

Chapter Three

Applications of Psychometric Intelligence to the Prediction of Everyday Competence in the Elderly

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INTRODUCTION

Almost 50 years ago Louis Leon Thurstone began his seminal work of developing a taxonomy and measurement instruments for the assessment of well-specified components of human intelligence. In his early enthusiasm, he spoke of identifying the very "building blocks of the mind" (Thurstone, 1935, p. 135). Thurstone was an eminently practical man, and nothing was farther from his mind than creating synthetic dimensions that would interest only basic researchers. His hope was to identify those basic components, called by him the Primary Mental Abilities (PMA), whose combinations and permutations would characterize the essentials of individual difference variance in the manifold behavioral situations that require the exercise of competence.

Thurstone was successful in identifying dimensions that have consistently accounted for substantial proportions of individual difference variance, and he created model assessment tools with exemplary psychometric characteristics such as high reliability and internal consistency. He was less successful, however, in demonstrating the utility of his psychometric system for the prediction of differential everyday criteria in educational settings. Even more problematic was the fact that summary IQ measures derived from the published PMA batteries were less effective in predicting overall academic performance than was true for more global measures such as the Stanford-Binet Intelligence

Test that had been constructed with the objective of selecting highly correlated test items.

Other assessment systems that follow the Thurstonian tradition, such as the work of Guilford (1967), the extensive development of factor reference kits by the Educational Testing Service (Ekstrom, French, Harmon, & Derman, 1976), and the second-order factor studies associated with the work on fluid and crystallized intelligence (Cattell, 1971) have introduced many technical refinements. It is questionable, however, whether they have proceeded any further than Thurstone in the quest for ecological validity.

Strong concerns have also been raised regarding the potential inadequacy of dealing with products of the mind rather than with the processes that lead to the observed performance. Consequently much recent work in cognitive psychology either has followed Piaget's quest for the accurate description of the origin and transformation of cognitive structures (Flavell, 1963; Piaget, 1972), or has sought to apply information-processing strategies to develop fine-grained portrayals of the components and timing of effortful behavior (Sternberg, 1977). Moreover, the contextual relevance of all the traditional paradigms has been seriously challenged (e.g., Charlesworth, 1979). Attempts to integrate the different approaches to the conceptualization and measurement of intelligence generally suggest that different paradigms may be relevant to alternative facets of the construct that may have differential import for acquisition and display of intelligent behavior. See for example Sternberg's triarchic theory (Sternberg, 1984; Sternberg & Berg, chapter 1 of this volume).

This argument can be extended further by proposing that different paradigms for the study of cognitive behavior may also have greater or lesser relevance for different life stages. To do so, it may be instructive to address the question as to what criteria for intelligent behavior might be most appropriate for adults and the elderly. I will then argue that the work of Thurstone and his followers may deserve renewed attention because their psychometric approaches appear to be particularly appropriate for the assessment and prediction of everyday competence in adults and the elderly. Finally, some steps will be described that I and my associates have taken to relate the wide body of knowledge on the psychometric performance of the elderly to the assessment and predictions of real-life issues affecting that particular target population.

THE CRITERION ISSUE

Early efforts at assessing intellectual competence had little reason to worry about ecological validity issues (Cook & Campbell, 1979; Schaie,

1978). For example, it was unambiguously clear to Binet and Simon (1905) that their work was concerned with identifying objective assessments of public school performance (also see Brooks & Weintraub, 1976). And Wechsler's principal concern was with the utility of intelligence tests for clinical diagnosis (Matarazzo, 1972; Wechsler, 1939). When more basic researchers entered the field of human intelligence, however, the importance of ecological validity receded. These investigators (e.g., Burt, Guilford, Spearman, or Thurstone) were far more concerned about theoretical issues regarding the nature of intellectual structures. They preferred description by means of reasonably pure measures of specific abstract components of intelligence rather than the complex tasks characterizing real life. The distinction between competent performance on abstract measures of intellectual structures such as might be observed in the laboratory and the competencies involved in daily life were therefore bound to emerge.

Most work with children is concerned either with the acquisition of intelligent behavior or with the description and prediction of a single universally relevant criterion (e.g., performance in the public school system). When dealing with adults and the elderly, however, we are no longer concerned with the emergence of intellectual structures, but rather with their maintenance or decline. Likewise, the call for the direct measurement of criterion variables seems naive, because there does not seem to be any single criterion that has the social importance and situational generality that is associated with successful performance in a societally mandated and universally experienced educational system.

