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COGNITIVE ASSESSMENT OF USAF PILOT TRAINING CANDIDATES: MULTIDIMENSIONAL APTITUDE BATTERY AND COGSCREEN-AEROMEDICAL EDITION

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This technical report has been reviewed and is approved for publication.

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CONTENTS

	Page
SUMMARY	1
INTRODUCTION	1
Background	1
Pupose	2
METHOD	3
Subjects	3
Measures	3
RESULTS	3
DISCUSSION	5
REFERENCES	8
Appendix A: CogScreen Variable Definition	16

Table Number

1	Means and Standard Deviations for all MAB Variables	9
2	Means and Standard Deviations with t-tests for USAF Pilot Candidates and Commercial Pilots on CogScreen-AE Speed Variables	10
3	Means and Standard Deviations with t-tests for USAF Pilot Candidates and Commercial Pilots on CogScreen-AE Speed Variables	11
4	Means and Standard Deviations with t-test for USAF Pilot Candidates and Commercial Pilots on CogScreen-AE Throughput Variables	12
5	Means and Standard Deviations with t-tests for USAF Pilot Candidates and Commercial Pilots on CogScreen-AE Process Variables	13
6	Means and Standard Deviations with t-tests for USAF Pilot Candidates and Commercial Pilots on CogScreen-AE Variables	14

PREFACE

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Cognitive assessment of USAF pilot training candidates:
Multidimensional Aptitude Battery and CogScreen-Aeromedical Edition.

SUMMARY

Most intellectual and cognitive assessment of pilots is done with locally developed assessment devices. This paper presents the test scores of 537 USAF pilot training candidates who were tested with commercially available, "off-the-shelf" products. Multidimensional Aptitude Battery subscale scores and summary intelligence scores were found to be well above average. Data from the new CogScreen-Aeromedical Edition is also provided and shows consistent differences between pilot training candidates and commercial pilots across reaction time, accuracy, throughput, and process measures.

INTRODUCTION

Background

While it is widely acknowledged that cognitive ability is one of the primary prerequisites to flight training success and a successful aviation career, the vast majority of work in this area has utilized locally developed, "in-house" testing systems. Two of the best and most widely used in the US Air Force are the Air Force Officer Qualification Test (AFOQT; Skinner and Ree, 1987) and the Basic Attributes Test (BAT; Carretta, 1989). They have both been found to predict important outcome variables. They are, however, very specific to aviation assessment in both presentation and conceptualization. They also come from an experimental and industrial/ organization psychological perspective, representing some of the best work in these fields.

A different perspective comes from clinical psychology which has a history of using "off-the-shelf" tests. Here the development of tests is often quite separate from their final use. While these tests are at times less optimized to a particular need, they eliminate the need for extensive test development and validation. They can also be used in a broader variety of areas. For example, general purpose cognitive tests can be used not only for selection and training but also for clinical assessment. The results can also be compared to data from other military branches and to data from civilian populations. This paper presents the data from two such "off the-shelf" tests.

The Multidimensional Aptitude Battery (MAB) (Jackson, 1985) is a broad-based test of intellectual ability. It was patterned on the Wechsler Adult Intelligence Scale (WAIS-R), the most widely used individually administered test of intelligence. The WAIS-R is individually administered and requires about an hour and a half per subject. While the MAB requires approximately the same amount of testing time, it can be given in large group settings. Additionally, the WAIS-R requires skillful scoring while the MAB has a multiple choice format. All subtests in the WAIS-R have corresponding paper-and- pencil subtests in the MAB except immediate digit memory. Verbal components tapped include information, comprehension, arithmetic, similarities, and vocabulary. Performance measures include digit symbol coding,

picture completion, spatial, picture arrangement, and object assembly. Scores on each of the subtests are scaled to a mean of 50 and a standard deviation of 10. Verbal and performance sub-scores are available as is a full scale IQ score. These scores are scaled to a mean of 100 and a standard deviation of 15. Reliabilities for the summary scores range from .94 to .98 and the validity against the WAIS-R is .91.

