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PROSPECTIVE MEMORY AND COLLEGE STUDENTS: VALIDATION
OF THE WOOD PROSPECTIVE MEMORY TEST

THESIS

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This study provides information regarding the validity and reliability of the Wood Prospective Memory Test (WPMT), a newly developed test consisting of three main subscales intended to measure prospective memory. Subjects were 69 college students (50 female, 19 male, age range 18-24), who were administered several memory tasks including the WPMT. The results of this study suggest that the subscales of the WPMT do not have sufficient internal reliability (.50, .60, and .44), and therefore, would be unlikely to correlate highly with any other measures. The usefulness of the WPMT as a clinical instrument is discussed.

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PROSPECTIVE MEMORY IN COLLEGE STUDENTS: VALIDATION
OF THE WOOD PROSPECTIVE MEMORY TEST

Extensive research has been done regarding recall, recognition, short-term and long-term memory, memory aids, memory processes, age differences in memory, intentions and motivation in memory and a myriad of variations on these and other memory related topics (Craik & McDowd, 1987; Dobbs & Rule, 1987; Ellis, 1985; Harris, 1980; Patterson, 1972; Petrusic & Dillon, 1972; Tulving, 1976). Despite this variety of memory research, there has been a concern that most of the studies have been laboratory studies conducted in hopes of developing a general theory of memory. The restricted and controlled nature of the laboratory setting and emphasis on theory has led some researchers to question the social significance of some memory research (Neisser, 1988).

According to Neisser (1982), the study of memory can be divided into two areas. One area is comprised of studies attempting "to find basic mental mechanisms that can be demonstrated in well-controlled experiments" (p. xi). The other area of memory research is interested in understanding "the specific manifestations of memory in ordinary human experience" (p. xi). Within the last decade, however,

memory research has turned more toward the ecological study of memory, as opposed to controlled laboratory experiments, (Neisser, 1988), which have predominately been concerned with retrospective memory (Harris, 1984). Retrospective memory is that aspect of the memory concerned solely with the recall of information about the past (Harris, 1984; Meacham & Singer, 1977). Another function of memory--prospective memory--is an area of study which has been relatively neglected. Until recently, few studies have been done on prospective memory. Prospective memory is that aspect of memory that "reminds us to remember." It refers to our ability to carry out everyday actions in the future such as paying a bill or remembering to take our medication.

Meacham and Singer (1977) use the example of delivering a phone message to illustrate the difference between retrospective and prospective memory. These researchers state, "In order to deliver a message one must remember not only the content of the message (retrospective), but also to find the person for whom the message is intended, and deliver the message (prospective)" (p. 191). Therefore, retrospective memory is remembering what to recall and prospective memory is remembering to recall in the first place. Without prospective memory people would not be able to remember to take their medication at the appropriate time, would be late for appointments, or any number of

activities that require planning and remembering in the future.

Prospective memory can be divided into two main categories. The first category, habitual prospective memory, is remembering what is engaged in routinely, such as taking a shower, brushing one's teeth, taking a morning walk, or other activities of daily living. This type of memory may be guided by spatial and temporal cues in the environment (Meacham & Singer, 1977). The second category of prospective memory is episodic memory. Episodic remembering involves actions performed infrequently and on an irregular basis. For example, filling the car with gas on the way home from work would involve episodic prospective memory.

The importance of investigating prospective memory might be best understood in terms of the practical necessity of remembering daily tasks. For example, understanding prospective memory in the elderly as it might relate to their remembering to take medication would be valuable information. Also, through further studies we may develop and test ideas about viable strategies used to aid prospective memory. The implications of possible age differences in prospective memory may also provide us with valuable information.

Although there has been a vast amount of research that provides evidence for retrospective memory loss as people

age (Hill, Crooks, Zadek, Sheekh, 1989; Mitchell, Brown, & Murphy, 1990) the way in which age affects prospective memory is not clear. One current theory of aging (Craik, 1986) suggests that prospective memory may be especially difficult for the elderly. According to Craik's theory, prospective memory is the memory task which requires the most self-initiation, so without the help of external cues, he predicts the elderly would not do as well as younger people on prospective memory tasks. In other prospective memory studies by West (1988) and Poon and Schafer (1982), no reliable differences were found between older and younger subjects. Consistent with these results, Einstein and McDaniel (1990) in a laboratory study of prospective memory, showed no age-related decrements in prospective memory.

