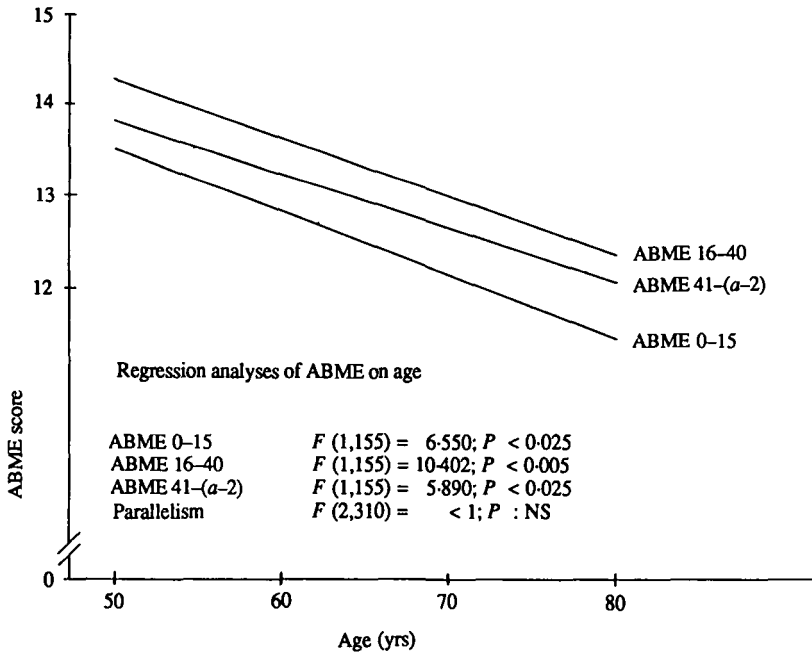


FIG. 3. Age-related life-period regression slopes across ages.

score varies across the six age-groups considered. There is a tendency for it to decline with age.

Fig. 2 plots the age-related mean raw scores for single life periods; their slopes appear to be equivalent.

Regression analysis of the ABME overall scores on age, education and sex (each adjusted

for the other factors) yielded the following values:  $F(1,155) = 7.031, P < 0.01$ ;  $F(1,155) = 8.600, P < 0.005$  and  $F(1,155) = 3.831, NS$ , which support the view that ABME raw scores need to be adjusted for age and education but not for sex.

As age appeared to be the more relevant of

Table 3. Values to add or to subtract from the original ABME total score in order to adjust it for the influence of age and education

Education (yrs)	Age (yrs)					
	55	60	65	70	75	80
3	-1.0	0	+1	+1.5	+2.5	+3.0
5	-1.5	-0.5	0	+1.0	+1.5	+2.5
8	-2.5	-2.0	-1.0	0	+0.5	+1.5
13	-4.5	-3.5	-3.0	-2.0	-1.0	-0.5
17	-6.0	-5.0	-4.5	-3.5	-3.0	-2.0

the two variables, more detailed analysis was done on age by calculating the degree of divergence across life periods, if any, with age. This is set out in Fig. 3. The upshot is the near equivalence of the role of age across the life periods.

To get an idea of equivalence of the questions posed in the three life periods, we calculated Pearson's product-moment coefficients. The scores for the first and second, first and third, and second and third life periods proved to correlate significantly (all  $P < 0.01$ ) yielding the following near-identical coefficients: 0.59, 0.52

and 0.54. This points to a fairly good equivalence across life periods.

### Healthy baselines

The next step was to adjust every new ABM score for age and education so that ABME would be suitable for diagnostic purposes. The statistical procedures are detailed elsewhere (Capitani & Laiacona, 1988). Table 3 shows how the original score of a new subject has to be adjusted for these two variables.

Fig. 4 gives the distribution of the adjusted scores. On these data we calculated non-parametric tolerance limits (one-tailed) for the best 95% of the population, with 95% confidence.

