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Abstract

Personality as measured by the Myers-Briggs Type Indicator has been shown to change with age. Specifically, older adults become more sensing, while younger adults remain more intuitive on the SN dimension. Memory and the use of mnemonic strategies, or memory aids, changes with age as well. Older adults typically report more problems with their memory, yet use fewer memory strategy aids. If adults learn and use memory aids consistent with intuitive processing in youth. the hypothesized transition to a more sensing modality in old age may cause the use of intuitive strategies to decline. Thus, the finding that older adults may use memory aids less frequently than younger adults may be partially explained in terms of personality type. The present study hypothesizes a mediation model of personality and memory change with age. Preliminary support for a partial mediation model is presented.

Age and Personality Differences in Choice of Mnemonic Strategy

Popular convention predicts a general decline in cognitive function with a more rapid decline in memory functions with age. Research into cognitive aging has generally supported this view that some forms of cognitive functioning and memory do decline (Craik, 1977; Kausler, 1982; Labouvie-Vief, 1985; Perlmutter, 1986; Poon, 1985). However, memory decline is not as extensive or inevitable as folk wisdom may predict. There is a wider variability among older adults in type and extent of change in memory functioning than among younger adults. The researcher's task is to pinpoint specific changes in memory functioning that do occur over the wide range of functioning.

Older adults usually perform more poorly on laboratory test of memory than younger adults. A common explanation for this performance differential is anxiety (Ruisel, 1983; Whitbourne, 1976; Yesavage & Jacob, 1984). Older adults have

been outside the academic testing setting for many years whereas undergraduates (the most common younger age sample) are very familiar with this situation. Older adults may also be disadvantaged by time demands. This combination may crate test anxiety which would detract an older adult from performing to the best of his/her ability. Test anxiety is often included as a post-hoc explanation for differences in performance levels, however it is not frequently examined in the experiment proper. When situational test anxiety is controlled, researchers are better able to examine more permanent changes in memory functioning.

Metamemory, or an individual's knowledge of his/her own memory processes, has demonstrated reliable change with age in previous studies (Hultsch, 1969, 1974; Lovelace & Marsh, 1985). Monitoring one's own memory through self-evaluation, a form of metamemory, has been shown to decline with age. Older adults do not self-test when given the opportunity to study a memory task. Self testing allows an individual to discover the areas where more study is necessary

to perform well on a memory task. This failure to self-test puts older adults at a disadvantage in the testing situation.

Older adults also fail to adopt effective mnemonic strategies to facilitate the recall process. Mnemonic strategies are memory aids used to facilitate recall and recognition. When educated on the uses of such strategies, older adults can effectively employ them; performance on memory tests improves accordingly (Arenberg & Robertson-Tchabo, 1977; Hulika & Grossman, 1967; Murphy, Schmitt, Caruso & Sanders, 1987; Rankin, Karol & Tuten, 1984; Treat & Reese. 1976; Schmitt, Murphy & Sanders, 1981). The ability to use memory aids when educated indicates that the failure to spontaneously adopt them is a production deficiency and not an inability to make use of these strategies. The production deficiency lowers performance levels (Reese, 1976) in testing situations thus could be responsible for the reduction in memory function in everyday living. A complete investigation into the causes of this production deficiency has not been accomplished, however there are several likely mediating variables. This study

proposes to investigate the possibility of personality as a mediating variable.

Several studies suggest and interaction between personality and memory in general (Cavanaugh & Murphy, 1986; Gabrys, 1983; Lezak, 1987; Ruisel, 1983, 1988). Gratzinger, Sheikh, Friedman & Yesavage (1990) could predict memory performance based on personality factors measured by the NEO Personality Inventory. Subjects who rated high on the Openness scale scored significantly higher on measures of face-name recall. Arbuckle, Gold & Andres (1986) concluded that personality, as measured by the Eysenck Personality Inventory, accounted for more variance in tests of memory than was accounted for by age. Specifically, extroversion, neuroticism and lie scores were significantly negative predictors of memory performance in all age groups.

Studies of personality and memory frequently use the Eysenck Personality Inventory, however the Myers-Briggs Type Indicator is a more theoretically appropriate measure for this study. The sensing/intuition dimension of the Myers-

Briggs assesses the preferred method of acquiring and encoding information. The encoding of information should have a direct affect on the recall of this information. Mnemonic strategies facilitate this encoding and recall. The choice of mnemonic strategy to recall or recognize processed information should be affected by an individual's preferred method of encoding that information.

According to Jungian theory, adults become more versatile in the use of skills and strategies of the type opposite of themselves with experience and age (Myers & McCaulley, 1989). Consequently, personality, as measured by the MBTI, should change with age. Cross-sectional studies have produced reliable age differences in types, specifically the sensing and intuitive dimension and the judging and perceiving dimension; older adults tend to be more sensing and judging. The MBTI yields dichotomous type symbols, however, the symbols are merely endpoints along a tension continuum model. Thus two subjects may differ only seven points on the S/N dimension although they receive different type symbols. To ascertain

more subtle and accurate distinctions between younger and older adult groups, continuous scale scores are the more appropriate measure. Discussion on subject types will assume that sensing and intuition are subsections of a continuum rather than dichotomous variables.

Given that adults exhibit changes in memory, mnemonic strategy usage, and personality with age, it is possible that personality could serve as a mediating variable between age and memory through its relationship with encoding and mnemonic strategy use. Adults learn mnemonic strategies while in school, younger adults are usually more intuitive than sensing, thus the strategies employed would fit an intuitive encoding modality. As adults gain experience and begin to focus their energy and resources, changes occur in personality as they become more sensing. The intuitive mnemonic encoding strategies may no longer be effective so they fall into disuse. Thus the relationship between age and memory and age and mnemonic strategy usage may be mediated by personality. A two part mediation model based on the above

stated logic was tested. First, the mediational affects of personality on age and memory was examined. Then mnemonic strategy use was added to create a three step mediational approach: age's affect on memory should be mediated by mnemonic strategy use which, in turn, is mediated by personality.

