Psychometric Assessment of Intellectual Competence in the Elderly

from K. WARNER SCHAIE*

Introduction

The purpose of this paper is threefold. First, I would like to acquaint the reader with the extensive program of studies on the psychometric measurement of intellectual competence in adults and the elderly which we have pursued in my laboratory over the past two decades. Second, I will discuss some of the problems which limit our present approaches to such psychometric assessment. And third, I will describe briefly some of the new aproaches we are currently examining to determine whether it may be possible to offer the clinician psychometric assessment techniques specifically selected, normed and validated for work with older adults, whether they are community-dwelling or institutionalized.

Before proceeding with these matters I would like to dwell briefly on the question why one would want to engage in the psychometric assessment of the elderly, and to distinguish for you the terms competence, intelligence and intellectual competence.

Why should we assess the intellectual competence of the old?

Hopefully, the purpose of assessment is always related to the intent to provide some action with respect to the problems presented by the individual to be assessed. But the goal of this action will differ upon the source of the desire to obtain action. For example, if the older person seeks our attention, then the objective may be to establish that competence remains to fulfil a desired social role, or it may involve the search for remediation of disabling psychological symptoms. If the referral for assessment comes from other professional sources it is likely designed to seek evidence which would require or permit the institutionalization or imposition of controls, such as guardianship, upon an older individual whose competence has declined, or perhaps to seek some clues towards treatment which might make it possible to continue keeping the elderly person in a family or community situation.

All these assessment questions can conveniently be grouped into three categories: The first involves the *diagnosis* of psychopathology; that is, the differentiation of pathological changes in function from those expected due to «normal aging». The second category is concerned with the assessment of base line behavior to make it possible to determine the effects of behavioral *intervention*. The third is concerned with the review of present levels of function to

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establish a profile of those abilities which remain high as compared to those for which decline has been noted to permit *counseling* the older individual to achieve better adjustment in the last part of life (cf. SCHAIE & SCHAIE, 1977).

Intelligence and competence

The distinction is of importance if the reader is to understand how the measures of intellectual competence discussed in the following sections relate to the prediction of competence in everyday situations which, for many clilicians, is likely to be the major goal of psychometric assessment. In this context, the term competence may be said to refer to intelligence in its broad sense; that is in the aspect of «*knowing how* rather than simply *knowing that*» (CONNOLLY & BRUNER, 1974). Competence always involves the application of intellectual skills to specific situations. The psychometric measures of intellectual competence, however, being designed to have trans-situational generality, cannot directly predict behavior in a given situation. Thus, we might note that competent behavior in such situations will require a pattern of different intellectual competencies. By corollary, such abilities will have differential importance for competence in different situations.

The construction of psychometric measures of intellectual competence for children and young adults has always been validated against performance in scholastic or vocational entrance situations (cf. the work of BINET and WECHSLER). By contrast, measures applied to the elderly must be validated against a multiplicity of other criteria specific to the situations in which the old are expected to display competence. Our work, therefore has shied away from the traditional WAIS to measures more suitable for our purpose (SCHAIE, 1978).

Longitudinal-sequential Studies of Psychometric Intelligence

In our attempt to assess normal changes in intellectual competence with age, we have intensively studied a set of five mental abilities (derived from the work of L. L. THURSTONE), over the age range from the early twenties to the late eighties. We have attended both to the issue of changes within the same individual by following samples of persons over seven, fourteen and twenty-one years, and we have considered the effects of socio-cultural change by repeatedly assessing age differences at several points in time. These studies have been described elsewhere in greater detail (SCHAIE, 1979; SCHAIE & LABOUVIE-VIEF, 1974; SCHAIE & PARHAM, 1977). Here we will simply summarize and describe some selected aspects which may be of interest to the clinician involved in the psychometric assessment of the elderly.

The Variables. The main measures for which we have collected extensive data over the age range from the twenties into the eighties include two estimates of the range of a person's vocabulary: *Verbal Meaning,* a recognition vocabulary test assessing the extent of passive work knowledge; and *Word Fluency,* a recall measure, assessing the person's active vocabulary. Next, there is a measure of visual rotation, *Space,* which involves the ability of rotating geometric figures in one's mind. The ability measured by this test is involved in the competencies of translating one's driving behavior from reading a map, assembling an object in kit form from a set of instructions, etc. The fourth test is a letter series test of

Inductive Reasoning, an ability implicit in situations where rules or general principles must be induced. And finally there is a simple addition test, *Number* which predicts situations in which numerical skills are required.

