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Gilewski, M. J., & Schaie, K. W. Short-term longitudinal changes in memory, intelligence and perceived competence in older adults.

Much of the research on intelligence and aging has relied on tests originally constructed for younger adults. Two problems exist because of this reliance, one relating to the measuring instrument and one to the external criteria used to validate the construct. Schaie and his colleagues have developed a battery of tests created primarily for older adults. Schaie (1978) has also favored competence over intelligence as a means of validating mental abilities in older adults. The purpose of the present study was to investigate short-term longitudinal change in memory and intelligence tests created expressly for older adults, and to relate these changes to change in perceived competence in everyday situations.

Since most tests used in previous studies of intelligence and aging, such as Thurstone and Thurstone's (1948) Primary Mental Abilities (PMA) battery, have been developed for adolescents or young adults, the tests incorporate many factors that are impediments to optimal performance in the elderly: small print, computerized answer sheets, and meaningless test items, to name a few. Schaie (manual in preparation) developed the Adult Mental Abilities (AMA) expressly for older adults. The AMA is similar in content to the PMA with alterations in format to minimize impediments to test-taking in the elderly: large type, improved layout of the test, elimination of computerized answer sheets, and alternate forms containing meaningful test items.

A second difficulty stemming from previous reliance on tests developed for younger adults is the nature of criterion. The major external criterion providing validity for the construct of intelligence is the strong relationship between performance on intelligence tests and academic performance. For most

older adults, formal education is no longer an issue in their lives. Even many who are in school are there for enrichment rather than achievement toward some other goal. For this reason Schaie (1978) argued for competence, or the application of intelligence in life situations, as a more appropriate criterion for mental ability in older adults. Scheidt and Schaie (1978) have also developed a Q-sort of 80 situations as a means of measuring perceived competence in everyday situations.

Schaie, Gonda and Quaynagen (1981) have already established a definite relationship between several AMA subtests and scores from the Scheidt and Schaie (1978) Q-sort. The present study goes a step beyond, examining longitudinal change in the AMA-competence relationship. The study will also examine reliability of the AMA and Q-sort over time. We have added a set of memory variables to the analyses for two reasons. First, no longitudinal study of memory exists in the field of aging. Second, the nature of the relationship between memory and perceived competence may shed further light on the appropriateness of competence as a criterion for abilities in older adults. Memory, for instance, may predict competence in certain situations better than intelligence would predict it.

## Method

Participants were members of a prepaid health plan in Southern California. The total sample of 227 was composed of three age groups: 1) middle-aged (MA) (ages 55-64) consisting of 41 men and 33 women, 2) young-old (YO) (ages 65-74) with 38 men and 57 women, and 3) old-old (OO) (ages 75-84) having 26 men and 32 women. Age groups were determined at the first time of measurement, and all subjects returned for a second testing three years later. Subjects volunteered for the first testing, but were offered $12.00 to offset expenses for the second phase of the study. Subjects were of moderate socioeconomic status and of good

health. Age differences obtained for education (Means: MA = 14.1, YO = 12.8, OO = 11.6), but no other demographic variable.

Subjects took a battery of memory and intelligence tests, filled out several questionnaires about lifestyle and background information, and completed a Q-sort of life situations in a three-hour session. Memory tests consisted of immediate (IR) and delayed (DR) free recall of a 20-item word list, delayed recognition (DRG) of these same 20 words embedded among 10 synonym distractors and 10 unrelated words, and free paragraph recall (PR) of a 227-word essay entitled "Parakeets: Ideal Pets" (Meyer, 1975).

Intelligence measures were all subtests of Schaie's AMA. Recognition Vocabulary (RV) was a 50-item multiple-choice vocabulary test. Figure Rotation (FR) is a test of spatial ability requiring the subject to differntiate rotated figures from rotated mirror-images of the target figure. Object Rotation (OR) replaced the abstract figures of FR with concrete objects such as a dog and telephone. Letter Series (LS) was an inductive reasoning test in which the subject must identify the pattern in a series of letters. Word Series (WS) was a parallel form of LS employing days of the week and months of the year instead of letters.