The MAB has been used to assess intelligence in aviators in a few studies. Retzlaff and Gibertini (1988) presented psychological data on 350 US Air Force pilot training students. Testing included scales of intelligence, personality, and psychopathology. The average Full Scale IQ for this group using the MAB was found to be 120. The ten subtests showed mean performances about one standard deviation above the normative mean. Similar results were found in a study of fully qualified Air National Guard pilots (Flynn, Sipes, Grosenbach, and Ellsworth, 1994).

The CogScreen-Aeromedical Edition (AE)(Kay, 1995) is a test of cognitive ability intended for use in the assessment of pilots. While the MAB is a test of relatively complex, higher order intellectual processes, the CogScreen-AE tasks are generally more fundamental processes such as reaction time. It is not a test of aviation knowledge but considered to include abilities necessary in the performance of aviation duties (Kay, 1995). There are 11 tasks resulting in 65 scores. The tasks include Backward Digit Span (BDS), Math (MATH), Visual Sequence Comparison (VSC), Symbol Digit Coding (SDC), Matching-to-Sample (MTS), Manikin (MAN), Divided Attention (DAT), Auditory Sequence Comparison (ASC), Pathfinder (PF), Shifting Attention (SAT), and Dual Task (DTT). Each of the tasks is usually scored in a number of ways. Typical scorings include task speed (RTC suffix), accuracy (ACC suffix), and throughput (PUT suffix). Throughput is a function of speed and accuracy; basically, it is the number of correct responses per minute. Throughput is indicative of the amount of accurate work accomplished. A number of tasks also include process completion measures which quantify task specific behavior such as control of the computer screen elements. The manual and other research refers to the CogScreen-AE scores by a relatively cryptic variable naming process. These variable names are defined in Appendix A.

The CogScreen-AE is relatively new and represents an attempt by its authors to produce an assessment device which meets a number of Federal Aviation Administration requirements. It is currently used in the USAF Enhanced Flight Screening (King and Flynn, 1995) program and is used by a number of commercial airlines. It is published and available from one of the major psychological test publishers.

Purpose

The purpose of the current work is to assess the behavior of the MAB and CogScreen-AE when used with USAF pilot candidates. The MAB scores will be compared to the normative sample and the CogScreen-AE scores will be compared to commercial pilot norms. The final purpose is to archive the norms on these tests for selection and training purposes.

METHOD

Subjects

A sample of 537 Air Force pilot training candidates participated in this study. The sample as a whole had a mean age of 23.5 (SD 4.2) and 5% were female. Subjects who had been commissioned through Officer Training School, Reserve Officer Training Corps (ROTC), and the Air National Guard were all college graduates. Approximately, 42% were Juniors at the United States Air Force Academy. Prior to entering the Enhanced Flight Screening programs at Hondo, TX, and at the Air Force Academy in Colorado Springs, CO, student pilot candidates are required to participate in baseline cognitive testing.

Measures

The version of the MAB used in the current study was primarily the Armstrong Laboratory's computerized version (Retzlaff, King, and Callister, in press). This version presents verbal type questions as text on a computer screen. Subjects respond with an a, b, c, d, or e response with light pen or keyboard entry. The performance type items were scanned into computer graphic files and are presented in a window on the monitor. This computerization was done, and is used, with the consent of the test author through explicit copyright permission. it is important to note that the 1990 norms for the MAB were used for this study. These norms are used in the computer scoring software from the publisher. Earlier work with the test or other current paper-and-pencil type scorings use the original 1985 norms as published in the manual. Hence, direct comparison with data such as Retzlaff and Gibertini's (1988) may be difficult.

The CogScreen-AE was used as provided by the test publisher. That software administers the test, times the tasks, scores the tests, and archives the data in report form.

