HHS Public Access
Author manuscript
Appl Neuropsychol Adult. Author manuscript; available in PMC 2014 August 13.

Published in final edited form as:
Appl Neuropsychol Adult. 2013 ; 20(3): 203–210. doi:10.1080/09084282.2012.685133.

Aspects of Attention Predict Real-World Task Performance in Alzheimer's Disease

Beyon H. Miloyan,
Department of Psychology, California State University, Northridge, California

Jill Razani,
Department of Psychology, California State University, Northridge, California

Andrea Larco,
Department of Psychology, California State University, Northridge, California

Justina Avila, and
Department of Psychology, California State University, Northridge, California

Julia Chung
Department of Psychiatry, Harbor-UCLA Medical Center, California

Abstract

More research is needed to examine the relationship between specific neuropsychological functions and observation-based daily activity tests in patients with Alzheimer's disease (AD). Fifty-six patients with AD were administered tests of attention and processing speed, and an observation-based activities of daily living (ADL) task. Complex short-term attention capacity best predicted real-world task performance, accounting for several domains of ADL functioning. These results suggest that complex attention requiring working memory systems, but not simple attention or processing speed, account for moderate portions of variability in daily task performance. These results may aid in understanding the attentional processes required for performing daily activities and can be useful to healthcare professionals in treatment planning.

Keywords

aging; attention/perception; neuropsychology; tests

Alzheimer's disease (AD) is a neurodegenerative disorder that is characterized by progressive cognitive decline and associated functional decline (Farias, Harrell, Neumann & Heutz, 2003; Freilich & Hyer, 2007; McKhann, Drachman, Folstein, et al., 1984; Stavitsky, Brickman, Scarmeas, et al., 2006). There have been long-standing efforts to characterize the neural (Habeck, Foster, Perneczky, et al., 2008; Holland, Brewer, Hagler, et al., 2009; Scarmeas, Habeck, Zarahn, et al., 2004), clinical (Bondi, Jak, Delano-Wood, et al., 2008; Salmon & Bondi, 2009; Vliet, Manly, Tang, et al., 2003), genetic (Cosentino, Scarmeas,

Address correspondence to: Jill Razani, Department of Psychology, California State University, Northridge, 18111 Nordhoff Street, Northridge, CA 91330-8255. jill.razani@csun.edu.

Helzner, et al., 2008; Scarmeas, Brandt, Albert, et al., 2002; Wolk, Dickerson & Alzheimer's Disease Neuroimaging Initiative, 2010), and cognitive impairments (Castel, Balota, Hutchison, et al., 2007; Cherry, Buckwalter & Henderson, 2002; Peters, Majerus, Baerdemaeker, et al., 2009) associated with AD.

While there is a large body of literature on the relationship between cognitive functioning and ADLs, the issues with the existing literature are that 1) the majority of the studies have either used ADL rating forms (informant or patient rated; Liu, McDowd, Lin, 2004; Marshall et al., 2011; Monaci & Morris, 2012), and/or 2) have used brief cognitive screening measures, such as the Mini Mental State Examination (Ford et al.,1996; Lecky & Beatty, 2002; Nadler, Richardson, Malloy, Marran, Brinson, 1993; Reed, Jagust, & Seab, 1989). A major problem with using these measures as outcomes is that the functional ability of the patient is being inferred, rather than being directly measured. A better understanding of the relationship between specific cognitive deficits and actual ability to perform particular real-world tasks would help clinicians make more informed decisions regarding treatment planning, patient quality of life, living arrangements, and health-care services (Brickman, Riba, Bell, et al., 2002; Scherer, Scarmeas, Brandt, et al., 2008; Siedlecki et al., 2009).