Scheidt and Schaie's (1978) Q-sort required individuals to sort 80 situations, rating themselves more or less competent in each of the situations. The competence ratings were forced into a normal distribution with higher scores reflecting greater perceived competence. For this study eight dimension scores were obtained: social, nonsocial, active, passive, common, uncommon, supportive and depriving. Sample situations for each combination of dimension are provided in Table 1. The eight dimensions actually form four independent dimensions, since one's score on social, for instance, would predict one's score on the nonsocial dimension. Half of the situations fall into social, and the other

half fall into nonsocial.

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Table 1 About Here

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Subjects took the tests in the following order: RV, IR, FR, OR, PR, DR, DRG, LS, WS, and the Q-sort. Dependent measures were total items correct for RV, LS and WS, total words recalled for IR and DR, number correct minus errors of commission for FR and OR, total content units recalled for PR, total correct recognitions for DRG, and the average competence ratings for each of the eight Q-sort dimensions. Data were analyzed in a 3 (age) x 2 (sex) x 2 (time of measurement) ANOVA with time as a within-subjects factor. The alpha level for tests of significance was set at .01 because of the number of tests conducted. Stepwise regressions of changes in the ability variables on changes in the perceived competence measures was conducted with .01 as the minimum change in $R^2$ for entrance into the equation.

## Results

Memory and intelligence. Results are summarized in Table 2. Age differences obtained for all measures. Generally, the three age groups differed from each other with highest scores in the middle-aged group and lowest scores in the old-old. Sex differences obtained for the three word list tasks with women remembering more than men. Sex differences were also observed for the spatial tests with men performing better than women. No age x sex interaction was reliable.

Table 2 About Here

No time of measurement effect was significant. The time x age interaction for the spatial tests saw an increase over time for MA and a decrease over time for OO. The YO group decreased significantly only for OR and did not change over time for FR. A third-order interaction was obtained for IR. Sex differences were observed for all age groups at both times of measurement except for the MA group at the first time of testing.

Q-sort dimensions. For the social dimension, perceived competence increased with age, with a corresponding decrease for the nonsocial dimension. For the active dimension MA rated themselves as more competent than the older groups, which did not differ from one another. The older groups perceived themselves more competent in passive situations than did the middle-aged group. MA rated themselves as more competent overall on uncommon situation than the two older groups, while both older groups rated themselves as more competent than MA in common situations. No age differences obtained for the supportive-depriving dimensions. Women rated themselves more competent than men in social, common, and supportive situations, while men perceived themselves as more competent than women in nonsocial, uncommon, and depriving situations.

Only one within-subjects effect was significant. This was the time of measurement effect for the nonsocial dimension. Overall competence ratings were higher at the first time of testing than at the second. There were no significant within-subjects interactions.

Regressions on changes in Q-sort variables. Neither changes in memory or intelligence variables predicted more than about 10% of the variance on changes

on the social-nonsocial dimensions (cf. Table 3). Change in DR predicted most of the variance of all memory variables for changes on the active-passive dimensions. Still, DR only predicted about 10% of the variance. Changes in intelligence could account for much more variance of changes on the active-passive dimensions, 34% of active variance and 26% of passive variance. Change in RV accounted for most of this variance for active with changes in FR accounting for the next largest amount. For changes on the passive dimension change in FR accounted for the most variance with change in RV accounting for most of the remainder of accounted variance.

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Table 3 About Here

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While changes in intelligence variables could only account for 11% of the variance of changes on the common-uncommon dimensions, changes on the memory variables could account for twice as much. Most of this was due to DRG and PR for both dimensions. Finally, changes on the memory variables could account for 31% of the variance of the changes on the supportive-depriving dimensions, while the changes in the intelligence variables accounted for about 22%. IR and DRG accounted for more than 80% of the accounted for variance on both dimensions. Change in LS accounted for more variance than any other intelligence variable in predicting change on the supportive-depriving dimensions.