To ensure that the adjusted scores would be fully comparable with the scores earned on every similarly checked cognitive test, we converted them into 'equivalent scores' ranging from 0-4 (Capitani & Laiacona, 1988) according to the following criteria: 0 corresponds to adjusted scores below the fifth inferential centile of the normal population, and 4 to a score equal to or better than the median value, 1, 2 and 3 being intermediate points on a quasi-interval

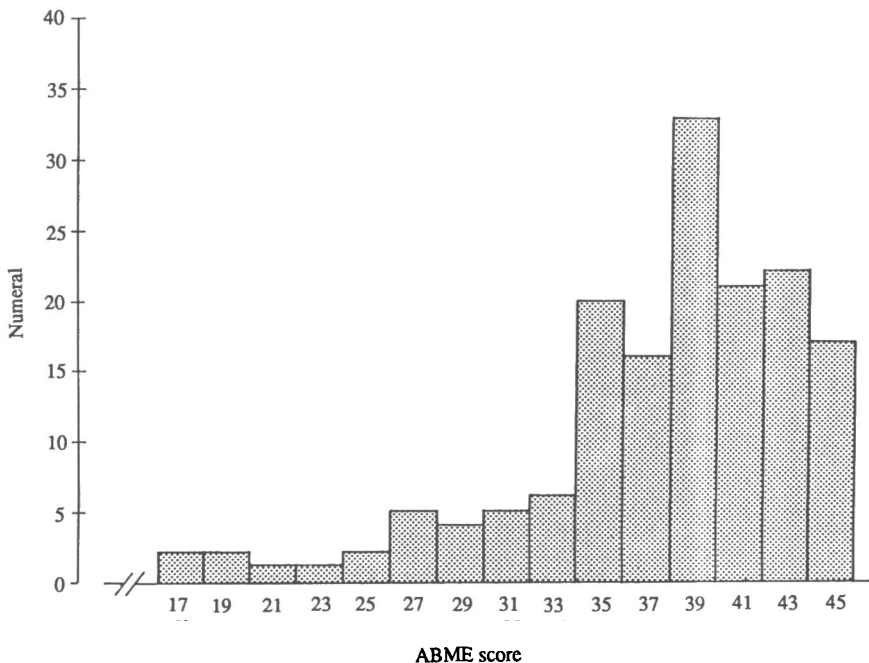


FIG. 4. Distribution of the adjusted ABME scores.



Table 4. Correspondence with the 'Equivalent Scores' of age-education adjusted ABME total scores

Equivalent score	Range of adjusted ABMI scores	Density	Cumulative frequency
0	0-19	3	—
1	19.5-28	11	14
2	28.5-34.5	25	39
3	35-38	40	79
4	38.5-45	78	157

scale. For diagnostic purposes an equivalent score of 0 denotes pathological risk. Table 4 shows the correspondence between equivalent scores and adjusted ABME scores.

## DISCUSSION

The present study with a structured enquiry shows that a standardized instrument for ABM assessment which yields reproducible and reliable measures is feasible.

The results of the experiment confirm the significance of education and ageing in ABM retrieval and the non-significance of sex. The forecast rôle of old age might reflect the vanishing of past memories or increasing difficulty of access to them, for there is no reason to assume any systematic differences in encoding conditions between the present elderly and the young, or future elderly. Our data throw no light on the erosion of biographical traces because they do not start by separating out the influence of the age of the subjects and that of the reported memories. There is, however, statistical evidence for the proposition that ageing operates similarly on each of the three life periods. This is supported by our data, which emphasize the non-significance of the divergence between the regression slopes of the scores for the three life periods. In other words, our data do not seem to provide support for any selective vanishing of old traces (which are likely to be 'older' in the elderly than in younger subjects), especially because of this non-significant difference in regression slopes across the age groups. The conclusion that reports from the three life periods are broadly equivalent suggests that ABME is a suitable tool of access to the memories

of brain-damaged patients, irrespective of any time gradient there may be through the history of their ABM memories. As the last life period is of variable length according to the age of the testing subject, younger subjects might be at a disadvantage compared to older subjects because of the comparatively smaller volume of personal events likely to have occurred in a shorter period. Fortunately, the experimental data (Fig. 1) do not suggest any such bias. It was forecast that ABME scores would be in proportion to those of prose memory, chiefly because both require an organized verbal report (Luria, 1973). We have found (Barigazzi *et al.* 1987) that performance on prose memory is significantly affected by age and education in healthy persons. The correlation between ABME scores and prose memory scores turned out to be very small and non-significant (with the first, second and third life periods yielding coefficients of 0.26, 0.26 and 0.23 respectively). These data point to a different mode of retrieval in the two memory reports, possibly due to the different nature of the traces to be retrieved (i.e. old and prevalingly semantic in ABM *versus* new and prevalingly episodic in prose memory). A specific defect in a brain-damaged subject, such as an aphasic disorder or an attention deficit, might enhance these correlations, the weakness of which in a normal subject argues against a common psychological construct underlying ABM and prose memory.