RESULTS

Table 1 presents the Scaled Scores and raw scores of the pilot candidates on the MAB. As can be seen, the Full Scale IQ is 119. The Verbal IQ is 118 as is the Performance IQ. Scaled Scores are generally 1 to 1.5 standard deviations above the normative sample. Within the Verbal subtests the highest score is on Information and the lowest is on Vocabulary. A caveat here is that Information was one of the most changed scales between the 1985 and 1990 norming processes. Within the Performance subtests, Digit Symbol is highest and Picture Arrangement is lowest. Generally, there is less spread of means within the Performance subtests. It is apparent that pilot candidates are very intelligent compared to the population as a whole.

With 65 variables, the CogScreen-AE is somewhat difficult to interpret. In order to better understand the data, it is presented not by subtest but by type of score. As such, speed variables are presented first, followed by accuracy, throughput, and process variables.

Table 2 provides all of the reaction time variables across all tasks. Here the reaction time in seconds for the USAF pilot candidates is compared to the normative sample of commercial pilots presented in the test manual. Since only the means and standard deviations of the commercial pilots were available and not individual raw data, only t tests could be calculated. These are presented in the tables. Multivariate statistics would have been preferable but would have required the original dataset.

In general, commercial pilots are faster on most single type tasks. These include the Math, Match-to-Sample, Manikin, Auditory Sequence Comparison, Pathfinder, and Shifting Attention Test. USAF pilot candidates are faster on dual and divided type tasks. They are faster on both the Indicator Alone and Indicator Dual elements of the Divided Attention Test. They are also faster than the commercial pilots on the Previous Number Dual Speed element of the Dual Task Test. This indicates a consistent difference between the two groups with respect to simple, focused versus complex reaction times with commercial pilots better at the former and USAF candidates better at the latter.

Table 3 provides the accuracy of response data across all tasks. Here scores represent the proportion of items or events accurately performed. Of concern is the fact that many of these tasks are performed at ceiling levels. many of the tasks are accomplished with accuracy in the 901 area. When this occurs there is very little variance of scores, resulting in unstable inferential statistical results. As such all variables with standard deviations of .10 or less have been identified in the table and will not be discussed. This restriction of range, of course, points to a limitation of these variables in their ability to differentiate among pilots.

Of the remaining accuracy variables, commercial pilots are better at math with 861 of items correctly answered compared to the USAF sample only answering 721 correctly. USAF pilot candidates, however, are better at remembering digits backward, coding symbols for digits both immediately and in delayed memory format, and remembering previous numbers while performing the Dual Task Test. A theme develops with the USAF sample displaying superior memory across a number of tasks.

Table 4 provides the mean comparisons for the throughput variables. Throughput is calculated by dividing accuracy by 100, multiplying this by 60 seconds, and dividing the result by the median response time of the correct trials. Throughput provides a measure of workload or accomplishment during the tasks. Unfortunately, it is of little value in the case of variables with little variance on the accuracy component. For those variables, it is simply a linear transformation of the speed data.

Commercial pilots are better at most tasks. However, only the Math Throughput is based upon an accuracy which had a reasonable amount of variance and avoided a test ceiling. Again, AF pilot candidates are specifically better at divided attention and dual tasks. The Divided Attention task results are of limited interpretive value as they are derived from truncated variance and as such are not unique. The Dual Task is, though, more unique. These results obviously parallel the results of the speed variables, again largely due to the lack of variance on the accuracy variables.

Table 5 presents the process variables which are indicative of a wide range of test behaviors. While five appear to differ significantly between the two groups, a scoring problem is probably responsible for three of them. The Path Finder task requires subjects to highlight numbers and letters on the screen with a light pen. The number/ letter is seen as a target and the distance from that target is scored. The Path Finder task has three of these "coordination" variables. One is under the number condition, one under the letter condition, and the third under a combined number/ letter condition. The early software used in this study quantified the coordination in terms of EGA pixels from the target. Later software uses characters (8x14 pixels). The data from the earlier software was converted to characters by dividing by the character average of 11 pixels. It is highly probable given the magnitude and consistency of these data that such a transformation was inaccurate.