## Discussion

Most of the memory, intelligence and perceived competence variables were reliable with no overall change across the three-year interval. The only exceptions to this were the nonsocial Q-sort dimension and the spatial tests.

It is unclear why the nonsocial decreased between times, since the parallel social dimension did not change. Given the power in the repeated-measures test, the result may have been due to chance. The interaction between time and age for the spatial tests was quite understandable. It appears the increase for the MA group was due to practice or familiarity with the test. The decrease for CO could have been due to age changes. Schaie and Parham (1977) noted age 74 as being the onset of first reliable age decrement over a seven-year interval for spatial abilities. The present results suggest that such decrement can even be detected in a shorter time span. This is consistent with the YO also showing decrement but only on one of the spatial tests.

The relationship between changes in perceived competence with changes in ability were small, but reliable. We would not expect much variance to account for in the first place, since the measures were stable over time. Changes in vocabulary and spatial ability as measured by FR were positively related to changes in perceived competence in active situations. Changes in perceived competence in uncommon situations was positively related to changes in delayed recognition ability. Changes in paragraph recall were positively related to changes on competence in common situations. Finally, changes on the supportive dimension were related to delayed recognition and reasoning (LS) in a positive manner and to immediate recall in a negative fashion. While the reasons why such relationships exist is not readily apparent, the fact that different ability variables relate to different dimensions of competence is important. Future research may elucidate the nature of the relationship between ability and competence in old age.

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Table 1. Attributes and Illustrative Content of 16 Classes of Situations (West Los Angeles Elderly).

| Situational Attributes | Social | Nonsocial |
|---|---|---|
| High Activity | | |
| Common-Supportive | Arguing with person about important point.<br>Being visited by son or daughter and their children. | Gardening in yard, planting seeds, weeding.<br>Doing weekly shopping in crowded supermarket. |
| Common-Depriving | Pressured by salesperson to buy merchandise.<br>Quarreling with relative. | Climbing several steps to building entrance.<br>Cleaning apartment or household. |
| Uncommon-Supportive | Having sexual intercourse.<br>Traveling around city looking for new residence. | Preparing large meal for friends.<br>Exercising for a few moments each day. |
| Uncommon-Depriving | Waiting at end of long line for tickets to entertainment.<br>Returning faulty or defective merchandise to store. | Moving into new and unfamiliar residence.<br>Driving auto during rush-hour traffic. |
| Low Activity | | |
| Common-Supportive | Seeking aid/advice from friend or family member.<br>Offering money to son or daughter who needs it. | Browsing through family photo album.<br>Making plans for future. |
| Common-Depriving | Hearing from friend that he/she is considering suicide.<br>Hearing that close friend has recently died. | Eating meal alone in own home.<br>Worrying about ability to pay a debt. |
| Uncommon-Supportive | Entering darkened nightclub to take dinner.<br>Attending art exhibit. | Recording day's events in diary.<br>Wading in waist-high water in ocean. |
| Uncommon-Depriving | Opening door to stranger selling product or soliciting opinion.<br>While talking with someone, you feel you have unintentionally hurt their feelings. | Slipping on slick part of floor and falling.<br>Discovering you locked keys in car while shopping. |

Reprinted from Scheidt and Schaie (1978).

Table 2

F-ratios from Age x Sex x Time of measurement ANOVAS for Memory, Intelligence & Q-sort Variables