Cohort differences and age changes. The clinician who assesses the functioning of an older individual is generally confronted with two questions: First, has this individual declined because of age-related loss from a prior level of functioning, and second, even if there is no loss, is this individual disadvantaged as compared to younger individuals because he was never functioning at the level of today's young adults. The first question, of course, is related to age decrement and possible psychopathology, the second to the issue of socio-cultural obsolescence.

Figure 1 provides an example of these issues for the variable of Space. In this example (from SCHAIE & LABOUVIE-VIEF, 1974) seven samples of subjects were followed for fourteen years. The youngest sub-set was followed from age 25 to 39, and the oldest from 67 to 81. Figure 1 gives both cross-sectional and longitudinal data for these samples. The top part of this figure shows the three cross-sectional gradients constructed by comparing means for the samples in 1956, 1963 and 1970 respectively. Note that for comparable ages performances increase for subsequent cross-sections. The bottom part shows the longitudinal gradients, which, by contrast to the cross-sectional gradients, do not show decrement until the very last two cohorts. But note the substantial level differences between successive cohorts at the same ages. Strong evidence, then, is provided here that until the late sixties there is no within-person decrement, but that the cohort differences would certainly suggest obsolescence phenomena for the older persons, regardless of whether they showed evidence of individual decrement.

Magnitude of Decrement. The scientific research literature is frequently preoccupied with the concern to demonstrate the presence or absence of reliable differences or relationships. For the practicing clinician, it may be of greater importance to know whether observed differences are large enough to have practical consequences. To address this issue, we have accepted the convention in our aging studies, to demand that normal age decrement should be considered to be of practical consequence only in those instances where performance at any given age drops below the average range of a 25 year old comparison group. This average range is defined, following traditional psychometric assumptions (cf. MATARAZZO 1972, pp. 124–126), as the middle 50% of a normal population sample.

It is now possible from our longitudinal data to compute cumulative change over age as a proportion of performance at the base age to determine at what age there is sufficient loss to suspect practical consequences, and moreover to provide reasonable estimates which permit the clinician to judge whether a given patient of advanced age is performing at a level typical for individuals of his age, or may be doing less well by reason of functional or organic pathology. Data of this kind based on seven year longitudinal studies were first reported by SCHAIE and PARHAM (1977) for panel and independent random samples data. Similar data on two even more stable samples follows for fourteen years from

Figure 1. Cross-sectional and Longitudinal Findings on Age Differences and Age Changes on the Primary Mental Abilities SPACE test. (From: SCHAIE & LABOUVIE-VIEF, 1974. Copyright by the American Psychological Association. Reproduced by permission).