A few recent studies have assessed the relationship between neuropsychological test performance and activities of daily living (ADLs) using observation-based tasks in AD (Farias, Harrell, Neumann & Heutz, 2003; Freilich & Hyer, 2007; Razani, Casas, Wong, et al., 2007) with the goal that the former can be used to predict the latter. In one of the most extensive ADL studies to date, Farias, et al. (2003) examined the relationship between performance on a comprehensive neuropsychological test battery which assessed various cognitive domains, and ADLs. Visuospatial and immediate memory, and executive functioning measures correlated most strongly with ADL performance, accounting for 50% of the variability in the total score of a performance-based ADL measure. These findings demonstrate that neuropsychological tests to some degree predict daily functioning in patients with AD, and that certain domains of neuropsychological functioning are better suited for predicting overall daily functioning than others. Findings from other studies echo these results, and extend them by identifying specific clinical measures with the greatest utility for predicting real-world functioning (Razani, et al., 2007; Mitchell & Miller, 2008; Razani, et al., 2009). A better understanding of the relationship between specific neuropsychological measures and their associated functional correlates would help clinicians better predict the ecological impairments that patients are likely to face.

Studies have demonstrated that attentional deficits – particularly the mediation and control of attention during working memory and dual-task procedures – are among the earliest identifiable cognitive impairments in AD (for reviews, see Parasuraman & Haxby, 1993; Perry & Hodges, 1999). That is, it appears that while basic attention skills are relatively intact in AD (Perry and Hodges, 1999), more complex attention, requiring significant involvement of working memory appears to be rather impaired (Parasuraman & Haxby, 1993).

In the current study we were interested in examining the relationship between daily functional ability and two components of the attentional system in patients with AD;

namely, short-term capacity and processing speed. The two tests selected were the Digit Span and Digit Symbol subscales from the Wechsler Adult Intelligence Scale given that they are commonly used clinical measures. Digit Symbol was selected because it has been found to be one of the most sensitive tests for the detection of brain damage (Botwinick, Storandt & Berg, 1986; Storandt & Hill, 1989). Digit Span Forward and Backward tasks were examined separately given that they are presumed to assess different aspects of attention and working memory. Digit Span Forward has been conceptualized as a simple span test in which it measures the storage and maintenance components of working memory since it involves very little manipulation of information. Digit Span Backward, on the other hand, is thought to be a more complex task which relies more heavily on working memory processing given that it requires storage and concurrent processing of information (Wilde et al., 2004). Within the framework of Baddeley and Hitch (1974), Digit Span Forward would be managed primarily by what they refer to as a phonological (i.e., an articulatory) loop, while more extensive involvement of the central executive (comprised of a supervisory controlling system which is aided by two peripheral “slave” systems) seems to occur when the Digit Span-Backward task is carried out.

Thus, the purpose of the present study was to assess the relationship between these attention and processing speed tasks and specific aspects of daily functioning, as well as to assess which task best predicts everyday functioning. We hypothesized that Digit Span Backward would predict a wider range of ADL abilities as it is a more complex, measure of attention and working memory relative to the other tasks. Digit Span-Forward and Digit Symbol, on the other hand, were expected to have more limited utility for the purpose of predicting ADL performance.

Method

Participants

The participants were a total of 56 patients with AD. Patients were recruited from 3 sites, including a regional Alzheimer’s Association Center, a hospital-based geriatric center, and a Veterans Administration healthcare center. All participants were referred to the study with a predetermined diagnosis of AD, based on clinical evaluation by their primary physician, neuropsychologist, and/or neurologist using the National Institute of Neurological and Communicative Diseases and Stroke-Alzheimer’s Disease and Related Disorders Association (NINCDS-ADRDA) criteria for probable AD (McKhann et al., 1984). The determination of probable AD was made with cognitive and/or functional tests other than those used for analysis by this study. All patients’ caregivers completed a comprehensive health questionnaire on behalf of the patient. Those with a history of significant, untreated medical conditions (e.g., diabetes, hypertension), psychiatric illness (e.g., depression), substance abuse, incidents of loss of consciousness for >5 minutes, and neurological disorders (with the exception of the diagnosis of AD for the patient group) that are known to affect cognitive functioning were excluded from the study. Additionally, participants with major issues with mobility that would interfere with task performance were excluded from the study.