That leaves two variables which appear to differentiate the two groups. Commercial pilots made more perseverative errors (SATDIPER). This means that they continued to respond in a manner which may have been successful in the past but was no longer appropriate. USAF pilot candidates more often "failed to maintain set" on the attention shifting task. This means that they failed to thoroughly learn a task prior to changing approaches. Rather nicely, the two groups are seen as different on this common discipline dimension with commercial pilots perhaps overly disciplined and USAF pilot candidates insufficiently disciplined.

Table 6 is provided as a summary of all variables and Appendix A presents the definitions for the variable names.

DISCUSSION

The current data shows that important intellectual and cognitive variables can be assessed in aviators with commercially available tests. The MAB, a broad-based test of intelligence, performed well with this sample. It is easy to administer and allows for highly reliable intelligence assessment within a computerized, group administered environment. The CogScreen-AE, a commercially available test of reaction time and fundamental cognitive ability, also, in general, behaved well. It is well constructed, easy to administer, and commercially available.

One problem with the CogScreen-AE, however, is the ceiling effect of the accuracy variables. Many of the tasks are so simple that most subjects get maximum scores. Since so many subjects appear to do a "perfect" job, the variables have very little variance and it is unclear how they "behave" because there is so little behavior. Further, since the throughput variables are a function of speed and accuracy, the lack of variance on the accuracy variables lead the throughput variables to be largely linear transformations of the speed variables. Consequently, while the CogScreen-AE appears to have 65 variables, many of the variables are of questionable use.

The MAB nicely quantifies the intelligence of the pilot candidates. It is apparent with an average IQ of 119 and a standard deviation of 7 points that the pilot candidates are well above the

population as a whole. Indeed, a 119 IQ is at the 90th percentile of the population. Intelligence is important in aviator selection and success.

There are differences between US Air Force pilot candidates and commercial pilots on the CogScreen-AE. These differences are fairly logical and probably represent true differences between the two groups. USAF pilot candidates were more accurate on measures of numeric working memory, while commercial pilots were more accurate and more productive in solving arithmetic word problems. USAF pilot candidates more quickly completed divided attention and other dual tasks, while commercial pilots more quickly completed simple, more focused tasks. Finally, while commercial pilots were more perseverative, pilot candidates were more impulsive.

A specific caveat of the above differences must be noted. The two groups not only differed in respect to actual pilot status but also age. Age differences are highly correlated with cognitive ability. The USAF pilot candidates were all quite young with an average age of 23.5. The commercial pilot sample had a mean age of 44.0. While the difference in age may have contributed to the superior performance of the pilot candidate group on some tasks, the commercial pilot group actually was superior to the younger sample on a number of tasks. It is likely that the two groups were quite similar, with age benefiting the younger group, while selection variables benefited the older group. In essence, two confounding variables may have balanced each other out.

These differences reinforce the need for some population specific data. The CogScreen-AE manual and computerized reports are based upon older, commercial pilots. There are sufficient differences noted here that norms specific to USAF are probably indicated. Indeed, even fully rated USAF pilots would be younger than commercial pilots as many military pilots fly commercial aircraft after separation or retirement from the military.

This MAB and CogScreen-AE data can be used in a number of ways. First, these tests and data could be used in selection and training programs. They could be incorporated into the selection programs for ROTC or Air National Guard units. They could also be used in commercial or foreign selection and training programs. An additional use could be the academic assessment of student pilots having difficulty in Undergraduate Pilot Training (UPT). Students having difficulty could be tested and the data could help understand the particular difficulty the student is having. From a clinical perspective, cognitive declines could be documented. For this purpose, however, an additional caveat is necessary given the narrow age group in the current sample. Cognitive capability declines with age and the current work should be used with extreme caution in samples over age 50 or so.