If the necessity of multiple criteria for intellectual competence in adults is accepted, it is then possible to distinguish two somewhat different approaches that may each contribute to our understanding of the complexity of adult behavior. The first is in agreement with contextualism and considers the possibility that different behavioral situations demand alternative combinations of intellectual abilities for their competent mastery. In addition, it should be noted that the situational demands that impinge on an individual's cognitive performance may vary markedly depending on the developmental tasks implicit in a given life stage (Chickering & Havighurst, 1981; Schaie, 1977/1978). The individual's response may also be determined by the perceived attributes of a given situation, and such perceptions, in turn, may differ by life stage (Schaie, Gonda, & Quayhagen, 1982). It is necessary therefore to specify life-stage-specific situational taxonomies and to provide instruments that allow the appraisal of observed and perceived competence in specific situations (see Scheidt & Schaie, 1978; Willis & Schaie, 1986). Although there may be essential skills that are required in some situations, it may nevertheless be possible to respond

adaptively to many other situations given different permutations and combinations of cognitive skills.

A second approach, by contrast, proceeds from the assumption that there are classes of everyday activities that are *essential* for adaptive functioning in given life circumstances. It is argued that the inability to perform certain essential tasks of daily living will often lead to the institutionalization or other curtailment of independence for many elderly people. Examples of such critical tasks might be medication compliance, appropriate responses to written or oral requests by public authorities, or payment of utility bills when due. An important characteristic of such activities is their high face validity, in addition to immediate relevance to effective functioning of individuals in their community.

We are here not concerned with the increasingly popular methods of functional assessment (e.g., Pfeiffer, 1975). The criteria we are searching for must instead refer specifically to the exercise of intellectual abilities. Specific situation-relevant competencies for the above examples would be the ability to interpret medicine bottle labels, comprehending the meaning of textual materials, and interpreting materials presented in charts in documents. Although no exhaustive taxonomy of the requisite real-life tasks has thus far been attempted, reasonably representative measurement instruments are available that assess tasks such as those just mentioned (Educational Testing Service, 1977).

Our identification of possible criteria for real-life competence will soon inform us, however, that there are a multitude of behavioral situations and specific everyday behaviors, only few of which circumstances occur with respect to any given individual. Moreover, we are often concerned with the prediction of performance in circumstances that cannot be under our direct scrutiny. Our assessment of individuals for such purposes then must proceed at a greater level of abstraction, one that permits a more parsimonious organization of the underlying structure of intellect. A more basic level is also appropriate for attempts at behavioral intervention, unless work is to remain at a purely symptomatic level (Willis & Schaie, 1983a; Willis, 1985).

WHAT KIND OF "INTELLIGENCE" WILL PREDICT REAL-LIFE COMPETENCE?

Given the kinds of criteria outlined above, it now becomes necessary to ask at what level the structure of intellect might most profitably be sampled in adults and the elderly. My introductory statement indicated a preference for the Thurstonian approach and its derivatives. Let me now suggest further reasons for such a preference.

For some time, a number of students of adult developments have attempted to conceptualize further Piagetian stages that might account for qualitatively different aspects of intellectual functioning beyond young adulthood (e.g., Commons, Richards, & Kuhn, 1982; Riegel, 1973). But there remains a real question whether there are cognitive transformations in adulthood that lead to even near-universal stages. Indeed, it appears that operational definitions of Piagetian stages in adulthood lead to measurement systems that collapse upon intellectual and cognitive style dimensions of existent psychometric measurement frameworks (Hooper, Hooper, & Colbert, 1984; Humphreys, Rich, & Davey, 1985). The basic problem seems to be that the Piagetian approach was conceptualized for the study of the acquisition of cognitive behaviors in childhood. Without extensive reconceptualizations (Schaie, 1977/1978) it remains therefore of limited value in explaining maintenance and decline or reorganization of cognitive structures in adulthood.

Quite different limitations adhere to the utility of switching directly to an information-processing approach as our preferred basic measurement system. Information-processing studies may tell us much about the mind's processes and capabilities in optimally functioning individuals such as college students. Much of the work to date, however, has been concerned with the investigation of response speed under various instructions but with the primary requirement that subjects had reached a uniform criterion level of accuracy. Such an approach may be rather problematic in work with average adults and the elderly. Many subjects, first of all, could never be brought to a reasonably high criterion level. But more important, speed of response may be an irrelevant predictor for real-life tasks in which the range of response speed required for an adaptive response may be quite wide (Sternberg, 1984). As pointed out by others, any real-life situation would involve a rather wide array of componential processes, any one of which would show only low correlation with a specific criterion task (e.g., Egan, 1978, 1981). While we certainly should continue to explore the possibilities of componential analyses with older persons, it seems that the laboratory tasks used in the classical information-processing studies may not be best suited for our purposes.

What is at issue here is that we need predictors that represent the skills required to produce intellectual *products* rather than the *processes* that lead to their acquisition. Second, the basic ability measures to be used must be efficient markers of the ability factors to be assessed to permit test batteries short enough for pragmatic assessment conditions. Third, we need to identify a limited set of factors that is likely to reproduce as much individual difference variance in as many classes of real-life behaviors as is possible. And fourth, we need measures that

have been tested on and adapted for the entire spectrum of adults, well into the old-old age range. I would like to suggest that these considerations imply that it should be possible to identify some subset from the broad spectrum of psychometric abilities that is likely to provide the most useful predictors of everyday competence.