See Table 1 for participants' demographic characteristics. Participants included 38 males and 18 females, in their seventh decade of life, with an average of 17 years of education. The ethnic distribution of the sample was Caucasian (86%), African-American (7%), Hispanic (2%), Asian (2%), and Unidentified (3%). Based on MMSE scores, the majority (80%) of the participants were in the mild stages of illness (scored ≥ 19), less than 19% were in the moderate range (scored between 18 and 11), and only 1 individual was in the severe range (scored a 9).

Raw scores for the Digit Span and Digit Symbol tests are reported. The Digit Span Total score for this average age group represents a scaled score of 9, which is within the average range, while the Digit Symbol average raw score represents a scaled score of 5, which is considered within the impaired range.

As a part of the study, participants completed approximately three hours of testing; which included a performance-based ADL task and a neuropsychological test battery assessing cognitive functioning in the areas of: attention, memory, language, information processing, and abstract reasoning. Given the collaborative and longitudinal nature of this project, WAIS-Revised subscales were used and available of the current study. All participants were paid for their involvement in this study. Since our interest was to better understanding the relationship among activities of daily living and various aspects of attention and processing speed, we selected only the tests relevant for examination in this study.

Measurement Instruments

Wechsler Adult Intelligence Scale-Revised, Digit Symbol (Wechsler, 1981)— The Digit Symbol test consists of a key with 9 digits, in which each digit is paired with a unique symbol. Below the key are multiple rows of partitioned boxes, of which the top half consists of a digit and the bottom half is empty. Participants are required to fill in the empty boxes with the matching symbol of the given digit as quickly as possible, based on the key.

Wechsler Adult Intelligence Scale-Revised, Digit Span (Wechsler, 1981)—The Digit Span task consists of two subtests: Forward and Backward. In the Forward task, the examiner reads number sequences starting from "2" and ranging to "9" at a rate of one per second, and the participant is required to repeat the numbers as heard. In the Backward task, the participant is read the number sequences in the same way, but the participant is instructed to repeat the numbers in a reverse order. If the participant makes an error on two consecutive trials containing the same number of digits, the test is discontinued.

Activities of Daily Living

Direct Assessment of Functional Status (DAFS; Lowenstein et al., 1989)—The DAFS is a performance-based activities of daily living (ADL) task, in which seven specific functional domains are assessed: Time Orientation, Communication, Transportation, Financial skills, Shopping ability, Grooming and Eating. Grooming and eating were not included in the analysis, as participants retain their ability to perform these tasks as healthy normal adults would. The 'Time Orientation' subtask examined (a) the ability to tell time using a clock and (b) orientation to person, place, and time. The 'Communication' subtask included (a) ability to use a telephone and (b) mail a letter; 3) 'Transportation' required (a) identification of driving signs and (b) rules. The financial subtask assessed participants' ability to (a) identify and (b) count currency, as well as (c) write a check and (d) balance a checkbook. The shopping subtask assessed participants' ability to learn a list of shopping items and then (a) freely and (b) with cueing select the items from a mock grocery store after a 10-min delay, (c) shop with a list, and (d) make correct change. Scores were obtained by computing individually completed correct responses in each domain.

Procedures

All participants were administered the Digit Span, Digit Symbol and the DAFS. Independent raw scores were obtained for the Digit Span Forward, Backward, and Total, which is simply the number of the highest string of digits successfully completed. Digit Symbol scores were obtained by computing the number of boxes successfully completed in the allotted time (90 seconds).

Data Analysis

Bivariate correlation analyses were conducted in order to examine the relationship between attention/processing speed, and the five broad subscales of the DAFS. A series of stepwise regression analyses were then conducted in order to assess which attention/processing speed tests best predicted specific subscales of the DAFS. Since raw scores were used for the neuropsychological outcome scores, age and education were also examined in the regression model. Thus, age and education were entered into the first block, and then the neuropsychological measures were entered as the independent variables (i.e., predictors) into the stepwise regression and the specific DAFS subscales were entered as the dependent variable in each analysis. The same set of regression analyses were repeated, in which age and education were again entered into the first block, but this time, Digit Symbol and a Digit Span combined score were entered into the second block, with the DAFS subscales entered as dependent variables.