The current study has a number of additional limitations. The current sample were pilot training candidates. They were neither in training nor pilots. Although, the IQ data is very consistent with pilots in training and working pilots. The current work also is based upon a fairly rigid computerized testing protocol. Individually administered testing may result in different data.

Future research with this dataset should include follow-up studies. This cognitive data can be used to predict UPT variables such as test scores, check rides, and final completion. It can also

be used to model selection for, and success in, follow-on aircraft such as fighters versus multi-crew aircraft.

This paper has presented two commercially available cognitive tests which can be used to quantify important cognitive variables of interest in the aviation field. For the most part they behave well. This paper also provides data on the behavior of these tests in the assessment of pilot candidates.

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Table 1

Means and Standard Deviations for All MAB Variables.

Variable	Scaled Scores		Raw Scores	
Full Scale	119.3	(7.0)	n/a	
Verbal	118.1	(7.0)	n/a	
Performance	118.0	(8.8)	n/a	
Information	67.4	(6.8)	29.4	(4.5)
Comprehension	60.1	(4.1)	23.4	(2.2)
Arithmetic	62.3	(6.5)	15.7	(2.0)
Similarities	62.1	(4.8)	27.8	(3.0)
Vocabulary	58.4	(6.4)	29.2	(5.7)
Digit Symbol	66.4	(6.8)	29.2	(3.4)
Picture Completion	63.7	(6.8)	26.9	(3.7)
Spatial	63.5	(7.3)	36.8	(6.8)
Picture Arrangement	60.1	(7.2)	12.6	(2.1)
Object Assembly	64.5	(7.5)	15.7	(3.1)

Note: N=537

Table 2

Means and Standard Deviations with t-tests for USAF Pilot Candidates and Commercial Pilots on CogScreen-AE Speed Variables.

Variable	Air Force		Commercial**		t
	Mean	SD	Mean	SD	
MATHRTC	27.25	8.79	20.10	7.58	14.3203*
VSCRTC	2.24	.51	2.21	.55	0.9366
MTSRTC	1.47	.28	1.32	.24	9.4537*
MANRTC	1.98	.38	1.78	.41	8.3780*
DATIRTC	.40	.07	.42	.09	-4.1309*
DATDRTC	.69	.20	.76	.23	-5.3893*
DATSCRTC	2.15	.53	2.24	.60	-2.6367
ASCRTC	.98	.24	.83	.20	11.1496*
PFNRTC	.85	.16	.79	.23	5.0604*
PFLRTC	.79	.13	.64	.18	15.9460*
PFCRTC	1.20	.30	1.09	.36	5.5159*
SATADRTC	.70	.10	.54	.09	27.6847*
SATACRTC	.68	.09	.55	.11	21.5061*
SATINRTC	.86	.15	.75	.15	12.1126*
SATDIRTC	.95	.21	.87	.25	5.7562*
DTTAABS	24.12	19.50	22.85	17.25	1.1349
DTTDABS	49.42	26.06	51.45	26.03	-1.2873
DTTPARTC	.48	.19	.51	.24	-2.3068
DTTDRTC	.66	.24	.72	.27	-3.8947*
N	512		584		

Note: All scores are in seconds except DTTAABS and DTTDABS which are numbers of errors. Please see Appendix A for variable name definitions.

* denotes significance at .001 (1>3.29).

** data abstracted from CogScreen-AE manual (Kay, 1995).

Table 3

Means and Standard Deviations with t-tests for USAF Pilot Candidates and Commercial Pilots on CogScreen-AE Accuracy Variables.