This mediation model incorporates four a priori hypotheses: 1) younger adults will perform better on tests of memory than older adults, 2) older adults will report using mnemonic strategies less often that younger adults, 3) older adults will be more sensing than intuitive while younger adults will be more intuitive than sensing as measured by the MBTI, and 4) MBTI intuitive and sensing subjects will differ on their choice of mnemonic strategies. The general experimental design is 2x2, age by personality (S/N) type. State and trait anxiety levels were analyzed in an effort to isolate which age differentials in memory performance are attributable to test anxiety so this variable could be statistically varied out if significantly affecting results.

Method

Subjects

Eighty-eight younger (53 female, 35 male, mean age 18.64 (1.64)) and 30 older (21 female, 9 male, mean age 72.14 (4.73)) were recruited to participate in the study. The mean education levels were 12.9 (1.12) years for younger subjects and 16.26 (4.36) years for older subjects. Younger subjects were drawn mainly from the introductory psychology subject pool and received course credit for participating. Older adults were recruited from the community via newspaper and newsletter advertisements. Older subjects received $5 to $10 monetary reimbursement for their participation.

Procedure

Subjects completed six testing instruments, the Myers-Briggs Type Indicator (Myers, 1962), the verbal paired-associates test #1 from the Wechsler Memory Scale (Wechsler, 1987), the State Trait Anxiety Indicator (Spielberger,1983), one of two standardized text recall tasks developed by Dixon, Hultsch & Hertzog (1989), and two inventories of the use of

mnemonic strategy based on the free-recall questions used by Harris (1980) and the questionnaires developed by Intons-Petersen & Fournier (1986). Tests were presented in random order. Testing sessions were run in groups of 2-15, with the paired-associates test administered individually. Sessions lasted from 1 1/2 to 3 hours.

Testing procedures began with the experimenter reading the general instructions and consent form aloud (appendix A). Consent forms were signed and collected before testing began. General instructions included a brief definition and example of each type of mnemonic strategy listed on the inventories. Subjects worked through the test batteries at their own rate, leaving the room for individual testing. Upon completion of the battery, subjects were given a debriefing form to read (appendix B).

Description of Measures

Myers-Briggs Type Indicator. The MBTI Form G was administered. This 126 item forced choice test based on Jungian theory is designed to measure individual differences in

relating to the world (extroversion/introversion), manner of acquiring and encoding information (sensing/intuition), manner of judgment (thinking/feeling), and process of dealing with the outer world (judging/perceiving). Participants were asked to answer the questions according to how they thought they were, not how they would like to be. Answer sheets were scored using templates. Scoring yielded a numerical indication of strength of preference and a companion letter type. The dichotomous letter type and preference score were converted to continuous scale scores with 100 as the median point (ESTJ type scores fall below 100, INFP type scores fall above the 100 point median). Continuous scale scores were used to allow for more subtle discrimination in personality differences than would be available using letter type scores. All subscales are independent of one another. however. SN and JP are often significantly positively correlated (Myers & McCaulley, 1985). For 18-20 year olds, SN and JP correlate r=.37; for adults 60 and over, SN and JP correlate r=.44.

Wechsler Memory Scale Paired-Associates Test #1. WMS standardized instructions were read at the beginning of individual test administration. The test consisted of eight word pairs, 4 easy (e.g. baby-cries) and 4 difficult (e.g. obey-inch) associations. The test word list was read followed by reading the first of each word pairs in turn. Subjects were given an unlimited time to respond to each word pair. If an incorrect response was given, the response was recorded verbatim, otherwise, responses were recorded as correct, or no memory. Accurate responses were reinforced with "correct"; incorrect answers were supplied with the correct pair word before the first word of the subsequent pair in the list was presented. The trial to criterion test was administered at least 3 times with a maximum limit of six administrations. Easy and difficult pairs from trials 1-3 difficult were summed to yield two composite memory scores for analysis.

At the conclusion of the test, subjects were asked to recount any strategies they could identify having used to remember the word pairs and to assess the effectiveness of

these strategies. In addition, the experimenter made notation of any obvious use of strategies, such as verbal rehearsal. These responses will be coded according to the best fitting mnemonic technique title as listed in the Mnemonic Strategy questionnaires. Free response results will not be reported in this manuscript.

State-Trait Anxiety Indicator. The State-Trait Anxiety Indicator, labeled as "Self-Assessment Questionnaire" by publishers, is a double-sided, 40 item test designed to measure both situational and personality trait anxiety factors. Questions on side 1 asked subjects to respond how they felt at this particular moment; questions on side 2 asked subjects how they felt in general. Responses were made on a 4 scale. Summing the responses resulted in composite state and trait anxiety scores. Normal means and standard deviations for state anxiety reported by Spielberger (1983) are 38.76 (11.95) for college women, 36.47 (10.02) for college men, 32.20 (8.67) for working women ages 50-69, and 34.51 (10.34) for working men ages 50-69. Normal means and standard deviations for

trait anxiety scores are 40.40 (10.15) for college women, 38.30 (9.18) for college men, 31.79 (7.78) for working women ages 50-69 and 33.86 (8.86) for working men ages 50-69.