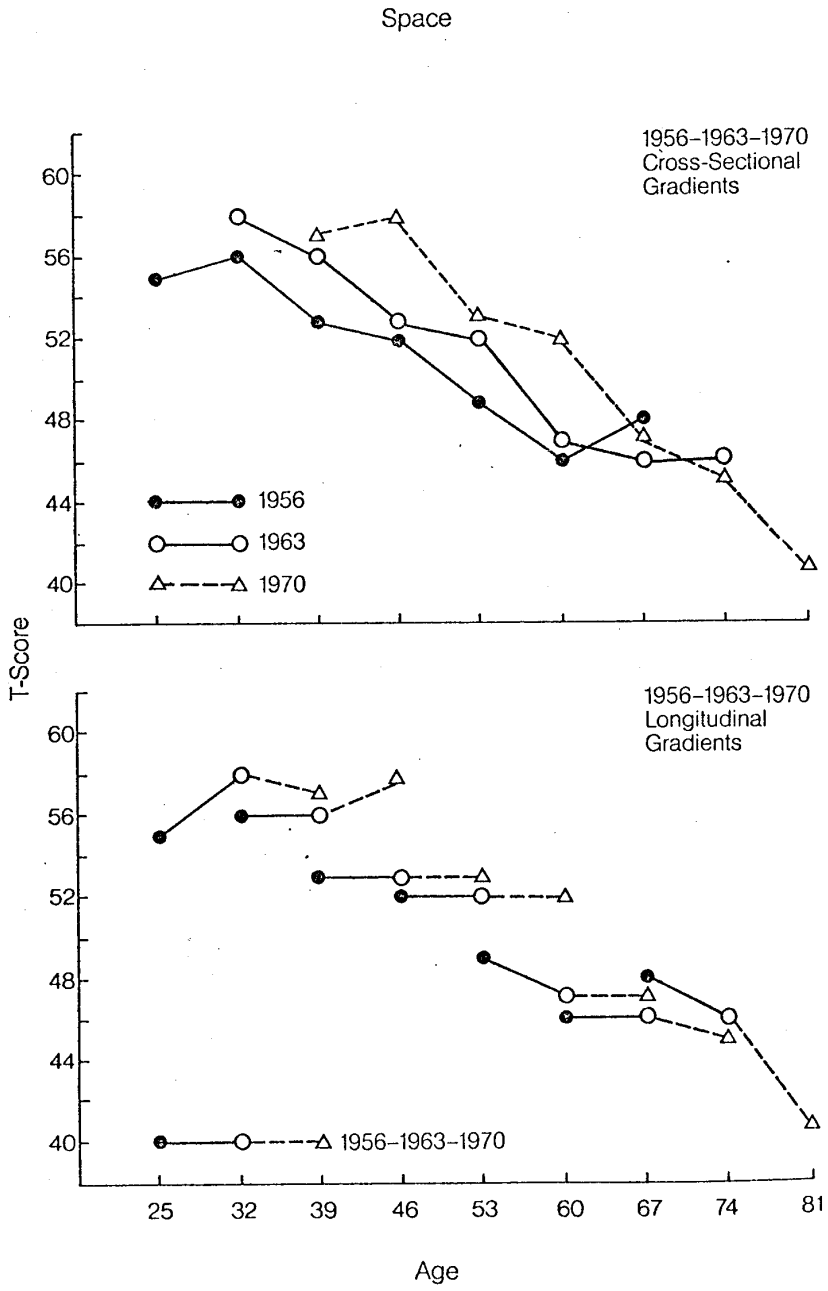

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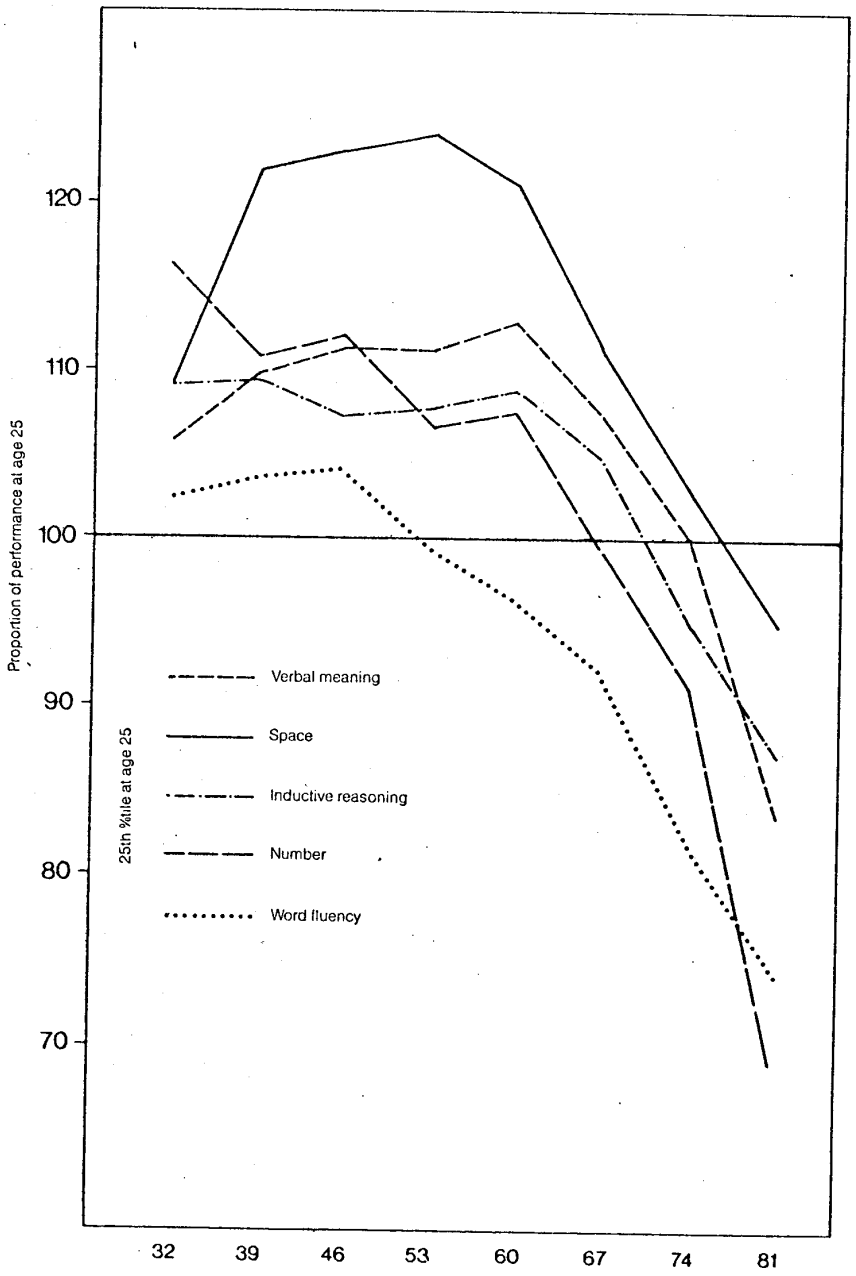
Figure 2. Cumulative Age Changes from Ages 25 to 81 as a Proportion of Performance at Age 25, Estimated from Two Fourteen-year Longitudinal Studies of the Primary Mental Abilities. (From: SCHAIE, 1978).