Due to the multiple comparisons, the p value required for statistical significance was lowered to .01 rather than the standard .05 value. While we recognize that this may not entirely protect against Type I error, more stringent criteria would increase Type II error due to the relatively small sample size.

Results

The results of the bivariate correlation, presented in Table 2, revealed moderate (.44) to strong (.60) relationships between DAFS Total and Digit Span Forward and Backward, respectively. Digit Span Backward correlated with all 5 broad subscales of the DAFS, and Digit Span Forward correlated moderately with all but the shopping subscale. Additionally, all DAFS outcome scores correlated moderately with the combined Digit Span scores with the exception of the shopping subscale. The Digit Symbol correlated only with orientation and financial ability.

The degree to which Digit Span combined (i.e., Forward and Backward scores combined) correlated with and predicted ADL functioning was first evaluated. The correlation analysis revealed that the Digit Span combined scores correlated significantly (at the .01 level) with all but the DAFS Shopping task, and was nearly significantly related to the DAFS Transportation task (see Table 2). The first set of regression analyses (assessing age, education, and Digit Span combined) revealed that Digit Span combined was the best predictor of the majority of the DAFS subscales, even when the variability accounted for by age and education were removed (see Table 3). Digit Span significantly accounted for approximately 11% to 34% of the unique variability in performance on the various DAFS tasks.

In the second set of regression analyses, Digit Span Forward and Backward were entered as separate scores along with Digit Symbol into the second block of the equation. The results of these analyses are demonstrated in Table 4. Digit Span Backward was the single best predictor of the majority of DAFS measures (with the exception of orientation to person, place and date, ability to identify driving signs, ability to identify currency, and shopping from free recall), uniquely accounting for 36% of the variability in the Total DAFS score, 36% of the variability in overall communication skills 32% of the variability in financial ability, and 19% of the variability in the shopping task. Additionally, Digit Symbol was the single best predictor of Orientation to ‘person, place, and date,’ accounting for 15% of the total variability.

Discussion

The aim of the present study was to examine the relationship between aspects of attention and daily functional ability in patients with AD, as well as to assess how well each of the tests of attention predict daily functioning in these patients. The current results demonstrated that a test of attention (i.e., Digit Span) that is most often used in clinical assessment is, in fact, correlated with and to some degree predicts various daily functional abilities in AD patients. These findings are in line with previous results (Farias, Harrell, Neumann & Heutz, 2003; Freilich & Hyer, 2007), as well as extend the findings in this area by indicating that certain aspects of attention predict specific ADL abilities more than others. For instance, the current study found that Digit Span Backward correlated with and predicted nearly all DAFS subscales. This component of the Digit Span accounted most notably for approximately 36% of the overall ADL functioning, and specifically for 36% of the communication, 32% of the financial, and 19% of the shopping skills portions of the DAFS. These findings are intriguing when considering that Farias et al. (2003) demonstrated that a number of combined neuropsychological variables across six cognitive domains accounted for a total of 50% of total DAFS performance. But in the same study, they found the composite Digit Span score (i.e., combined Forward and Backward) to have limited utility for predicting daily functioning. Closer comparison of our findings with Farias et al. shows that we found moderate correlations that were in the same range as those found in their study between the DAFS subscales and Digit Span combined scores. However, unlike the Farias et al. study, we found the combined Digit Span scores to be a significant predictor of nearly all DAFS subscales. The discrepancy between our finding and theirs may be due to the fact that we did not have other neuropsychological tests in the regression equation accounting for and partitioning out portions of variability that would have been accounted for in DAFS test performance by the Digit Span scores. Studies have demonstrated significant overlap between performance on tasks of attention and those of memory and executive functioning in AD (Bondi, Salmon & Butters, 1994; Castel, Balota & McCabe, 2009; Heindel, Salmon & Butters, 1993; Iidaka, Anderson, Kapur, et al., 2000; Perry & Hodges, 1998).