Text Recall Task. Two texts were selected from 25 parallel texts developed by Dixon, Hultsch & Hertzog (1989). The texts all involved older protagonists, having been developed specifically for use in aging research. The text report published by Dixon, Hultsch & Hertzog (1989) included ratings of 10 stories on dimensions such as ease of readability, identification with characters, believability of characters, interest of the stories, and satisfaction with the stories. In an effort to select a text equally engaging to both younger and older adults, mean ratings were summed across dimensions for older and younger adults for each story. Text #4 was chosen because of the small difference between summed mean ratings of older and younger adults and was therefore judged to be an engaging text for both young and older readers. (A table of differences in summed mean ratings appears in appendix C.) It was deemed important to include at least one

text with a female protagonist as Dr. Roger Dixon reports that older women perform better on text recall tasks involving a woman protagonist (personal communication, October 1992). Text #4 involves a female protagonist; text #6, involving a male protagonist was selected upon the recommendation of Dr. Robin West. Text #4 was used as published, however, text #6 was modified slightly to reduce sex bias and racially biased phrasing. These non-structural changes should not affect the validity or reliability of the texts (Dixon, personal communication). Texts as used appear in Appendix D.

One of the two texts was randomly assigned to each subject. Instructions informed the subject to read and study the story for as long as (s)he wished to prepare for recall. Subjects alerted the experimenter after completion of preparation. Texts were collected and subjects were given 1) a blank recall sheet with accompanying instructions to retell the story, and 2) a free-response questionnaire asking what mnemonic strategies had been employed and how effective these strategies had been.

Text recall will be scored according to the propositional analysis system developed by Kintsch (1975, 1978) and adapted by Dixon, Hultsch & Hertzog (1989). Mnemonic strategy usage will be coded according to the definitions and procedures presented for coding free responses to the mnemonic strategy questionnaires. Results from the text recall task and accompanying strategy usage questions will not be reported in this manuscript.

Mnemonic Strategy Inventory - General. Subjects were given a list of 20 mnemonic strategies and accompanying definitions (adapted from Intons-Petersen & Fournier, 1986). Examples of mnemonic strategies include calendar notes, face-name associations, imagery, mental rehearsal and creating rhymes. Subjects were asked to rate each of the 20 strategies for its ease of use, effectiveness, and frequency of use in everyday life across situations (strategy use for specific situations was assessed via the situational strategy questionnaire). Ratings of ease of use were made on a 7 likert scale, effectiveness on a 6 likert scale, and frequency on a 7

likert scale (scale increments appear on general mnemonic form, Appendix E).

Statistical differences in mnemonic strategy use have been assessed using several methods. Results have been computed summing across strategy yielding composite scores for ease of use, effectiveness and frequency of use of mnemonic strategies in general. Strategies have been coded as either internal or external (involving memory strategies within the mind, such as imagery, or using aids external to the mind, such as timers, reminder notes). Preliminary correlations and regression statistics are reported for strategy use, memory, age and personality type.

Mnemonic Strategy Inventory - Situational. The twenty mnemonic strategies and definitions presented in the general mnemonic inventory are presented with 30 situational scenarios posing a memory task (adapted and expanded from Intons-Petersen & Fournier, 1986; Harris, 1980). Scenarios as used appear in Appendix F. Subjects were instructed to respond to each of the 30 scenarios with the mnemonic

strategy they would employ if confronted with that specific memory task. If definitions provided did not fit the strategy subjects would employ, subjects were instructed to briefly define their strategy or to write "none" if no strategy would be used. The scenarios were followed by the free response question, "Please describe the situation in which you have the most difficulty with your memory."

Responses not utilizing provided titles of mnemonic strategies were coded by two trained raters according to the mnemonic title definitions. "Other" was used for responses that could not be fit into the coding scheme. Disagreements in coding between two raters were resolved by a third rating. Scores for strategy use consist of the frequency with which each specific strategy was listed throughout the scenario questionnaire. If two strategies were listed for one scenario, each was counted.

Analyses for scenarios will include: whether "none" appears in greater frequency for older subject than it does for young, whether strategies listed are significantly different for

older and younger subjects and for sensing and intuitive subjects. Results from the scenario questionnaires will not be reported in this manuscript.

Results

Preliminary correlations and mean differences are reported for 4 of the testing instruments: Myers-Briggs, WMS, STAI and Strategy Use - General Questionnaire. Significant correlations among personality, memory and age are the foundation for regression analyses which assess the fit of the mediation model. Strategy usage is added into regression analyses to expand the test of fit of the mediation model.

Insert table 1 about here

Differences in education levels (mean young 12.9 (1.12) years; old 16.26 (4.36) years) did not significantly contribute to variance accounted for in tests of regression therefore

education was omitted as a variable. Similarly, sex differences were not significant contributors to variance accounted for in tests of age, memory and personality. Consequently, sex was consequently omitted as a variable. Means of primary variables appear in Table 1.

Insert Table 2 about here

Myers-Briggs Type Indicator

Means for the entire sample were EI 103, SN 102, TF 105, and JP 97, indicating that the sample was within an average range (100 is the median) on all four measures of personality. The hypothesis that older adults would be more sensing (comparison scores below 100) than younger adults was supported by a $r=-.31$, $p<=.01$ correlation of MBTISN and age (means young 107.68 (26.03), old 86.87 (32.60)).

Wechsler Memory Scale - Paired Associates Task

It was predicted that older adults would perform more poorly on WMS tests of memory, resulting in lower mean scores of correctly recalled word pairs. This hypothesis was confirmed by correlations of $r=-.28$, $p<=.01$ for easy word pairs and $r=-.46$, $p<=.01$ for difficult word pairs with age (means: young 11.53 (0.89), 8.93 (2.57); old 10.83 (1.34), 5.71 (2.79), easy and difficult respectively).

Recall of the difficult associations was significantly correlated with both the SN and JP dimensions of the MBTI, $r=.28$, $p<=.01$; $r=.27$, $p<=.01$ respectively. Correlations of memory performance with EI and TF dimensions were insignificant (Table 2), providing indirect support for the theoretical hypothesis that SN should relate to encoding therefore relate to memory performance.