Variable	Air Force		Commercial		t
	Mean	SD	Mean	SD	
BDSACC	.89	.12	.84	.20	5.0868*
MATHACC	.72	.19	.86	.17	-12.7805*
VSCACC	.97	.03	.98	.03	-5.5057*a
SDCACC	.99	.01	.98	.03	7.5888*a
SDCIRACC	.94	.13	.86	.20	7.9406*
SDCDRACC	.93	.15	.84	.22	7.9918*
MTSACC	.95	.05	.96	.05	-3.3034*a
MANACC	.93	.09	.92	.10	1.7423 a
DATSCACC	.89	.07	.87	.08	4.4141*a
ASCACC	.90	.10	.93	.08	-5.4330*a
PFNACC	.99	.01	1.00	.01	-16.5172*a
PFLACC	.99	01	.99	.02	0.0000 a
PFCACC	.98	.03	.98	.04	0.0000 a
SATANIC	.98	.03	.99	.03	-5.5057*a
SATACACC	.99	.03	.99	.03	0.0000 a
SATINACC	.97	.03	.98	.04	-4.7153*a
SATDIACC	.67	.11	.68	.12	-1.4390
DTTPAACC	.93	.07	.91	.11	3.6340*
DTTPDACC	.86	.11	.81	.15	6.3418*
N	512		584		

Note: The "a" denotes variables with so little variance due to ceiling effect that the significant t statistics are probably unstable and uninterpretable.

* denotes significance at .001 (1>3.29).

Table 4

Means and Standard Deviations with t-tests for USAF Pilot Candidates and Commercial Pilots on CogScreen-AE Throughput Variables.

Variable	Air Force		Commercial		t
	Mean	SD	Mean	SD	
MATHPUT	1.82	1.22	3.00	1.40	-14.9102*
VSCPUT	27.56	6.20	28.00	6.40	-1.1546
SDCPUT	33.74	6.00	33.00	8.20	1.7184
MTSPUT	40.44	7.73	44.90	8.50	-9.0960*
MANPUT	29.51	7.05	32.80	8.80	-6.8649*
DATSCPUT	26.32	6.47	24.90	6.40	3.6435*
ASCPUT	58.79	17.48	71.50	20.60	-11.0483*
PFNPUT	72.00	12.86	81.60	22.10	-8.9160*
PFLPUT	77.46	12.24	99.50	26.20	-18.1905*
PFCPUT	51.83	12.54	59.70	19.20	-8.1244*
SATADPUT	86.55	12.77	113.90	19.60	-27.6798*
SATACPUT	88.51	11.20	112.30	18.30	-26.2967*
SATINPUT	69.59	11.64	81.40	15.80	-14.1960*
SATDIPUT	44.64	11.68	50.20	15.70	-6.7006*
DTTPAPUT	131.25	46.15	134.00	84.80	-0.6776
DTTPDPUT	90.85	38.48	80.20	45.00	4.2232*
N	512		584		

Note: * denotes significance at .001 (1>3.29).

Table 5

Means and Standard Deviations with t-tests for USAF Pilot Candidates and Commercial Pilots on CogScreen-AE Process Variables.

Variable	Air Force		Commercial		t
	Mean	SD	Mean	SD	
DATIPRE	2.52	1.80	2.70	1.90	-1.6093
DATDPRE	2.22	2.04	2.60	2.40	-2.8331
PFNCOOR	2.73	0.29	1.40	.30	74.5396*
PFLCOOR	2.64	0.33	1.40	.30	64.7447*
PFCCOOR	2.63	0.30	1.40	.30	67.7205*
SATDIRUL	6.96	2.50	7.30	2.50	-2.2463
SATDIFAI	2.15	1.92	1.40	1.80	6.6426*
SATDIPER	1.89	2.51	2.80	3.20	-5.2680*
SATDINON	1.57	2.71	1.90	3.20	-1.8483
DTTAHIT	.92	1.95	1.20	1.90	-2.4003
DTTDHIT	3.49	3.39	3.10	3.30	1.9239
N	512		584		

Note: Coordination data is probably non-comparable.

* denotes significance at .001 (t>3.29).