In our study, the Digit Span Backward, and not Forward, accounted for a significant portion of variability in nearly all of the DAFS subscales. It is possible that the discrepancy between Digit Span Forward and Backward in predicting daily functioning is due to the fact that each test is measuring a different aspect of attention and working memory (Baddeley, 2003). Within the working memory framework, Digit Span Forward is simply a reflection of the storage capacity of the phonological loop. Digit Span Backward, on the other hand, is thought to involve the concurrent function of two separate systems: A storage capacity system, which functions to hold the string of digits in the short-term store, and a central executive system, which systematically rearranges the digits in reverse order. There is some evidence to suggest that there is a selective impairment of the central executive (also referred to as dysexecutive syndrome; Baddeley & Wilson, 1988), and relative sparing of the short-term store in AD (Baddeley, Bressi, Della Sala, Logie & Spinnler, 1991; Cherry, Buckwalter & Henderson, 1996). Additionally, two prospective longitudinal studies have reported early executive deficits in MCI cases which were predictive of incident AD at 1 – 4 years follow-up (Rapp & Reischies, 2005; Silveri, Reali, Jenner & Puopolo, 2007).

Furthermore, previous clinical investigations assessing the Digit Span's ability to identify brain damage found that separation of the Digit Span task into Forward and Backward components yielded the most sensitive results (Leskela, Hietanen, Kalska, et al., 1999; Banken, 1985; Diller & Weinberg, 1972). Although we did not specifically test the hypothesis that Digit Span Backward is more sensitive in its ability to identify brain damage, our findings do support the notion that Digit Span Backward is a more complex attentional task which accounts for greater portions and wider ranges of daily functional abilities than the Digit Span Forward subtask.

Also of note, processing speed (as measured by the Digit Symbol) was not very useful in predicting DAFS performance. This result was somewhat surprising given that the Digit Symbol is one of the most sensitive tests for differentiating between brain damaged patients and healthy controls (Storandt & Hill, 1989). Patients in this study, on average, scored at the 5^{th} percentile for the Digit Symbol test. These low scores may have contributed to the poor correlations and predictability of this test with the ADL task. Nonetheless, this suggest that processing speed, although highly indicative of the presence of underlying pathology, may not be indispensable to the performance of real-world tasks, particularly in the mild stages of AD.

As the focus of clinical intervention and research has shifted to very early stages of cognitive impairment (e.g., those patients referred to as having mild cognitive impairment; MCI), these findings may have even more important implications. Several studies have found that individuals with MCI show deficits in instrumental ADLs (Tuokko et al., 2005; Perneczky et al., 2006; Wadley et al., 2007). Given the relationship between the Digit Span Backward test and most aspects of ADL functioning in the current study, we might speculate that this task would be important to use with MCI patients. We might suspect that daily functional impairments would be better correlated with this complex attention task in MCI, relative to a more basic (e.g., Digit Span Forward), or diluted (e.g., Digit Span combined) measure of attention. This hypothesis, however, would need to be empirically tested.

There were several limitations to the current study. The first limitation concerns the neuropsychological measures used and the extent to which they are an accurate representation of the attentional system. We recognize that the Digit Span and Digit Symbol tests may not be the most comprehensive measures of attention. Nonetheless, these measures were used for two reasons: First, we wanted to assess commonly used measures of attention employed in neuropsychological test batteries; and second, Digit Span Forward, Backward, and Digit Symbol provided assessment of short-term capacity and processing speed, the two components of the attentional system we sought to examine. As such, future studies should consider utilizing additional neuropsychological and cognitive measures of attention in order to more thoroughly characterize the relationship between specific components of the attentional system and functional ability. Second, there were specific limitations to the current sample, including the relatively small number and highly educated participants, no direct measure of psychiatric symptoms and their effects on the present outcome, and lack of assessment of the role of comorbid medical illness or physical disabilities affecting the results. Finally, because of our interest in the role of attention and processing speed on daily functional ability, no tests from other cognitive domains were included. Thus, the current findings do not address how deficits in other cognitive domains and their overlapping effects with attention problems might affect everyday functioning in AD. Finally, given that this was a collaborative and longitudinal project, we used the WAIS-Revised subscales. These subscales have since been revised and for future studies we have adopted the WAIS-III versions of these tests. While the WAS-R may be somewhat outdated, for the purpose of the current study and clinical utility, these data are still quite useful and relevant. The protocol has since been revised for the project and we hope to demonstrate similar results using the WAIS-III subscales in future studies.