State-Trait Anxiety Indicator

Previous research has indicated that older adults are more anxious taking tests than younger adults; however, the older adults were significantly less anxious than younger adults

on both situational (state) and trait anxiety, r=-.25, p<=.01 state; r=-.21, p<=.05 trait. However, anxiety, either state or trait, did not account for significant amounts of variance when entered into the regression equations testing the mediation model. Anxiety was omitted as a variable in further analyses.

Mnemonic Strategy Questionnaire - General

Summing across strategies. Older adults found mnemonic strategies more difficult to use, less effective and used strategies less frequently than younger adults, r=-.34, p<=.01; r=-.46, p<=.01; r=-.35, p<=.01 for ease of use, effectiveness and frequency of use scales respectively (refer to Table 1 for mean values). The hypothesis that older adults would use mnemonic strategies less often than younger adults was supported.

Ease of use, effectiveness and frequency of use for mnemonic strategies in general differed as a function of personality type. Individuals testing as more intuitive, more feeling and more perceptive reported higher efficacy and use levels and reported using mnemonic techniques more frequently(refer to table 2 for r values).

Frequency of use of internal vs. external mnemonic techniques. The frequency of use of both internal and external mnemonic techniques are significantly higher for younger adults than for older adults, r=.32, p<=.01 internal; r=.33, p<=.01 external. The frequency of use of internal mnemonic devices is positively correlated with intuition (SN), feeling (TF) and perceiving (JP), r=.34, p<=.01; r=.36, p<=.01; r=.25, p<=.01 respectively. Use of external mnemonic techniques is also positively correlated with feeling, r=.33, p<=.01. This corroborates the results that feeling individuals use mnemonic techniques more in general (frequency of use: r=.41, p<=.01).

Insert Table 3 about here

Analysis of specific mnemonic strategy use by personality and age. Sixteen of twenty strategies were significantly correlated with age or personality. EI variables were excluded from analysis because preliminary correlations with ease of use, effectiveness or frequency of use were not

significant. Alphabetic searching, insight, special placement and verbal rehearsal were not significantly correlated with SN, TF or JP. Ten strategies were significantly correlated with both personality type and age: asking someone else to remind you, calendar notes, face-name association, imagery, mental rehearsal, rhymes, social memory, story creation, tie to life events and writing on hand. Imagery was most significantly correlated with personality and age; highest ease of use, effectiveness and frequency of use scores correlated with both younger subjects and intuitive, feeling and perceiving subjects (refer to table 3 for r values and significance levels).

Mediation Model Testing via Regression Analyses

In order to postulate a mediation model among age, personality and memory, all three variables must correlate significantly with one another. The sensing/intuition dimension of the Myers-Briggs (MBTISN) will be focused on first, over other measures of memory, because of the theoretical validity of the relationship with age and memory. Memory will be measured as summed performance on the

more difficult pairs of the Wechsler Memory Scale because the difficult pairs yield stronger correlations with other primary variables. The preliminary criteria for the mediation model have been met: Age to MBTISN r=-.31, p<=.01; Age to WMSD r=-.51, p<=.01; MBTISN to WMSD r=.30, p<=.01.

Forced entry hierarchical regression analyses were conducted entering personality type then age with memory as the dependent measure. The SN dimension of the MBTI yielded an r^2 = .08, p<=.0012 (pr=.30, T=3.31, p<=.0012), indicating that differences in sensing and intuition accounted for 8 percent of the variance in memory. Entering age yielded an r^2 = .19, p<=.0001. Partial correlation coefficients when both variables are entered are pr=.15, T=1.8, p<=.07 for SN, and pr=-.44, T=-5.53, p<=.0001 for age, indicating that age is the most significant predictor of memory performance. If personality completely mediated differences in memory performance due to age, the r^2 for age would have equaled zero. The high significance of age when personality is accounted for indicates

that differences in the SN dimension of the Myers-Briggs do not contribute significantly to the variance in memory performance separate from the age dimension; however, SN does approach significance in the expected direction.

The JP dimension of personality type also met the criteria for postulating a mediation model: Age to MBTIJP r=-.51, p<=.01; Age to WMSD r=-.51, p<=.01; MBTIJP to WMSD r=.29, p<=.01. Although there was no theoretically based prediction for the relationship among judging and perceiving personality differences, age and memory performance, forced entry hierarchical regression analyses were completed to rule out differences in JP as a contributing factor to the relationship between memory and age. Entering JP continuous scores yielded r^2=.08, p<=.0016 (pr=.29, T=3.23, p<=.0016); entering age yielded an r^2=.18, p<=.0001. Age was, once again, the most significant contributor to memory performance variance. Differences in JP significantly accounted for variance in memory performance until age was entered into the equation.

Resulting partial correlation coefficients were pr=.03, T=.40, p<=.69 for JP and pr=.-44, T=-5.23, p<=.0001 for age, indicating that age differences in JP are most likely responsible for its correlations with memory performance correlations (p<=.69).

Although prediction of the mediation model was not significantly proven, as age differences subsumed a large part of the variance in memory performance attributed to personality, SN differences did approach significance in the expected direction. Hierarchical regressions were run including mnemonic strategy usage (summed values for ease of use, effectiveness and frequency of use), personality, age and memory performance to evaluate any apparent trends for future research pursuit. Similar criteria must be met for the postulation of a four part mediation model, which were met by two of the three measures of mnemonic strategy usage (refer to table 2 for criterion correlation levels). Criteria were not all met for Ease of Use regression, as correlations between ease of use and memory and ease of use and personality were not significant.