Figure 2. Cumulative age changes in intellectual abilities



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1956 to 1970 and from 1963 to 1977 respectively (SCHAIE, 1978b) are shown in Figure 2.

Note that practically significant decrement occurs for the speeded measure of World Fluency as early as 53 years, for most other measures, however, such decrement does not occur until 74 years, and for space, inductive reasoning and verbal meaning average performance even at age 81 is still within the average range of 25 years old.

Effects of Cardiovascular Disease. A further qualification on the data for intellectual decrement in normal individuals of advanced age must further be qualified in the light of our analyses of the relation of cardiovascular disease and changes in intellectual function (HERTZOG, SCHAIE & GRIBBIN, 1978). In the latter study health history data were classified by ICDA codes of disease over the fourteen year period for which psychological data were available. Systematic relations were found between presence or absence of various cardiovascular disease entitites and the magnitude of decrement of intellectual performance. When the health criteria are applied to the samples for which cumulative decrement is reported in Figure 2, in order to remove all individuals suspected of cardiovascular disease, then significant positive changes occur in the patterns displayed by the remaining disease-free subjects. For this group, as shown by Figure 3, decremental phenomena occur on average at least seven years later, than was found for the total sample, before controlling for cardiovascular disease.

Impact of Environmental Factors. Before leaving this topic we should also refer to our studies of the impact of environmental and demographic factors upon intellectual changes with age. Data from a Life Complexity Inventory (SCHAIE & GRIBBIN, 1975) administered to our subjects, have permitted identifying at least four patterns of life style which seem to have differential effect on intellectual development in adulthood. In terms of environmental complexity, the lifestyle typology moves from high social status fully engaged, through average-status engaged, to the semi-engaged homemaker and finally the disengaged homemaker. As shown by Table 1, which records fourteen-year changes in function by subject type, there is maintenance or slight increment for the most advantaged and engaged type, while there is evidence for a clear decrement trajectory for the disengaged type with the other types falling in between.

Tab. 1. Cumulative Mean Score Change on Cognitive Variables over a 14-year Period by Subject Type in T-Score Points.

	Type 1	Type 2	Type 3	Type 4	All
Verbal Meaning	+3.6	+1.4	−0.2	−4.4	+0.4
Space	+1.0	−1.1	+1.5	−0.1	+0.2
Reasoning	−0.2	+1.1	−1.9	−3.1	−0.7
Number	+1.0	+0.8	−0.9	−1.6	−
Word Fluency	−3.5	−4.2	−6.2	−5.6	−4.8
Intellectual Ability	+0.5	−0.2	−1.9	−4.0	−1.1
Educational Aptitude	+2.8	+1.3	−0.6	−4.3	+0.1

Note: + = denotes incremental change; − = denotes decremental change. (From: SCHAIE, 1979).