The present results outline rudimentary connections between attention and ADL performance in AD. To our knowledge this is the first study to specifically examine how daily functioning in AD patients is related to different aspects of attention and speed of information processing. Our findings revealed that complex short-term capacity in tandem with working memory systems, not processing speed and simple short-term capacity, best predict real-world functional ability, accounting for moderate portions of variability in most functional tasks. Future studies should further delineate how attention, along with other neuropsychological measures, relate to real-world functional ability.

The current findings have important clinical utility and may be of use to healthcare professionals, patients and their caregivers. Added knowledge about the relationship between clinical tests of attention and ADL can aid in treatment planning for patients, particularly for those whom actual ADL assessments are not available. Clinicians can also help families and caregivers of patients to make better use of neuropsychological test information as it applies to anticipating areas of functional difficulties and need for assistance by patients.

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Table 1

Participant demographic data, Digit Span, Digit Symbol and DAFS scores

Variables	Mean	Standard Deviation
Age	74.82	8.749
Gender	(38 M/18 F)	
Education	16.78	9.276
MMSE	23.33	5.41
Digit Span (Combined)	11.49	3.82
Digit Span-Forward (1–18)	9.0	2.81
Digit Span-Backward (1–18)	4.89	2.29
Digit Symbol (0–63)	11.88	11.45
DAFS-Orientation (0–16)	12.43	4.49
DAFS-Communication (0–14)	11.50	3.05
DAFS-Transportation (0–13)	11.48	2.27
DAFS-Financial (0–21)	15.39	3.61
DAFS-Shopping (0–16)	7.77	3.47
DAFS-Total (0–92)	71.39	14.51

*DAFS-Total score includes scores for Grooming and Eating subtasks.

Table 2

Correlations between neuropsychological data and DAFS performance

	Digit-Span Forward	Digit-Span Backward	Digit-Span Combined (Forward and Backward)	Digit Symbol
DAFS Total	.435**	.602**	.420**	.246
DAFS Orientation	.501**	.473**	.507**	.324*
DAFS Communication	.418**	.604**	.462**	.228
DAFS Transportation	.322*	.410**	.335*	2.44
DAFS Financial	.465**	.620**	.458**	.283*
DAFS Shopping	.128	.362*	.093	.158

P = *<.05, **<.01

Table 3

Results of regression analyses with age and education as the independent variables entered into the first block, and Digit Span Total and Digit Symbol entered as the independent variables into the second block and DAFS subscales entered as dependent variables.

DAFS	Variables Entered	R^2	R^2 Change	F Change	*p*
Total	Age & Education	.001	-	0.03	.970
	Digit Span Total	.121	.119	5.97	.019
Orientation	Age & Education	.013	-	0.25	.776
	Digit Span Total	.215	.202	9.77	.003
Tell Time	Age & Education	.039	-	0.79	.457
	Digit Span Total	.266	.227	11.72	.001
PPD	Age & Education	.001	-	0.02	.970
	Digit Symbol	.132	.130	5.70	.022
Communication	Age & Education	.004	-	0.10	.905
	Digit Span Total	.160	.156	8.16	.006
Telephone	Age & Education	.045	-	0.92	.407
	Digit Span Total	.388	.343	21.2	.000
Letter	Age & Education	.061	-	1.26	.295
Transportation	Age & Education	.002	-	0.05	.946
Driving Signs	Age & Education	.022	-	0.43	.651
	Digit Span Total	.121	.099	4.27	.046
Driving Rules	Age & Education	.004	-	0.07	.930
	Digit Span Total	.127	.123	5.36	.026
Financial	Age & Education	.081	-	1.99	.148
	Digit Span Total	.193	.111	6.06	.018
ID Currency	Age & Education	.011	-	.210	.811
Count Currency	Age & Education	.155	-	3.58	.037
	Digit Span Total	.296	.141	7.60	.009
Write Check	Age & Education	.136	-	3.05	.058
	Digit Span Total	.334	.198	11.3	.002
Bal. Checkbook	Age & Education	.082	-	1.73	.190
	Digit Span Total	.196	.115	5.43	.025