Although the investigation of age differences has been emphasized in the limited number of existing studies, other areas of prospective memory have also been investigated. The development of skills, strategies, and cues used in prospective memory are also observed in the existing literature (Beal, 1988; Ceci & Bronfenbrenner, 1985; Meacham & Dumitru, 1976). However, considering the sparsity and inconsistency of the current prospective memory studies, further research is warranted.

Before more can be learned about the related aspects of prospective memory, however, a reliable test must be developed to measure it. One proposed test to measure

prospective memory is the Wood Prospective Memory Test (WPMT). The WPMT is designed to measure a subject's ability to carry out novel instructions in the future. The test yields three subscores directly relevant to prospective memory ability: (1) the CLOCK sub-score indicates the subject's ability to use a clock to cue future actions; (2) the COVERT subscore indicates the subject's ability to initiate actions in response to covert cues (i.e., cues that are "disguised" as something else); and (3) the DETAIL subscore indicates the subject's ability, once cued, to follow detailed instructions given in the past. As a "by-product", the test also yields sub-scores for (4) VERBAL and (5) SPATIAL memory.

The present study is intended to (a) provide information regarding the test's validity and predictive value with college students, and to establish norms for this population group, (b) provide information on prospective memory for comparison with the elderly in future studies, and (c) as an auxiliary hypothesis, test the WPMT's predictive value in student's remembering in everyday situations (e.g., remembering not to lock their keys in the car).

METHOD

Subjects

Subjects were enrolled in an undergraduate psychology class at the University of North Texas. Recruitment of

subjects was done by addressing an undergraduate psychology class and explaining the purpose of the study. Subjects were offered extra credit in their class for participation in the study.

Procedure

Subjects voluntarily signed up to participate in the study. When they reported for testing, they were given a consent form to read and sign, and a copy to retain.

Along with the WPMT, subjects were administered a battery of neuropsychological tests to measure retrospective memory, verbal intelligence and attention. It was hypothesized that no significant correlations would be found between retrospective memory and aspects of prospective memory measured by the WPMT. The specific retrospective memory tests were chosen for their well-known psychometric properties. The tests were administered in the following order:

Vocabulary subtest of the Wechsler Adult Intelligence Scale-Revised (Wechsler, 1981). This subtest is a valid and reliable measure of ability to retrieve general knowledge, and is a rough estimate of verbal intelligence (Sattler, 1988).

Digit Cancellation Task. The digit cancellation test employs two duplicate sheets on which digits are printed in rows. Subjects were given one sheet and instructed to cross out all sixes, working as quickly as possible while

maintaining accuracy. After completion, subjects were given the second sheet and instructed to cross out fives and nines. The time the subject took to complete each task was recorded.

Logical Memory subtest of the Wechsler Memory Scale (Wechsler, 1945). Subjects were read two short passages and asked to recall as many ideas from each passage immediately after hearing the passages and then again after approximately a ten minute interval. This test is a valid and reliable measurement of immediate and delayed recall of logical information (Russel, 1975).

The California Verbal Learning Test (CVLT) (Delis, Kramer, Kaplan & Ober, 1987). Subjects were read the same list of sixteen grocery items five times and asked to freely recall as many items as possible after each reading. Next subjects were read a new list of items, asked to recall items on the new list, and then asked to recall items on the first list. Subjects were also asked to recall items from the first list after being given specific cues (i.e., "Name all the items on the list that are fruits"). This test is shown to be a valid and reliable measure of general short-term and long-term recall ability (Delis et al., 1987).

Rey-Osterreith "complex-figure" (1941). Subjects were first asked to copy the figure as it remained in view. After a period of approximately ten minutes, they were asked to reproduce the drawing from memory. This test is a valid and

reliable measure of short- and long-term visual-spatial integration and recall ability (Taylor, 1969; Wood, Ebert, & Kinsbourne, 1982).