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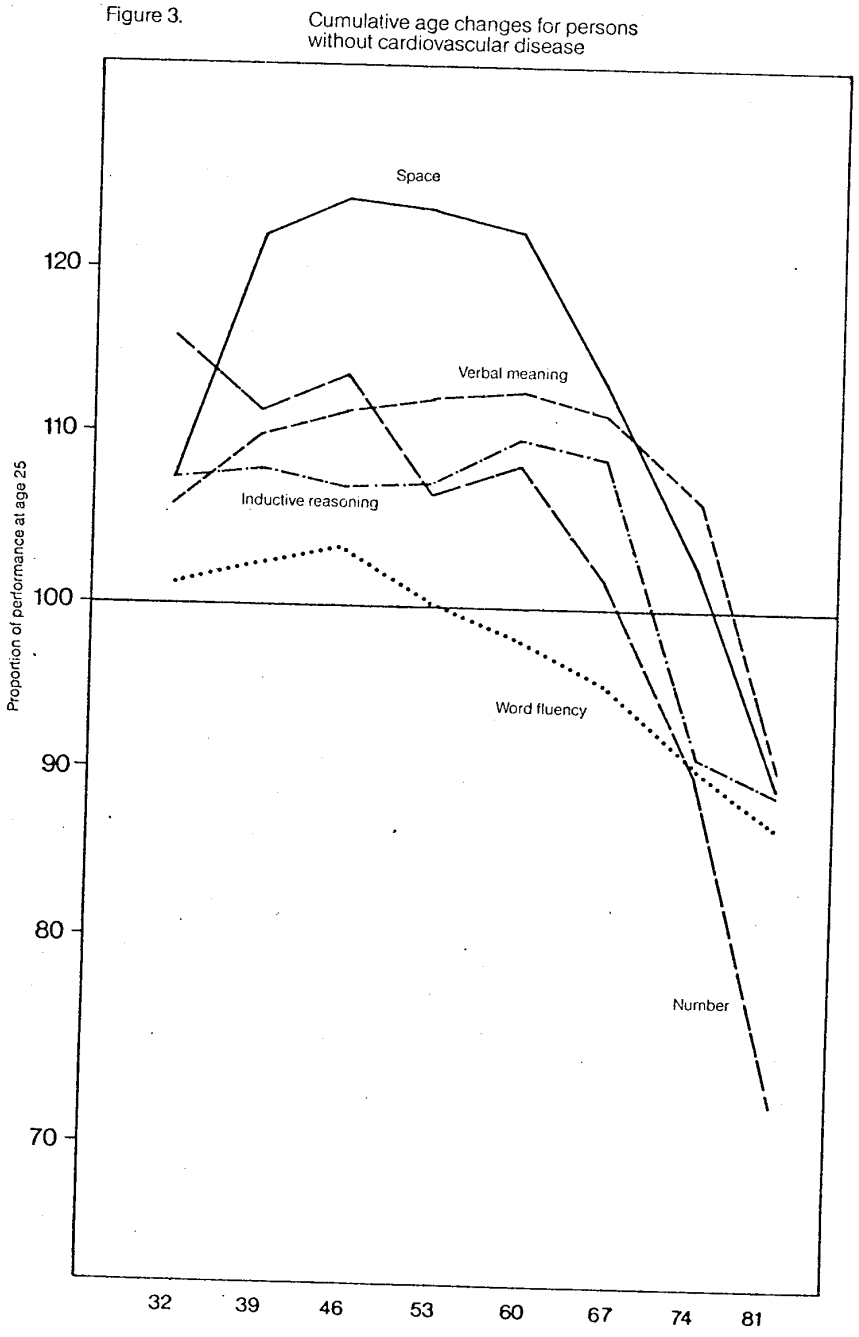
Figure 3. Cumulative Age Changes from Ages 25 to 81 as Proportion of Performance at Age 25 for Samples of Individuals Without Cardiovascular Disease. (From: SCHAIE, 1978).