Two advantages of our ABME are worth mentioning. It is easy to administer to nearly all subjects, including the oldest. The three life period sets of questions appear to be of equal difficulty, which prevented the artificial appearance of discrepancies in the amount of ABM retrieval across the life periods, possibly related to the different ages of the relevant memories. The disadvantage of ABME is that it is rather a crude tool, only providing general information. In fact, it does not separate out the different components of ABM, such as those envisaged by Brewer (1986) along biographical and contextual lines with a possible trade-off. We gained the impression that very poor ABM scores were much more the consequence of poor education than of ageing, the answers being characterized by long latencies, errors of categorization in the right life period and a tendency to vague generalization. Old age seems to lengthen the time spent in repeated attempts to ferret out

traces that in the end yield a thin report, giving the impression of cramped search ability. This seems to be the cause of very poor reports in the oldest subjects.

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## APPENDIX

ABME is a time-cued enquiry with five questions for each of three life-periods. Before enquiring about each period, the examiner makes sure that the subject really understands the time-span at issue: before each item the examiner reminds the subject of which life period he is going to ask about, and that is where the subject has to direct his search while recollecting. There are sometimes alternative questions (marked a, b, 1, 2).

### (i) Childhood and adolescence up to age 15

(1) *Primary school.* Can you remember anything that happened to you when you were at school?

(2) *Childhood home.* Can you recall the house where you lived when you were a child? Tell me about any event in any way connected with your home.

(3) *Family members.* Can you remember any accident or anything unusual or odd, either happy or sad, that happened to you or to anyone in your family before you were 15?

(4) *Family illness.* Can you remember anything about any illness that you or anyone in your family had in those days? Can you remember when you first saw a person taken to hospital or a dead person?

(5) *Play.* Can you remember anything that happened in connection with the games you used to play as a child?

### (ii) Early adulthood from age 16 to 40

(1) *Ceremonies.* Can you remember any particular ceremony you took part in during this period?

(2)(a, b) *Getting about.* (a) Can you remember your first bike? Or your first motorbike or car?

(b) (If you never had one or can't remember having had one) Can you remember how you got about or whether anything unusual ever happened to you in connection with travel?

(3)(a:1, 2; b:1, 2) *Children, military service* (a) If

subject is a woman: (a1) (if she has had children) Can you remember when you found you were pregnant? To whom did you first speak about it? What were the circumstances? (a2) (If she has had no children) Can you remember ever going to see a gynaecologist during this period? (or if not) a dentist?

(b) If subject is a man: (b1) Can you remember anything out of the way or impressive that happened to you or to your fellows when you were in the forces, either during the war or in peacetime? (b2) (If subject did not do military service) Can you remember why you were exempt and how the grounds were established?

(4)(a, b) *Wedding, trips* (a) (If subject is married) Can you remember your wedding day, or when you first saw the house you were going to live in?

(b) (If subject is unmarried) Can you remember any trip you made during this period, or (if not) a particular event you took part in, or (if not) going to vote?

(5)(a, b) *Work* (a) (If subject had a job after age 15) Can you remember your first job? Tell me something about it or how you got your first pay packet. (b) (If subject is housewife) Can you remember anything remarkable that happened to you during this period in connection with your children or your pets, or shopkeeper, or neighbours, or household appliances?

### (iii) Late adulthood from 41 up to 2 years ago

(1) *Moving house* Can you remember moving house during this period, (or it not) whether you have had any new furniture or furnishings, (or if not) whether there have been changes in the way the block in which you have your apartment is run?

(2)(a, b) *Work changes* (a) Can you remember changing jobs during this period or anything remarkable happening in connection with your job? (b) (If subject is a housewife) Can you remember anything unusual occurring during these years in connection with how you ran your home or the requirements of your family?

(3)(a, b) *Medical events, doctors* (a) (if subject is presently presumed to be healthy) Can you remember any illness that you or anyone in your family or a friend of yours had in this period? Also, its consequences? (b) (If subject is presently presumed ill) Can you remember how you felt when you fell ill, what the first symptoms were or what tests were done, or your stay in hospital or doctors you consulted?

(4)(a, b) *Retirement* (a) (If subject has already retired) Can you remember what steps you had to take to get your pension? (b) (If subject has not yet retired) Can you remember having any eye, ear or dental problems during this period?

(5) *Leisure* Do you remember going on holiday anywhere, far or near, perhaps an open-air holiday or an indoor holiday, (or if not) a special visit you paid to a friend or neighbour or someone else?

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