Warrington Facial-Recognition Task (Warrington, 1984).

Subjects were shown fifty photos of faces at the rate of approximately one every three seconds. Subjects were then shown fifty pairs of photos of faces and were asked to identify which one of the pair they had previously seen. This test is a valid and reliable measure of general non-verbal recognition-recall ability (Warrington, 1984).

The tests described above are designed to measure aspects of retrospective memory. Alternatively, the WPMT, which was administered after the Logical Memory subtest of the Wechsler Memory Scale, is designed to measure aspects of prospective memory. The WPMT includes tasks in three different areas. The first group of sub-tasks (CLOCK) require the subject to monitor a clock and carry out a designated action at a specific time. For example, subjects were asked to repeat a specific sentence after a period of five minutes has elapsed. The second group of sub-tasks (COVERT) measure the ability to remember to carry out simple actions when a particular event occurs in the environment. For example, the subject was asked to fill out a questionnaire beginning when the examiner taps a pen on the table three times. The third group of sub-tasks (DETAIL) measure the subjects' ability, once cued, to follow detailed

instructions previously given. For example, subjects were scored on their ability not only to recall a sentence, but also their ability to recall the sentence correctly.

Upon completion of all the tests, subjects were given a brief questionnaire to determine the frequency of certain everyday behaviors that would be expected to require the exercise of prospective memory (e.g., "How often do you miss appointments because you've forgotten about them?"). Administration of the complete test battery described above required 1 1/2 to 2 hours.

RESULTS

Subjects were 69 college students, (50 female, 19 male, age range 18-24). Means, standard deviations and medians for all tests are shown in Table 1.

Scores obtained for the WAIS, WMS, Rey-Osterreith, Warrington Facial Recognition Test, and CVLT are similar to those found by other researchers (Wechsler 1981, 1945; Rey, 1941; Warrington, 1984; Delis et al., 1987). The distributions of all WPMT prospective memory task subscales, (i.e., Covert, Detail, Clock) were negatively skewed and showed a positive kurtosis greater than 1. The mode of all prospective memory subscales was equal to the highest number of possible items correct, suggesting a ceiling effect.

Table 1

Means, Standard Deviations and Medians of Prospective Memory
and Other Measures

Variable	N	Mean	SD	Median
WMS: LOGICAL MEMORY	59	56.2	13.5	60
CVLT				
LIST A TOTAL RECALL TRIALS 1-5	69	65.7	6.9	66
SHORT-DELAY CUED RECALL	68	14.1	2.0	15
SHORT-DELAY FREE RECALL	69	13.9	2.0	14
LONG-DELAY CUED RECALL	69	14.3	1.8	15
LONG-DELAY FREE RECALL	69	14.2	2.0	15
RECOGNITION HITS	69	15.5	.80	16
CVLT: RECALL AND RECOGNITION COMPOSITE	69	0	5.1	1.6
FREE RECALL INTRUSIONS	69	.16	.37	0
CUED RECALL INTRUSIONS	68	.16	.41	0
CVLT: INTRUSIONS COMPOSITE	69	0	1.7	-0.83

(table continues)

Table 1 (cont'd)

Variable	N	Mean	SD	Median
REY-OSTERREITH: RECALL	69	24.85507	5.51275	26
WARRINGTON FACIAL RECOG.	69	43.15942	4.37111	43
WAIS-R: VOCABULARY	64	45.84375	8.20611	46
DIGIT CANCELLATION COMPOSITE	68	-0.0001592	1.89261	-0.13
PROSP. MEMORY QUESTIONNAIRE	69	3.72464	2.79645	3
PMT SUBSCALES				
COVERT	69	7.02899	1.55271	8
DETAIL	69	22.15942	2.33656	23
CLOCK	69	6.50725	2.12564	8
PROSPECTIVE	69	35.69565	4.21239	37
SPATIAL	69	30.85507	5.00375	32
DETAIL	69	22.15942	2.33656	23
NON-PROSPECTIVE	69	40.81159	5.07090	41

The internal reliability of the Prospective Memory subscales was assessed using coefficient alpha. The internal reliability of the Clock, Covert and Detail subscales were .50, .61 and .44, respectively. The internal reliability of the Prospective Memory scale, which consists of all items from these three subscales, was .61. The internal reliability of the self-report questionnaire on prospective memory was .66 as measured by coefficient alpha.