Technical Problems Limiting Current Assessment Techniques

I will now turn to some of the technical issues which limit the validity of our own work and that of others for practical work with the elderly. These issues relate primarily to the problem that virtually all techniques currently in use were originally developed for work with children or young adults. Conscientious efforts to obtain normative data upon both community-dwelling and at risk elderly (e.g. BRULL & WERTHEIMER, 1978; SAVAGE, BRITTON, BOLTON & HALL, 1973) are, of course, valuable but they do not solve this basic problem.

In our work with old subjects over the years we have identified four broad areas of problems reducing the validity of test results with the elderly. These are, first, the formal characteristics of tests; second, meaningfulness and relevance of item content; third, differential cautiousness and risk taking tendencies of the aged; and finally the problem of appropriate criteria in the construction and selection of test items (see also SCHAINE, 1978a).

Formal test characteristics. Several items must be noted here, upon which practically all conventional tests fail. The first of these, perhaps simple-minded but nevertheless important, is the matter of *type size.* Instructions and test materials developed for young adults, for reasons of economy, usually use type sizes which produce eye strain and confusion for the old. I would recommend that materials to be administered to the old not contain type less than 1 pica (12 points); in fact fourteen point type would seem optimal.

Most group-administered intelligence tests make use of *answer sheets* for ease of scoring. We have found that these devices seriously interfere with the accurate measurement of intellectual funtioning in the elderly. Particularly in slightly speeded tests, too much time is spent in figuring out how to allign answer sheets and test booklets, and the older person in a screening examination may appear to do less well simply because he has littler or no experience, as well as less of the required motor coordination to deal with the test format. We are now recommending that answer sheets should not be used in the assessment of individuals over age 60. Instead, for purposes of group screening, we suggest disposable test booklets, with instructions to mark answers directly on the booklet, and to change answers, by crossing out the incorrect answer and then indicating the correct one.

A third formal problem is the inappropriate use of *speeded tests,* where measurement of response speed is not the primary assessment goal. We know that the older nervous system responds at a slower rate (BIRREN, 1965), and that moreover longer intervals between stimuli are required for adequate discriminability (cf. WALSH, TILL & WILLIAMS, 1978). Consequently, time limits related to the logistics of test adminstration must be geared to the characteristics of older individuals rather than to the convenience of the clinician.

Meaningfulness of Test Materials. Although WECHSLER in constructing his original scales was concerned with creating materials which have high face validity for adults, recent trends in psychometric testing seem to have emphasized materials of low face validity, if only to prevent subjects from making social desirability motivated decisions as to whether or not they ought to respond to a given test item. As a result much of the content of intelligence tests

developed for the young lacks clearly identifiable meaning. As it happens, the young organism seems intrinsically motivated by simple novelty, and thus will respond to the games psychologists play, whether the materials be meaningful or not. Older individuals, on the contrary, require meaningful materials to beat their best. This fact has been demonstrated recently in studies of Piagetian materials by SINOTT (1975) where it was shown that older adults do significantly better on meaningful tasks even though this is not necessarily the case for younger comparison subjects. What needs to be done therefore, is to develop more tasks which measure intellectual ability variables in ways which have increased face validity, as well as using stimulus materials which by virture of their meaningfulness will not impose additional memory loads on the older subject, where memory per se is not to be measured.

Cautiousness. Most older individuals have had a life time of experiencing negative reinforcement for impulsive or risk-taking behaviors. They will therefore respond in a much more cautious manner in a test situation as well. BIRKHILL and SCHAIE (1975) showed that the standard test condition is equivalent to the least favorable reinforcement condition in an experiment where guessing behavior and amount of reward for right and wrong test responses were varied. This situation probably holds in most tests designed for young adults, who typically respond in the presence of partial assurance of knowledge or success, while the elderly will only respond when they are more certain of success.

The Criterion Problem. Intelligence tests have typically been constructed to predict behavior in educational or vocational entry situations. With such clear-cut criteria it has not been difficult to select and validate appropriate test items. Such criteria are, however, in most cases inappropriate with work with older adults. It is necessary therefore to determine the kinds of situations which would provide more appropriate criteria for the assessment of intellectual competence in older adults. For example, we may need to select tasks which will predict competence in independent living, or in maintaining consequential societal roles, or functioning in social groups. But the characteristics, and therefore the relevant dimensions of intellectual competence, of such situations will differ markedly from those found important in the assessment of the young.

