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11 Practical intelligence in later adulthood

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Some eight decades have passed since Binet's seminal research on the assessment of human intelligence (Binet & Simon, 1905), yet discussion on the nature of intelligence and its measurement continues. During the past two decades, the volume of research on traditional or "academic" forms of intelligence has increased with the refinement of new approaches (i.e., artificial intelligence, information processing) to the study of the phenomenon. Recently, there has been considerable debate regarding the relevance of traditional conceptions of intelligence for the study of practical, everyday intellectual competence (Connolly & Brunner, 1974; McClelland, 1973; Schaie, 1978; Sternberg, 1981; Willis & Baltes, 1980). Some argue that traditional conceptions of intelligence can serve as a useful basis for studying intelligence in real-world contexts; others question their applicability to contextually relevant forms of intelligence. From a historical perspective, these criticisms seem ironic, given the very appplied concerns of Binet in developing those early psychometric measures.

The issue of the nature of practical intelligence and its relationship to traditional conceptions of cognition is particularly salient in the study of intellectual aging. The ecological relevance of traditional conceptions of intelligence has been demonstrated most clearly for the earlier portion of the lifespan, when schooling is a major developmental task. Psychometric measures have been shown to predict performance in academic settings (Anastasi, 1976). Societal changes, including the extension of schooling into the period of young adulthood and the increase in the proportion of the labor force in professional occupations, have also contributed to the sustained use of academic intelligence measures. Performance on traditional intelligence tests (Egan, 1978; Hills, 1957; Smith, 1964) has been shown to be a useful predictor of entry-level competence in a number of professions (e.g., engineering, piloting, computer programming). However, in later adulthood neither academic performance nor entry-level work-related skills are useful criterion tasks for studying practical intelligence. During that age period, intellectual functioning is reflected in social competence and in tasks of daily living.

Thus, the relevance of traditional forms of intelligence to everyday functioning in old age is of particular concern.

One of the ambiguities in studying practical intelligence is that there is no commonly agreed-upon definition for the term. Generally, researchers can more readily agree upon what it is *not*. For example, it is said to be different from traditional or academic intelligence. Our research has focused on real-life type tasks that may be experienced by a particular community-dwelling age cohort in the pursuit of daily living. It should be noted, however, that other researchers are studying forms of optimal cognitive functioning in adulthood that may also be considered a form of practical intelligence. In work on gerontological intelligence, numerous attempts have been made to define, assess, and study the concept of wisdom (Clayton, 1975, 1980; Dittman-Kohli & Baltes, in press; Meacham, 1982). Others are attempting to define and study stages of cognitive functioning specific to adulthood and beyond formal operations (Commons, Richards, & Armon, 1982; Labouvie-Vief, 1982; Sinnott, 1982). Sternberg's "nonentrenched tasks" may also involve the notion of optimal levels of functioning, since they are said to require new conceptual systems of thought. The relationships between traditional intelligence and these new conceptions of optimal functioning should be differential.

This chapter considers the relevance of the psychometric approach to the study of everyday intellectual functioning in later adulthood. First, we will discuss what we believe to be some of the merits of a psychometric abilities approach to the study of practical intelligence in later adulthood. Second, we will consider the specification of criterion tasks for assessing real life intelligence in old age. Third, the findings of two studies examining the relationship between psychometric abilities and everyday cognition in the elderly will be reported. The first of these studies focuses on actual performance in every day tasks; the second study examines perceptions of competence. Finally, we will discuss issues and directions for future research in this area.

Psychometric abilities and practical intelligence in old age

Mainstream cognitive psychology has studied traditional or "academic" intelligence by means of three major approaches using either psychometric, Piagetian, or information processing paradigms (Eysenck, 1982; Resnick, 1976; Sternberg, 1982). Each of these approaches, with its many variations, addresses a different set of issues regarding intellectual functioning. A primary concern of the psychometric approach is the examination of individual differences among persons on a set of mental ability factors, derived through factor analytic procedures. The study of adult intelligence from a psychometric approach has been primarily concerned with quantitative changes in the individual's level of performance across the lifespan and with age-related qualitative changes in the structural relationships of the abilities. The Piagetian perspective provides a description of stages in cognitive development during childhood and adolescence. The information processing approach is concerned with the way in which people mentally represent and process information; the focus is on developing componential or process models of how individuals process information across a variety of settings and stimuli. In contrast to the emphasis of psychometric models upon between-subject variability, the information processing perspective focuses on between-stimulus variance.

Given these three paradigms for the study of traditional intelligence, how shall we approach the study of practical intelligence in later adulthood? At what level of analysis might practical intelligence be most profitably examined? Because the three paradigms evolved in response to different issues regarding the development and nature of traditional intelligence, it appears reasonable that they may also be of differential value in the study of practical intelligence at different life stages. Within the past two decades, strong concerns have been raised regarding the limitations of the psychometric approach's focus on the products of behavior (McClelland, 1973; Sternberg, 1980; Willis & Baltes, 1980). Consequently, much recent research in cognitive psychology has either followed Piaget's quest for accurate description of the origin and transformation of cognitive structures in childhood, or has sought to apply information-processing strategies to develop fine-grained portrayals of the components and timing of effortful behavior. The strengths of the Piagetian and information processing approaches are most obvious when the focus is on the emergence or acquisition of behaviors or on optimal level of functioning under speeded conditions, most commonly occurring in early life (Hooper, Hooper, & Colbert, 1984; Sternberg, 1982). However, when we consider the nature of practical intelligence in later adulthood, the focus is then primarily not upon emergent behaviors, but on previously acquired, intact abilities and skills.