To increase the reliability of measures and decrease the number of variables, several scores were combined into composites before statistical analyses. A factor analysis reported by Delis, Kramer, Kaplan, & Ober (1987) indicated the presence of two common factors in the CVLT, and a factor analysis of data from the present study confirmed this finding. Therefore, two CVLT composite scales were formed by adding together standardized scores for CVLT subscales with loadings greater than .50 on the appropriate factor.

A composite score named "CVLT: Recall and Recognition" was calculated by summing standardized scores on the following CVLT subscales:

- List A Total Recall, Trials 1-5
- Short-Delay Cued Recall
- Short-Delay Free Recall
- Long-Delay Cued Recall
- Long-Delay Free Recall
- Recognition Hits

A composite score name "CVLT: Intrusion" was calculated by summing standardized scores on the following CVLT subscales:

Free Recall Intrusions

Cued Recall Intrusions

Scores on the immediate and delayed portion of the WMS logical memory score were found to correlate .91, and were therefore added together to form a composite WMS logical memory score. Scores for the first and second parts of the two-part digit cancellation test were found to correlate .78, and were therefore added together to form a single Digit Cancellation score.

Correlations were computed among the WPMT subscales, the composite scores just described, and the remaining tests used in the study. Results are shown in Table 2. As can be seen, the Covert subscale of the WPMT correlated significantly with the WMS, CVLT: Recall and Recognition, CVLT: Intrusions, and the Rey-Osterreith. The Detail subscale of the WPMT correlated significantly with the CVLT: Recall and Recognition. The Clock subscale correlated significantly with CVLT: Intrusions. The Total Prospective subscales of the WPMT correlated significantly with the WMS, CVLT: Recall and Recognition, and the Rey-Osterreith.

Table 2

Correlation of Prospective Memory Subscales with Memory Tests and Other Measures

	COVERT	PROSPECTIVE MEMORY TEST SUBSCALES				NONPROS- PECTIVE	
		DETAIL	CLOCK	PROS- PECTIVE	SPATIAL DETAIL		
WMS: LOGICAL MEMORY	.37**	.20	.14	.31*	-.02	.20	.04
CVLT: RECALL AND RECOGNITION	.30*	.36**	.15	.39**	.11	.36**	.14
CVLT: INTRUSIONS	-.26*	-.02	-.26*	-.24	-.05	-.02	-.05
REY-OSTERREITH: RECALL	.37**	.18	.22	.35**	.20	.18	.21
WARRINGTON FACIAL RECOG.	.00	.03	-.15	-.06	-.06	.03	-.05
WAIS-R: VOCABULARY	.08	-.17	.17	.01	.10	-.17	.09
DIGIT CANCELLATION	-.17	-.09	-.11	-.16	.08	-.09	.04
PROSP. MEMORY PROBLEMS	-.16	-.11	-.11	-0.18	.03	-.11	.01

* = $p < .05$; ** = $p < .01$

DISCUSSION

The results of this study have indicated several interesting findings: (1) The WPMT subscales have lower reliability than predicted; (2) There was a tendency for the Prospective subscales to have low, positive correlations with measures of retrospective memory; (3) In the case of the COVERT scale, several significant correlations with retrospective memory were found; and (4) The self-report questionnaire of prospective memory did not correlate significantly with measure of prospective or retrospective memory.

Psychometric Properties of the WPMT. The analysis of the mean, median, and mode of the WPMT prospective memory tasks suggest a ceiling effect. Thus, the tasks are not well-suited to discriminating differences in prospective memory among college age subjects. A possible explanation is that the college student population may generally have high performance on prospective memory tasks and, therefore, not much variability would exist among scores. It is possible that through further research with different populations, (i.e., the elderly), we might expect to find greater variability among subjects as well as differences of prospective memory between populations.