Table 6

Means and Standard Deviations with t-tests for USAF Pilot Candidates and Commercial Pilots on CogScreen-AE Variables.

Variable	Air Force		Commercial		t
	Mean	SD	Mean	SD	
BDSACC	.89	.12	.84	.20	5.0868*
MATHACC	.72	.19	.86	.17	-12.7805*
MATHRTC	27.25	8.79	20.10	7.58	14.3203*
MATHPUT	1.82	1.22	3.00	1.40	-14.9102*
VSCACC	.97	.03	.98	.03	-5.5057*
VSCRTC	2.24	.51	2.21	.55	0.9366
VSCPUT	27.56	6.20	28.00	6.40	-1.1546
SDCACC	.99	.01	.98	.03	7.5888*
SDCPUT	33.74	6.00	33.00	8.20	1.7184
SDCIRACC	.94	.13	.86	.20	7.9406*
SDCDRACC	.93	.15	.84	.22	7.9918*
MTSACC	.95	.05	.96	.05	-3.3034*
MTSRTC	1.47	.28	1.32	.24	9.4537*
MTSPUT	40.44	7.73	44.90	8.50	-9.0960*
MANACC	.93	.09	.92	.10	1.7423
MANRTC	1.98	.38	1.78	.41	8.3780*
MANPUT	29.51	7.05	32.80	8.80	-6.8649*
DATIRTC	.40	.07	.42	.09	-4.1309*
DATIPRE	2.52	1.80	2.70	1.90	-1.6093
DATDRTC	.69	.20	.76	.23	-5.3893*
DATDPRE	2.22	2.04	2.60	2.40	-2.8331
DATSCRTC	2.15	.53	2.24	.60	-2.6367
DATSCACC	.89	.07	.87	.08	4.4141*
DATSCPUT	26.32	6.47	24.90	6.40	3.6435*
ASCACC	.90	.10	.93	.08	-5.4330*
ASCRTC	.98	.24	.83	.20	11.1496*
ASCPUT	58.79	17.48	71.50	20.60	-11.0483*
PFNACC	.99	.01	1.00	.01	-16.5172*
PFNRTC	.85	.16	.79	.23	5.0604*
PFNPUT	72.00	12.86	81.60	22.10	-8.9160*
PFNCOOR	2.73	0.29	1.40	.30	74.5396*
PFLACC	.99	.01	.99	.02	0.0000
PFLRTC	.79	.13	.64	.18	15.9460*
PFLPUT	77.46	12.24	99.50	26.20	-18.1905*

PFLCOOR	2.64	0.33	1.40	.30	64.7447*
PFCACC	.98	.03	.98	.04	0.0000
PFCRTC	1.20	.30	1.09	.36	5.5159*
PFCPUT	51.83	12.54	59.70	19.20	-8.1244*
PFCCOOR	2.63	0.30	1.40	.30	67.7205*
SATANIC	.98	.03	.99	.03	-5.5057*
SATADRTC	.70	.10	.54	.09	27.6847*
SATADPUT	86.55	12.77	113.90	19.60	-27.6798*
SATACACC	.99	.03	.99	.03	0.0000
SATACRTC	.68	.09	.55	.11	21.5061*
SATACPUT	88.51	11.20	112.30	18.30	-26.2967*
SATINACC	.97	.03	.98	.04	-4.7153*
SATINRTC	.86	.15	.75	.15	12.1126*
SATINPUT	69.59	11.64	81.40	15.80	-14.1960*
SATDIACC	.67	.11	.68	.12	-1.4390
SATDIRTC	.95	.21	.87	.25	5.7562*
SATDIPUT	44.64	11.68	50.20	15.70	-6.7006*
SATDIRUL	6.96	2.50	7.30	2.50	-2.2463
SATDIFAI	2.15	1.92	1.40	1.80	6.6426*
SATDIPER	1.89	2.51	2.80	3.20	-5.2680*
SATDINON	1.57	2.71	1.90	3.20	-1.8483
DTTAABS	24.12	19.50	22.85	17.25	1.1349
DTTAHIT	.92	1.95	1.20	1.90	-2.4003
DTTDABS	49.42	26.06	51.45	26.03	-1.2873
DTTDHIT	3.49	3.39	3.10	3.30	1.9239
DTTPAACC	.93	.07	.91	.11	3.6340*
DTTPARTC	.48	.19	.51	.24	-2.3068
DTTPAPUT	131.25	46.15	134.00	84.80	-0.6776
DTTPDACC	.86	.11	.81	.15	6.3418*
DTTDRTC	.66	.24	.72	.27	-3.8947*
DTTPDPUT	90.85	38.48	80.20	45.00	4.2232*
N	512			584	