Forced entry hierarchical regressions were run for ease of use, personality (MBTISN), and age with memory as the dependent variable, and again for effectiveness and frequency of use of mnemonic techniques. Entering ease of use first yielded an r^2=.03, p<=.07 (pr=.17, T=1.84, p<=.07); personality r^2=.05, p<=.02 (ease use pr=.15, T=1.59, p<=.11; personality pr=.23, T=2.46, p<=.02); and age r^2=.14, p<=.0001 (ease use pr=.02, T=.24, p<=.81; personality pr=.15, T=1.54, p<=.13; age pr=-.39, T=-4.37, p<=.0001). This indicates that differences in reported ease of use of mnemonic strategies do not significantly account for variance in memory performance separately from those differences in ease of use attributable to age. Null results are not surprising considering all preliminary criteria were not met with this model.

Regression analysis of effectiveness yielded similar results: effectiveness r^2=.07, p<=.0065 (pr=.26, T=2.78, p<=.0065); personality r^2=.04, p<=.04 (effectiveness pr=.22,

T=2.31, p<=.03; personality pr=.20, T=2.06, p<=.04); and age r^2=.13, p<=.0001 (effectiveness pr=.05, T=.50, p<=.62; personality pr=.15, T=1.55, p<=.12; age pr=-.34, T=-4.04, p<=.0001). Correlations in reported effectiveness of mnemonic strategies and memory performance are likewise mainly attributable to age.

Regression of frequency of use, personality and age are slightly more promising: frequency r^2=.11, p<=.0003 (pr=.33, T=3.78, p<=.0003); personality r^2=.04, p<=.03 (frequency pr=.26, T=2.90, p<=.0045; personality pr=.19, T=2.18, p<=.03); and age r^2=.13, p<=.0001 (frequency pr=.13, T=1.62, p<=.11; personality pr=.12, T=1.46, p<=.15; age pr=-.36, T=-4.49, p<-=.0025). Although frequency of use of mnemonic techniques was not a significant predictor of memory performance separate from the variance accounted for by personality and age, it did approach trend significance (trends p<=.10).

Discussion

All preliminary hypotheses were supported by the data set. Younger adults performed better on tests of memory than older adults. Older adults reported using mnemonic strategies less often than younger adults. Older adults were more sensing than intuitive while younger adults were more intuitive than sensing, as measured by the Myers-Briggs Type Indicator. MBTI sensing and intuitive subjects differed on their choice of mnemonic strategy as indicated by correlations among ease of use, effectiveness and frequency of use of mnemonic strategies in general, specific mnemonic strategies and MBTI personality type.

Anxiety performed contrary to predicted hypotheses. Although anxiety differences between younger and older groups were not significant predictors of memory performance variance in the regression equations, the findings themselves are of interest. The test sample of older adults is less anxious when compared to mean standardization scores published by Spielberger (1983). College student means appear to be within

normal ranges. These results could be attributed to two factors. First, that the sample of older adults volunteering to participate in this study are self-confident enough not to be affected by situational test anxiety variables. Second, that the small group testing format with a lack of emphasis on timed performance successfully alleviated an situational anxiety. LeRue and D'Elia (1985) and West, Boatwright and Schleser (1984) have indicated that older adults may not be disadvantaged by anxiety variables, thus results of this study do corroborate previous research, although not in the expected direction. Regardless of the reason for the unexpected direction of results, the lack of significant influence on memory performance indicates that testing measures recorded a relatively undiluted measure of memory performance, lending validity to results.

Although the mediation model of memory performance, age and personality was not supported, trends in the expected directions support a possible partial mediation model, in which personality differences may account for some, but not all, of

the variance in memory performance as a function of age. Both SN and JP personality dimensions met the criteria for positing a mediation model, however only the theoretically backed SN dimension approached significance. SN and JP are often correlated in samples, however, this correlation does not appear to be maintained where memory differences are concerned. The resulting "anti-correlation" for JP, memory and age suggests: 1) that JP differences in memory are more a function of JP differences in age than of unique personality/memory differences per se, and 2) that the theoretical rational for SN's relationship to memory and age was supported in part by these anticorrelations.

Memory, and cognitive functioning in general, is complex and affected by a multitude of variable from experiential to biological, therefore it is improbable to expect a complete mediation of age related memory performance differences by personality type. A partial mediational model may be much more accurate in describing the relationship among the proposed variables. The results as presently analyzed do

provide some support for a partial mediation by the trend significance of personality differences in memory performance when age differences are accounted for. The more complete mediation model including mnemonic strategy use may also fit the partial mediation model, as indicated by the trend significance of frequency of use of mnemonic strategies with personality and age variables accounted for. Several additions to the study could possibly increase the significance levels of these variables in regression analysis.

1. Sub-sample sizes of age groups were unbalanced, with the older subject group less than half the size of the larger group. Increasing the number of older adult subject participants may increase the power of the experiment enough increase significance levels of age differences.

2. Analysis of situational mnemonic strategy questionnaires may yield more information on age and personality differences in the use of mnemonic strategies. The two questionnaires were designed to go in tandem, one

assessing general and one assessing specific uses for mnemonic techniques.

3. Analysis of the strategies used to recall the word pairs in the Wechsler Memory Scale test and those used in the textual recall task (in comparison to textual recall scores) may allow for a more specific examination of the relationship of memory and mnemonic strategy variables.

While results were not as strong as desirable for significant support of a mediation model, results are not insignificant either. Much of the extensive data set remains to be analyzed. Further analysis may illuminate differences yet uncovered, or may pinpoint the lack of mediational relationship more strongly. Ruling out personality as a variable in changes in memory and aging would not be prudent at this juncture.

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Appendix A

Personality, Memory and Aging Project
General Instructions

Thank you for donating your time to participate in this experiment. The packet you have been given contains 6 tests, a consent form, and a background information sheet in random order. For one test, you will be asked to go to a separate room to participate in individual testing, then to return to this room to complete the test battery. Directions to the location of individual testing are included in your packet. Each test, the consent form and the information sheet contains a subject identification number that will be used instead of your name to protect your anonymity. The consent form and information sheet, which do ask for your name, will be separated from the testing materials and stored in a separate place. All responses to materials in this packet will be held in confidence and used for research purposes only.