| | df[a] error | Age(A) | Sex(S) | AxS | Time(T) | TxA | TxS | TxAxS |
|---|---|---|---|---|---|---|---|---|
| | | | | MEMORY | | | | |
| Imm. Recall | 220 | 32.68** | 21.42** | <1 | 5.35 | 1.12 | <1 | 6.24* |
| Del. Recall | 216 | 28.85** | 18.56** | <1 | 6.05 | 1.58 | <1 | 3.12 |
| Del. Recog. | 218 | 11.52** | 14.65** | <1 | <1 | <1 | <1 | 1.26 |
| Para. Recall | 206 | 5.93* | 3.82 | 1.71 | <1 | 2.41 | <1 | <1 |
| | | | | INTELLIGENCE | | | | |
| Recog. Vocab. | 219 | 11.41** | <1 | <1 | 1.41 | 4.58 | <1 | 3.01 |
| Fig. Rot. | 220 | 19.15** | 20.30** | 1.60 | <1 | 8.27** | <1 | 2.22 |
| Object Rot. | 220 | 33.99** | 10.90* | <1 | <1 | 9.24** | 3.08 | 2.30 |
| Letter Series | 219 | 26.34** | 1.14 | <1 | <1 | 2.78 | 2.49 | 2.16 |
| Word Series | 219 | 29.70* | 1.89 | 1.07 | 6.45 | 2.07 | <1 | <1 |
| | | | | Q-Sort Dimension | | | | |
| Social | 201 | 10.47** | 36.23** | 2.85 | 1.94 | 1.75 | <1 | 2.71 |
| Nonsocial | " | 10.86** | 33.43** | 2.87 | 8.08* | 1.34 | <1 | 2.99 |
| Active | " | 5.31* | <1 | <1 | <1 | <1 | <1 | 2.24 |
| Passive | " | 5.17* | 1.75 | <1 | <1 | 1.37 | <1 | 2.53 |
| Common | " | 4.94* | 15.99** | <1 | <1 | 1.61 | 3.00 | <1 |
| Uncommon | " | 4.67* | 11.60** | <1 | 4.36 | 1.75 | 2.33 | <1 |
| Supportive | " | 2.62 | 15.99** | <1 | 1.73 | <1 | <1 | <1 |
| Depriving | " | 2.30 | 15.10** | <1 | <1 | <1 | <1 | <1 |

[a] Df = 1 for Sex and Time, and 2 for Age. Df varied for error term because of different cases dropped for missing dara for each variable.

* p .01

** p .001

Table 3

Change in $R^2$ from stepwise regressions of Memory and Intelligence Variables on Q-sort Dimensions

| Dimension | $R^2$ | Change in $R^2$ (Variable) | | | | |
|---|---|---|---|---|---|---|
| | | MEMORY | | | | |
| Social | .11 | .07 (I) | .03 (R) | .02 (P) | | |
| Non social | .10 | .06 (I) | .02 (P) | .02 (R) | | |
| Active | .14 | .09 (D) | .03 (P) | .01 (I) | .01 (R) | |
| Passive | .13 | .10 (D) | .01 (I) | .02 (R) | | |
| Common | .21 | .11 (R) | .08 (P) | .02 (D) | .01 (I) | |
| Uncommon | .22 | .11 (R) | .09 (P) | .02 (I) | | |
| Supportive | .31 | .11 (I) | .15 (R) | .05 (D) | .01 (P) | |
| Depriving | .31 | .10 (I) | .15 (R) | .05 (D) | | |
| | | INTELLIGENCE | | | | |
| Social | .12 | .06 (W) | .02 (F) | .02 (R) | .02 (L) | |
| Non social | .11 | .05 (W) | .03 (O) | .01 (R) | .01 (F) | .01 (L) |
| Active | .34 | .18 (R) | .13 (F) | .02 (O) | .01 (L) | |
| Passive | .26 | .16 (F) | .08 (R) | .01 (L) | | |
| Common | .11 | .04 (F) | .03 (W) | .02 (R) | .02 (L) | .01 (O) |
| Uncommon | .11 | .04 (F) | .03 (W) | .02 (R) | .02 (L) | .01 (O) |
| Supportive | .22 | .17 (L) | .03 (F) | .02 (W) | | |
| Depriving | .23 | .18 (L) | .03 (F) | .02 (W) | | |

Note: A cutoff of .01 was chosen as minimum change in $R^2$ for acceptance in equation.

Abbreviations: Memory: Immediate Recall (I), Delayed Recall (D), Delayed Recognition (R), and Paragraph Recall (P). Intelligence: Recognition Vocabulary (R), Figure Rotation (F), Object Rotation (O), Letter Series (L), and Word Series (W).