PSYCHOMETRIC ABILITIES AS PREDICTORS OF REAL-LIFE COMPETENCE IN THE ELDERLY

Three distinct lines of inquiry will now be mentioned briefly that may be pertinent to the provision of the required assessment system. The first is concerned with identifying a suitable subset of ability measures. In this context, I would only remind the reader that I and my associates have studied the performance of adults and the elderly on the five mental abilities identified by Thurstone (1938) as accounting for the largest amount of individual difference variance in intellectual performance for the past three decades (Schaie, 1979, 1983). In addition to obtaining normative data on age changes and age differences it has also been possible to show that the structural properties of the mental abilities are well maintained across the adult life span (Hertzog & Schaie, 1986). This work has now culminated in the publication of a revision of the Thurstone tests suitable for adults and the elderly with extensive norms and other data on the psychometric characteristics of the updated battery that was named the *Schaie-Thurstone Test of Adult Mental Abilities (STAMAT)* (Schaie, 1985). The STAMAT battery includes the following five variables: (a) *Recognition vocabulary* is the ability to comprehend spoken and written language. (b) *Spatial orientation* is the ability to mentally rotate spatial concepts such as might be involved in translating information provided by maps into driving behavior. (c) *Inductive reasoning* involves the identification of a rule or general principle from specific instances. (d) *Number* assesses the ability to manipulate quantitative information. (e) *Word fluency* involves vocabulary recall and indicates proficiency at active verbal communication. Also used in our current work are other fluid-ability measures that come from the ETS Reference Kit of factors (Ekstrom et al., 1976) or derive from the ADEPT project (Baltes & Willis, 1982). Some of these provide alternative modes of assessing verbal ability and inductive reasoning. Others provide factor markers for some additional ability constructs including *figure relations*, the ability to analyze relationships among visual patterns; *memory span*, the ability to retain numerical symbols and meaningful words in short- and long-term storage; *social knowledge*, the ability to ascertain critical aspects and nuances of social interactions; and *perceptual speed*, the ability to make

quick perceptual discriminations and translate these into a motoric response. Further work is in progress to collect normative data on these additional ability markers over the adult age range from the 20s to the 80s.

The second line of inquiry consisted of the development of a situational taxonomy for the elderly. Four major attribute dimensions were identified (social/nonsocial, active/passive, supportive/depriving, common/unusual) and a Q-sort instrument was developed to permit ratings of relative perceived competence in prototypic situations (Scheidt & Schaie, 1978). Stability characteristics of this instrument have been studied over a three-year period (Gilewski & Schaie, 1984), and appropriately sized correlations have been demonstrated with the abilities of inductive reasoning and spatial orientation (Schaie et al., 1982; Willis & Schaie, 1986). The relationship of this instrument to a full ability battery still remains to be investigated.

A third, even more promising line of inquiry is concerned with relating psychometric abilities to an instrument that consists of prototypic items for several classes of everyday activities, the ETS Basic Skills Test (Educational Testing Service, 1977). An initial study based on the ADEPT data showed substantial correlations of psychometric abilities, particularly of fluid-ability markers, with the real-life criterion measure in a group of rural elderly (Willis & Schaie, 1983b). Similar data were collected on a somewhat different ability battery as part of our cognitive training inquiry (Schaie & Willis, 1986; Willis & Schaie, 1983a) on a larger group of urban elderly. In the latter study, substantial correlations were shown between the Basic Skills Test and the latent psychometric constructs of inductive reasoning, verbal ability, and perceptual speed. Normative data on the matrix of relationships between psychometric abilities and real-life tasks have also been collected for a large sample (over 1,300 participants) covering the adult age range from the 20s to the 80s as part of the fifth wave of the Seattle Longitudinal Study, for which data collection has just been completed. The availability of this large data set will now make it possible to examine more closely just how performance on individual everyday tasks may depend on the cognitive dimensions described within the psychometric ability framework.

SUMMARY

It is argued that prediction of competent everyday behavior in adults and the elderly, assuming multiple criteria for both tasks and situations, can best be accomplished by concentrating on ability subsets derived from a Thurstonian structure of intellect model. Piagetian approaches

are considered too complex and relevant specifically to the acquisition of cognitive structures. Information-processing paradigms are considered useful for obtaining an understanding of the components of psychometric performance, but seem to be at too detailed a level to be useful for the prediction of the cognitive products involved in everyday competence. Finally, some work was described that begins to investigate the network of relations between psychometric abilities and everyday competence in adults and the elderly.

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