You have certain rights as a subject of approved ethical research. Please remove the consent form from behind this instruction sheet. This form will be read aloud and all questions answered to ensure that all participants clearly understand their rights. If you wish to participate in this experiment, please sign the consent form and present it to the experimenter for collection at this time.

Please complete the following battery of tests at your own rate. The order of tests you have is different from that of your neighbors, therefore you should not feel pressured if someone near you is turning pages faster or slower than you are. He or she is probably working on a different test. If you need to get up at any time during the test session, please close all test materials in the folder provided. Please feel free to stretch or take a short break as necessary (between individual tests). The mens' restroom is on the main floor to the right as you enter the building. The womens' restroom is on the second floor to the right. Water is available at the front of the room for your convenience. Sharp pencils are available from the experimenter.

Please ask any questions you may have at this time. If a question arises during the testing session, please quietly ask the experimenter.

You may begin work at any time.

Alphabetic Searching: e.g., the name starts with "S"
Asking someone else to remind you
Association with familiar concept: Linking a new concept with one you already know
Calendar notes
Face-name associations: Identifying a person's distinctive feature and connecting the name with that feature. Example: one man participating in the study shared a mnemonic whereby he remembered a man's name, "Jersey" through association with a cow, since the man was large.
Imagery: Connecting concepts through mental pictures. Example: When you can picture the words on a page.
Insight: Expecting the idea to "pop-up", clearing your mind
Mental rehearsing: Silently repeating information to yourself
Mental retracing: Thinking about an event that happened before, step by step, in an attempt to remember the event. Such as trying to find where you last had your keys.
Photographs: Using photos to remind you of something
Putting something in a special place. Example: I put my notebooks out the night before so I remember to bring them to class in the morning.
Priming: Remembering concepts that are similar to what you need to remember, for example, "It's a Scotch name but not McLean."
Reminder notes
Rhymes Example: Thirty days hath September . . .
Social memory: Reconstructing an event with the help of others
Story method: Linking items or memories together by telling a story about them, or by making sentences out of them. Example, King George Came Over for Phil's Special, for Kingdom Genus Class Order etc.
Tie to other life events: e.g., right before lunch
Timer: Using a timer, alarm clock or other electrical device
Verbal rehearsing: Repeating information out loud
Writing on hand

Appendix B

Thank you for participating in this experiment. The purpose of this study is to explore the relationships among personality, memory strategy choice, and age. Memory often declines as adults mature. Part of this decline has been attributed to the decreased use of memory aids, although there is little empirical data to explain why this decrease occurs.

This study hypothesizes that the decline in memory aid use with age can be partially attributed to personality. According to one theory, people vary in the manner in which they acquire and assimilate/encode information along a continuum from sensing to intuitive. Previous research indicates that young adults, especially college students, are more intuitive while older adults are more sensing. This variability is measured on one of the questionnaires you just completed, the Myers-Briggs Type Indicator.

If encoding preferences or styles as measured by the MBTI change with age, then the memory aids associated with these styles should change as well. Strategies learned as a young intuitive adult may not be effective within a sensing modality. These ineffective strategies would fall into disuse. If this is true, it may be beneficial to teach older adults memory aids consistent with a sensing modality. These more effective enhancement strategies would be used and may ameliorate some of the decline in memory some older adults experience. Teaching persons to adopt any behavior, including memory aid use, is demanding of time and resources. Thus, before such an investment of resources is made, the relationships among personality, memory aid choice, and age should be established.

The battery of tests you completed also included three tests of memory. The verbal (paired-associates) recall and the text recall task will be used to assess any between group differences in memory between young and older adults. It is important to know the different memory levels of subjects so that any significant differences found between groups can be attributed to the most compelling potential source of those differences. For example, each group may differ with respect to memory strategy use but be equivalent with respect to memory ability. Thus the use of memory aids would not correlate with memory ability and there should not be an investment of additional resources in this line of research.

The battery also included the Self-Assessment Questionnaire which measures situational and trait forms of anxiety. Older adults are often said to experience increased anxiety in a testing situation. This statement is often made by researchers in an attempt to explain why performance levels differ among age groups but it is rarely tested. Having this additional information on situational anxiety will aid the explanation of any between-group differences we obtain.

Please do not discuss the hypotheses of this study with others. Once again, thank you for your time.

Appendix C

Mean Differences in Young and Older Adult Rating of Texts

Text #	Sum(Old-Young)
3	3.54
4	2.43
5	3.17
6	3.51
13	5.29
14	2.30
20	3.65
21	5.84
23	3.51
25	3.24

Appendix D

Text #6 A Vacation

Harry was excited about his first visit to the Grand Canyon. His son, Gerald, and his daughter-in-law, Sally, had invited him to come along on their vacation. His energetic five-year-old grand-daughter, Susan, was also there. On their first day Gerald and Susan rode mules down to the river at the bottom. Harry spent part of the day talking with a tour group of senior citizens from Phoenix. Then he went with several of them on a short hike. The next day he and his family had a picnic near a ranger station. The weather each day was beautiful, with warm temperatures and very dry air. Everyone is glad they waited until September to take their vacation. Summer in Arizona is too hot and the crowds at the Grand Canyon are too thick. Their drive from Topeka, Kansas, was cool and comfortable. The first night they stayed in Garden City, Kansas, where Harry's younger brother lives. The next night they stayed at a motel in Gallup, New Mexico. On the third day they drove through the beautiful Petrified Forest National Park. Susan was enchanted by the Native American Indians in real native costume. They arrived at the Southern Rim of the Grand Canyon in the late afternoon. Harry couldn't wait to see what this marvel of nature looked like up close. He

wasn't disappointed. He was dazzled by the depth and breadth of the canyon. His eyes moved from the raging Colorado river below, which looked like a trickle, to the distant northern rim. He had wanted to see this sight since his boyhood days in Topeka. On family vacations he had seen the Colorado Rockies several times and the California coastline once. But his late wife, Bea, was too sensitive to heat to come to Arizona. Before he retired, his two-week vacation was always in July.