New Approaches for Psychometric Assessment.

My discussion thus far calls for the conclusion that while we have some considerable knowledge about psychometric assessment of the elderly, it will be necessary to make further progress by examining new criteria against which measurement of intellectual competence in the old should be validated and to proceed to the construction of assessment tools with greater ecological validity. The final section of this paper will describe some modest attempts in this direction currently in progress in my laboratory.

Situational Criteria for Adult Intellectual Competence. We have recently completed an in orderly investigation of situations in which individuals over the age of 60 display competent behavior. Such persons were observed in natura-

listic settings such as park benches, senior centers, shopping centers and the like. As the next step, well-educated elderly raters evaluated each of approximately 300 situations on a number of evaluative dimensions, retaining those dimensions and situations upon which reliable rater classification could be obtained. A typology of four two-category dimensions, resulting in 16 types of situations, emerged. Each situation could be classified as to whether it can be described as common or uncommon, supportive or depriving, involving solitary or social activities, and whether it requires a passive or active role of the part of the individual coping with that situation. A Q-sort sample, containing five prototypic situations in each of the 16 classes, was then constructed to servie as an objective measure for the definition of situational attributes. (SCHAIDT & SCHAIE, 1978).

This Q-sort is currently being administered to a sample of 540 individuals aged from 55 to 81, who are also receiving an adult abilities battery (described below), and which will provide a more sensitive and individualized method of determining test validity for specific situational competency predictions.

The New Adult Abilities Tests. Our test construction program which is presently being field-tested (with 3-year short-term longitudinal follow-up already scheduled) tries to address all of the technical problems discussed earlier. The battery first of all includes a large-type disposable booklet from of the Primary Mental Abilities tests used previously in our work. In addition, we have included parallel forms with meaningful materials where indicated. For example, Figure 4, shows a test item from the Spatial Rotation test using the original geometric forms and the new Object Rotation form which is an exact parallel with the same angles of rotation, but using common household objects as stimulus materials.

Figure 4.

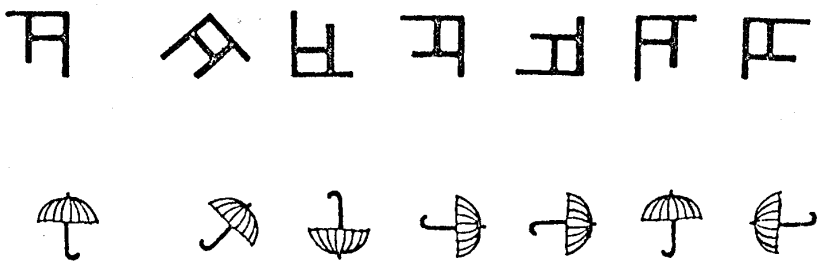


Figure 4. Examples of Items for the Primary Mental Ability SPACE. First item represents the traditional form; second item is a meaningful analog from the Object Rotation Test developed by MARGARET QUAYHAGEN.

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Similarly new word series forms have been constructed as a meaningful parallel for the Inductive Reasoning test, and for both Spatial Rotation and Inductive Reasoning there is another alternate form which uses reproductions of playing cards, of varied shapes and sizes capitalizing on the fact that most old people are well familiar with and make use of playing cards in their daily life. Because memory is such an important variable in the psychometric assessment of the elderly (see SCHAIE & ZELINSKI, 1978, for a detailed analysis), the battery has also added paper and pencil forms for the assessment of memory for words and paragraphs using both recall and recognition methods. Finally a fact-memory test was constructed, by selecting from the back files of the New York Times, for each decade since 1910, two facts each in the areas of sports, entertainment, science and history. This particular mode of construction permits analysis of the interaction in fact memory of the individuals age and cohort relevance of the information to be retrieved.

It is our intention to provide normative data relating the profiles of scores on the new ability battery to the classes of competency situations identified by means of the competence situation Q-sort.

Summary

This paper pointed to the increasing importance of the psychometric assessment of intellectual competence in the elderly. It reviewed an extensive program of longitudinal studies of adult intelligence with respect to its relevance to psychometric assessment. A number of technical problems limiting the utility of presently available techniques were reviewed, and a new psychometric assessment battery currently under development which is designed to meet these problems was described.

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