Note: * denotes significance at .001 (t>3.29).

Appendix A

CogScreen Variable Definitions

Backward Digit Span

1 BDSACC	Accuracy

Math

2 MATHACC	Accuracy
3 MATHRTC	Speed
4 MATHPUT	Thruput

Visual Sequence Comparison

5 VSCACC	Accuracy
6 VSCRTC	Speed
7 VSCPUT	Thruput

Symbol Digit Coding

8 SDCACC	Accuracy
9 SDCPUT	Thruput
10 SDCIRACC	Immediate Recall Accuracy
11 SDCDRACC	Delayed Recall Accuracy

Matching to Sample

12 MTSACC	Accuracy
13 MTSRTC	Speed
14 MTSPUT	Thruput

Manikin Test

15 MANACC	Accuracy
16 MANRTC	Speed
17 MANPUT	Thruput

Divided Attention Test

18 DATIRTC	Indicator alone speed
19 DATIPRE	Indicator alone premature response
20 DATDRTC	Indicator dual speed
21 DATDPRE	Indicator dual premature response
22 DATSCACC	Sequence comparison accuracy
23 DATSCRTC	Sequence comparison speed
24 DATSCPUT	Sequence comparison thruput

Auditory Sequence Comparison

25 ASCACC	Accuracy
26 ASCRTC	Speed
27 ASCPUT	Thruput

Pathfinder

28	PFNACC	Number accuracy
29	PFNRTC	Number speed
30	PFNPUT	Number thruput
31	PFNCOOR	Number coordination
32	PFLACC	Letter accuracy
33	PFLRTC	Letter speed
34	PFLPUT	Letter thruput
35	PFLCOOR	Letter coordination
36	PFCACC	Combined accuracy
37	PFCRTC	Combined speed
38	PFCPUT	Combined thruput
39	PFCCOOR	Combined coordination

Shifting Attention Test

40	SATANIC	Arrow direction accuracy
41	SATADRTC	Arrow direction speed
42	SATADPUT	Arrow direction thruput
43	SATACACC	Arrow color accuracy
44	SATACRTC	Arrow color speed
45	SATACPUT	Arrow color thruput
46	SATINACC	Instruction accuracy
47	SATINRTC	Instruction speed
48	SATINPUT	Instruction thruput
49	SATDIACC	Discovery accuracy
50	SATDIRTC	Discovery speed
51	SATDIPUT	Discovery thruput
52	SATDIRUL	Discovery rule shifts completed
53	SATDIFAI	Discovery failed set
54	SATDIPER	Discovery perseveration errors
55	SATDINON	Discovery nonconcept response

Dual Task Test

56	DTTAABS	Tracking alone error
57	DTTAHIT	Tracking alone boundary hits
58	DTTDABS	Tracking dual error
59	DTTDHIT	Tracking dual boundary hits
60	DTTPAACC	Previous number alone accuracy
61	DTTPARTC	Previous number alone speed
62	DTTPAPUT	Previous number alone thruput
63	DTTPDACC	Previous number dual accuracy
64	DTTDRTC	Previous number dual speed
65	DTTPDPUT	Previous number dual thruput