Text #4 A Change in Life

Velma has mixed emotions about her husband's upcoming retirement. She has been married to Joe for 44 years. He has always been a good husband and provider. Every day, Joe, who is an accountant, has gone to work and left her alone to pursue her own interests. She loves to bake, to read, to make quilts, and to work with ceramics. She thinks it would be wonderful to spend more time with Joe. But she wonders whether she will still have time to devote to her hobbies. She hopes that in their twilight years they can travel or develop some interests together. For example, she would love to drive to the west coast. She has never been to California, Oregon or Washington, and has heard so much about the Oregon coastline, Yosemite National Park, and Disneyland. But Joe does not seem very interested. He always says there are plenty of lakes and

forests in Wisconsin. Still, she hopes to convince him to take a long vacation. Joe's hobbies are very quiet ones and never require him to drive any further than Madison. One of Joe's passions is watching major league baseball on TV. His favorite team is the Chicago Cubs. Also, since he was a boy he has collected baseball cards. Velma does not want to spend their retirement watching baseball games or filing his baseball cards. She needs peace and quiet for her hobbies. She suggested to Joe that they both take up oil painting or watercolors. There are inexpensive classes at a local senior citizen center. It would be fun to have a hobby that they could learn and pursue together. They could also go swimming at the center, or play shuffleboard or miniature golf. It would be a shame to waste the years for which they have been waiting for so long.

Ease of Use:
EH - Extremely Hard
MH - Moderately Hard
SH - Somewhat Hard
SS - So So
SE - Somewhat Easy
ME - Moderately Easy
EE - Extremely Easy

Effectiveness:
0 - Never
2 - 20%
4 - 40%
6 - 60%
8 - 80%
10 - 100%

Frequency of Use Scale:
1 - Never
2 - About once a year
3 - Once every few months
4 - Once a month
5 - Once or twice a week
6 - About once a day
7 - More than once a day

Strategy Title	Ease of Use	Effective	Frequency
Alphabetic Eg. the name starts with "S"			
Asking Someone			
Association linking with a familiar concept			
Calendar Notes			
Face/Name linking feature with name			
Imagery using mental picures to conect ideas			
Insight expecting ideas to "pop-up"			
Mental Rehearsal			
Mental Retracing remembering step by step			
Photographs			
Placement putting object in special place			
Priming remembering similar concepts			
Reminder Notes			
Rhymes			
Social Memory reconstructing event w/others			
Story Method linking items thru sentences			
Tie to Event eg. right before lunch			
Timer			
Verbal Rehearsal			
Write on Hand			

Appendix F

_____ You have just stepped into a phone booth and have called a long distance operator for a new phone number you need. How do you remember this number long enough to dial it correctly?

_____ You are sitting around having a conversation with a few friends. You realize you want to bring up certain points you thought of a while ago. How do you remember the points?

_____ You and others bump into a few old friends of yours. You begin to introduce your old friends but find you are having trouble remembering their names. How do you remember?

_____ You are at a party and are introduced to some new people. You want to be able to remember their names so you can talk to them later. What will you do to be sure you can recall their names?

_____ You are sitting around with a bunch of friends and everyone is telling jokes. You remember a couple you heard a few days ago and want to retell them. How do you remember the jokes?

_____ You are at the grocery store to pick up a few items you noticed you needed when looking in your cupboards earlier. How do you remember what you need?

_____ You are half-way through your day's activities when you realize you are supposed to meet a friend later, but you don't remember the time. How do you recall this?

_____ You are driving to some unfamiliar place. You looked at a map the day before but left it at home. What would you do to try and remember where to go?

_____ You are on your way out the door and realize you need to bring something with you that you put somewhere last week. How do you remember where it was?

_____ You meet someone at a party, and later a friend mentions that person's name to you. You remember the name, but can't seem to remember where you met the person. What would you do to try to remember where you met the person?

_____ You and some friends are seated at a table in a fancy restaurant. The waitress comes to the table and introduces herself. How can you be sure to remember her name when you need her later?

_____ You have just made an appointment to see your doctor next week. How do you remember to keep this appointment?

_____ You took some visiting relatives to an amusement park. You came out a different gate than you entered and can't remember where the car is parked. How do you remember?

How would you remember:

_____ a friend's birthday

_____ an appointment with the doctor next week

_____ to take medicine three times a day

_____ where you have put something

_____ an appointment later in the day

_____ the names of persons you meet for the first time

_____ the faces of persons you meet for the first time

_____ to buy some bread

_____ a party one month away

_____ new address of a friend who has moved

_____ phone number

_____ the meaning of a word you have learned for the first time

******

_____ You have been asked to recite a poem/give a speech (without notes). How will you remember the material when the occasion comes?

_____ You will be attending a discussion on a book and want to remember key points. How do you do this?

_____ You accompanied a friend to lunch, enjoyed the restaurant and want to attend again. How do you remember the name of the restaurant and how to get there?

_____ You have just learned some exciting news and want to be sure to tell all of your friends, but you cannot immediately remember who you have told and who you haven't. How do you remember?

_____ The faucet in your kitchen leaks. You bought a new faucet piece and the salesperson explained how to install it. Now that you are home and installing the faucet, how do you remember the instructions?

_____ You are in a store buying Christmas gifts for relatives but have left the list of names and sizes at home. How do you remember which relative takes what size?