DAFS	Variables Entered	R^2	R^2 Change	F Change	*p*
Shopping	Age & Education	.027	-	0.61	.543
Free Recall/Selection	Age & Education	.061	-	1.26	.294
Recognition	Age & Education	.153	-	3.51	.040
Recall with List	Age & Education	.078	-	1.66	.203
	Digit Span Total	.204	.141	5.98	.019
Make Change	Age & Education	.109	-	2.38	.106
	Digit Span Total	.235	.126	6.27	.017

PPD = Person, Place, Date

ID Currency = Identifying Currency

Bal. Checkbook = Balance Checkbook

Table 4

Results of the regression analyses with age and education as the independent variables entered into the first block, and DS Forward, Backward, and Digit Symbol entered as the independent variables into the second block and the DAFS subscales entered as dependent variables

DAFS	Variables Entered	R^2	R^2 Change	F Change	*p*
Total	Age & education	.01	-	0.01	.99
	DS-Backward	-	.36	20.53	<.0001
Orientation	Age & education	.02	-	0.25	.78
	DS-Forward	-	.19	7.85	.009
	Digit Symbol	-	.19	9.45	.004
Tell Time	Age & education	.04	-	0.59	.56
	DS-Backward	-	.24	10.78	.02
PPD	Age & education	.01	-	0.24	.79
	Digit Symbol	-	.15	5.94	.02
Communication	Age & education	.01	-	0.05	.95
	DS-Backward	-	.36	19.87	<.0001
Telephone	Age & education	.05	-	0.89	.42
	DS-Backward	-	.36	19.20	<.0001
Letter	Age & education	.08	-	1.41	.26
	DS-Backward	-	.13	5.05	.03
Transportation	Age & education	.01	-	0.06	.94
	DS-Backward	-	.16	6.44	.01
Driving Signs	Age & education	.02	-	0.40	.67
Driving Rules	Age & education	.01	-	0.22	.81
	DS-Backward	-	.22	9.21	.005
Financial	Age & education	.07	-	1.43	0.25
	DS-Backward	-	.32	18.67	<.0001
ID Currency	Age & education	.02	-	0.35	.07
Count Currency	Age & education	.16	-	3.23	.01
	DS-Backward	-	.13	6.12	<.001
Write Check	Age & education	-	.14	2.65	.09
	DS-Backward	-	.28	7.61	<.0001

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DAFS	Variables Entered	R^2	R^2 Change	F Change	*p*
Bal. Checkbook	Age & education	.04	-	1.72	.20
	DS-Backward	-	.27	13.26	.001
Shopping	Age & education	.04	-	0.79	.46
	DS-Backward	-	.19	8.92	.005
Free Recall/Selection	Age & education	.10	-	1.81	.17
Recall Cued	Age & education	.21	-	4.42	.02
	DS-Backward	-	.14	7.05	.01
Recall with List	Age & education	.08	-	1.47	.25
	DS-Backward	-	.12	4.83	.04
Make Change	Age & education	.14	-	2.60	.09
	DS-Backward	-	.15	6.71	.01

PPD = Person, Place, Date

ID Currency = Identifying Currency

Bal. Checkbook = Balance Checkbook