The results of this study suggest that the subscales of the WPMT do not have sufficient internal reliability and, would be unlikely to correlate highly with any other

measures. Consequently, these subscales may not be clinically useful as predictors of prospective memory. It is possible that the internal reliability of the subscales may be improved by increasing the number of items on each scale. With thoughtful expansion and refinement, it is possible that future research with the WPMT may show increased reliability and predictive value in measuring prospective memory and differences in prospective memory among different populations.

Correlations of Prospective Memory. It was hypothesized that there would be no significant correlations between prospective memory subscales and retrospective memory tests. There was a "tendency" for WPMT scores to correlate with retrospective measures, but in most cases the correlations were non-significant. This study did show positive correlations, however, of the Covert subscale of the WPMT with the WMS, CVLT: Recall and Recognition, and the Rey-Osterreith. A possible explanation may be that the ability to recognize a covert cue, (i.e., the ability to recognize something as a symbol for something else) is similar to the ability measured by these retrospective tests -- the ability to learn new verbal material (i.e., recognize words as symbols for something else.) It would also logically follow that a negative correlation would exist with the CVLT: Intrusions, as an intrusion indicates a sort of "malfunction" in memory. The similar correlations of the

Total Prospective subscales may be explained due to the heaviest loading from the Covert subscale. The ability to remember detail may be a salient factor in the CVLT: Recall and Recognition test as one is required to recall several specific items of a list. It would seem reasonable then, that there is a positive correlation between the Detail subscale and the CVLT: Recall and Recognition test.

The Clock subscale of the WPMT measures one's ability to recognize the time shown on the clock as a type of covert cue or symbol. Thus, a "malfunction" in memory (i.e., an intrusion) would correlate negatively with this subscale.

Self-Reported Prospective Memory. The present study did not find significant correlations between WPMT scores on the one hand and the self-report prospective memory questionnaire on the other. This finding may be due to the poor reliability of the WPMT. It is possible that with increased internal reliability of the WPMT, significant results may be found in the future.

APPENDIX A
INFORMED CONSENT

Informed Consent

Name: _____

I hereby consent to participate as a subject in the present study on prospective memory. I understand the following points regarding the study:

- 1) I will spend about 2 years taking memory and mental abilities tests.
- 2) I will be given extra credit in my class for participation in the study.
- 3) The testing will not involve any pain, danger or risk for me.
- 4) Although I now intend to participate in the study in the manner just described, I am free to change my mind later. I can withdraw from the study at any time without violating any agreement or incurring any penalty whatsoever.
- 5) Information I provide and test results are absolutely confidential and will not be released without my written permission.
- 6) If I have any questions regarding the study at any time, I understand I can contact Dr. James Wood at the Psychology Department of the University of North Texas (817) 565-2671.

Signature of subject_____
Date_____
Signature of Experimenter_____
Date

APPENDIX B
SELF-REPORT QUESTIONNAIRE

Subject Name _____
Date _____
Examiner _____

Memory Survey

1. Do you drive a vehicle on a regular basis?
Yes No (Please circle one)

2. If you answered yes to question number one,
 - a. How many times in the past year have you locked your keys in your vehicle?
None One Two Three Four+ (Please circle one)

 - b. How many times in the past year have you had to call a locksmith to get your keys out of your vehicle?
None One Two Three Four+ (Please circle one)

 - c. How many times in the past year have you run out of gas because you forgot to fill the tank?
None One Two Three Four+ (Please circle one)

3. How often do you miss appointments because you've forgotten about them?
Not at all Rarely Sometimes Often Always
(Please circle one)

4. Do people close to you consider you to be absent-minded?
Not at all Rarely Sometimes Often Always
(Please circle one)

5. Do you consider yourself to be absent-minded?
Not at all Rarely Sometimes Often Always
(Please circle one)

6. How many times in the past year have you locked yourself out of your dwelling?

None One Two Three Four+ (Please circle one)

7. How often do you accidentally leave on household appliances?

Not at all Rarely Sometimes Often Always
(Please circle one)

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