_____ How do you remember the specific location of the list?

How would you remember:

_____ to return a book by the due date

_____ to pick up a garment from the dry cleaners (later in day, or next week)

_____ where you met your new friend Pat

_____ key points you have learned about a person you just met

_____ to watch a TV program that sounds interesting

_____ to give a message to roommate/spouse when no paper is handy

_____ the altered time of a regularly scheduled meeting

_____ to visit a sick friend

_____ words to a song

_____ to fold clothes in the dryer before they wrinkle

_____ to return videos on time

_____ to return a call received on an answering machine

_____ a skill you performed regularly in the past but are no longer in practice

_____ a card game you learned 6 months ago but have not played since

_____ to treat a stain before washing the garment

_____ to change your clocks for Daylight Savings Time

_____ to transfer money between accounts

_____ the birthday/anniversary of a semi-distant relative

_____ whether it was your niece or nephew who hates broccoli

_____ the title of a familiar song you are listening to

_____ the name of an interesting book a friend has told you about

_____ a story you read in the paper this morning and want to tell a friend about

_____ what you needed once you reach the kitchen

In the space below, please describe the most frequently occurring situation in which you have difficulty with your memory.

Table 1

Discriptive Means and Standard Deviations

	Young			Old		
	Male	Female	Total	Male	Female	Total
Myers-Briggs						
EI	109.69 (27.98)	97.53 (24.80)	102.36 (26.64)	119.00 (24.49)	99.57 (25.76)	105.40 (26.56)
SN	109.17 (28.67)	106.70 (24.35)	107.68 (26.03)	69.22 (37.97)	94.43 (27.65)	86.87 (32.60)
TF	97.29 (23.47)	116.36 (20.55)	108.77 (23.57)	76.78 (18.69)	102.81 (24.53)	95.00 (25.66)
JP	115.57 (29.40)	101.15 (27.84)	106.89 (29.18	65.89 (17.41)	72.52 (17.97)	70.53 (17.77)
WMS						
Easy	11.41 (1.02)	11.54 (0.85)	11.53 (0.89)	10.44 (1.51)	11.14 (1.11)	10.83 (1.34)
Difficult	8.74 (2.38	8.98 (2.71)	8.93 (2.57)	6.00 (2.96)	5.10 (2.64)	5.71 (2.79)
STAI						
State	38.74 (2.39)	37.26 (1.37)	38.49 (11.44)	26.78 (2.64)	30.48 (2.34)	30.75 (10.69)
Trait	39.55 (2.00)	43.02 (1.42)	41.56 (10.63)	32.11 (4.45)	34.24 (2.26)	36.17 (10.96)
Strategies						
Ease of Use	5.12 (0.54)	5.34 (0.56)	5.24 (0.55)	4.59 (0.87)	4.83 (0.48)	4.76 (0.61)
Effectiveness	4.30 (0.43)	4.38 (0.41)	4.36 (0.42)	3.59 (0.81)	3.88 (0.46)	3.79 (0.59)
Frequency	4.46 (0.51)	4.73 (0.64)	4.65 (0.61)	4.02 (0.79)	4.15 (0.55)	4.11 (0.61)
Internal	4.35 (0.56)	4.53 (0.76)	4.46 (0.69)	3.78 (0.93)	3.99 (0.52)	3.92 (0.67)
External	4.64 (0.69)	5.09 (0.68)	4.91 (0.71)	4.21 (0.57)	4.41 (0.78)	4.34 (0.71)

Table 2

Correlations of Primary Variables

	Age	EI	SN	TF	JP	WMSE	WMSD	Ease	Effect	Freq	Int	Ext	Stais	Stait
Age	1.00	.05	-.31**	-.24**	-.51**	-.23**	-.51**	-.34**	-.45**	-.37**	-.32**	-.33**	-.32**	-.32**
EI		1.00	-.09	-.30**	-.03	.06	.08	-.06	-.10	-.11	-.07	-.13	.02	.15
SN			1.00	.36**	.51**	.07	.30**	.11	.20*	.31**	.34**	.18	.01	.14
TF				1.00	.20*	-.06	-.01	.18	.20*	.41**	.36**	.33**	.13	.23*
JP					1.00	.13	.29**	.12	.14	.25**	.25**	.12	.06	.03
WMSE						1.00	.45**	.22*	.17	.06	.06	.04	-.08	-.00
WMSD							1.00	.17	.26**	.33**	.29**	.33**	.16	.24*
Ease of Use								1.00	.74**	.47**	.44**	.39**	.11	.21*
Effectiveness									1.00	.62**	.56**	.52**	.22*	.25**
Frequency										1.00	.93**	.79**	.25**	.41**
Frequency - Internal											1.00	.53**	.28**	.43**
Frequency - External												1.00	.13	.28**
Anxiety - State													1.00	.75**
Anxiety - Trait														1.00

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

Table 3

Significant Correlations of Specific Mnemonic Strategy with Age and Personality

	Ease of Use				Effectiveness				Frequency			
Strategy	SN	TF	JP	Age	SN	TF	JP	Age	SN	TF	JP	Age
Asking Someone				-.28						.26	.25	-.32
Association								-.21				
Calendar Notes			-.21				-.19				-.28	.19
Face Name		-.30	. 26	-.32		.19		-.35		.25	.18	-.28
Imagery	.25	.26	.26	-.30	.30	.24	.28	-.32	.34	.27	.27	-.26
Mental Rehearsal				-.23	.27			-.34	.26	.22		-.24
Mental Retracing									.24		.21	
Photographs								-.21				
Priming					.19					.19		
Reminder Notes											-.19	
Rhymes				-.36			.20	-.46	.19		.18	-.40
Social Memory				-.20		.21		-.28		.28	.32	-.26
Story		.22		-.27				-.32	.26	.30	.19	-.26
Tie to Event				-.18		.22			.32	.24		
Timer												-.20
Write on Hand		.19	.27	-.52			.34	-.64	.19	.27	.41	-.55

r=.18-.23, p=.05
r=.24 + p=.01