We believe that there are some inherent limitations to the application of existent Piagetian and information processes to the study of everyday functioning in later adulthood. A number of students of adult development have attempted to conceptualize further Piagetian stages that might account for qualitatively different aspects of intellectual functioning beyond young adulthood, but the question remains whether there are cognitive transformations in adulthood that lead to even near-universal stages, based on assumptions of pure logic (Commons, Richards, & Kuhn, 1982; Flavell, 1970; Labouvie-Vief, 1980, 1982). 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 reconceptualization, it remains limited in its explanation of maintenance or decline or the reorganization of cognitive structures in adulthood (Hooper et al., 1984; Kramer, 1983; Roberts, Papalia-Finlay, Davis, Blackburn, & Dellmann, 1982).

Somewhat different limitations may exist when the information-processing approach is considered the basic measurement system for the study of practical intelligence in old age. First, many of the information-processing studies to date have examined the cognitive processes and capabilities of optimally functioning persons, such as college students. Much of the work has been concerned with response speed as the dependent variable, when studied under various instructional conditions, and with the primary requirement that subjects have reached a uniform criterion level of accuracy (Eysenck, 1982; Jensen, 1982; Sternberg, 1981). Such an approach may be problematic in work with average adults and the elderly. Many subjects may never be brought to a reasonably high criterion level. More importantly, speed of response may not be a relevant predictor for many real-life tasks wherein the range of response speed acceptable for an adaptive response may be quite wide (Cornelius, Willis, Nesselroade, & Baltes, 1983).

Second, there is the issue of whether a parsimonious set of componential processes has been identified that can be applied to a wide array of cognitive tasks (Detterman, 1980; Baron, in press). Any real-life situation would be expected to involve a wide array of componential processes; previous research suggests that any one of these components might have only a low correlation with the real-life criterion task (Egan, 1978, 1981).

In view of the above issues, we believe that there is merit in employing the psychometric approach as a basic measurement system in the study of practical intelligence in old age. The largest and richest research literature on adult intelligence has been couched within the psychometric approach (Botwinick, 1977). Virtually all longitudinal and cohort-sequential studies of adult intelligence involve the psychometric approach (Schaie, 1983). Thus, the psychometric approach provides the most complete data base on quantitative and structural developmental changes in adult intelligence, as they may apply to practical intelligence. Second, a well-defined and reliable measurement system is available for studying abilities at the construct level. A limited set of ability factors has been identified, which should be useful in accounting for as much individual difference variance in as many classes of real-life behaviors as possible (Baltes, Cornelius, Spiro, Nesselroade, & Willis, 1980; Schaie, 1983). Psychometric ability measures have been tested on and adapted for a broad spectrum of adults, including those in the old-old age range.

The criterion issue

A major issue in the study of practical intelligence is the identification of criterion tasks for assessing intelligent behavior in real-world contexts. For

Binet and those who followed there was a clear focus on the ecologically relevant criterion task of school performance. For the more basic researcher, however, the focus soon turned to theoretical issues regarding the structure of intelligence (Matarazzo, 1972). The criterion tasks became relatively pure measures of specific abstract components (i.e., mental abilities) of intelligence, rather than the complex tasks characterizing real life. A distinction emerged between competent performance on measures of these abstract "building blocks" of intellectual structure and the competencies involved in daily life (Connolly & Bruner, 1974; McClelland, 1973).

For the purposes of this chapter, we shall use the term "traditional intelligence" to denote those genotypic ability factors commonly identified with the psychometric approach to the study of structural intelligence. In contrast, practical intelligence will be viewed as the phenotypic expression of that combination of genotypic factors that, given minimally acceptable levels of motivation, will permit adaptive behavior within a specific situation or class of situations (Schaie, 1978). Since behavior in real-world contexts is of necessity complex, we assume that no single measure or genotypic factor can adequately predict performance in a specific situation, rather some composite of genotypic ability factors will best predict everyday performance in such a situation.

What, then, might be some useful parameters for defining a set of criterion tasks for assessing practical intelligence in later adulthood? Even brief reflection suggests that the criterion tasks will vary by age or life stage. With respect to childhood there appears to be considerable consensus regarding the near-universal biologically and societally defined developmental tasks, that may serve as criteria for assessing practical intelligence. Across the adult life course, however, matters are complicated by increasing individual differences in the range of environments and experiences encountered (Schaie, 1983; Willis & Baltes, 1980). There appears to be no comparable, parsimonious set of near-universal developmental tasks in adulthood that have the situational generality and the biologically and societally defined age norms characteristic of developmental tasks identified in childhood, hence, the need for identifying *multiple* criterion tasks for assessing practical intellectual competence in various stages of adulthood. The nature of the criterial tasks, moreover, will vary not only by life stage, but across cohorts for any given life stage as well. For example, although relatively few of today's elderly are computer literate, we may expect that future generations of elderly will have interacted with a computer from childhood. A few other instances of cohort-specific forms of intellectual performance have been noted in the literature (Gardner & Monge, 1977; Looft, 1970).

A second parameter focuses on whether the form of practical intelligence studied reflects previously acquired skills and knowledge or is indicative of emergent, newly developed abilities. Because our focus is on the common everyday types of practical problem solving the elderly may experience, we are primarily concerned with the older adult's competence in applying previously acquired abilities and skills to new instances of a problem involving those skills, rather than with the emergence of new forms of thought. It should be noted, however, that those who are concerned with nontraditional forms of intelligence in later adulthood focus on optimal and unique forms of intelligent behavior in old age and are thus concerned primarily with newly emerging abilities and skills (Baltes, Dittman-Kohli, & Dixon, 1984; Kramer, 1983; Labouvie-Vief, 1982).

Berg and Sternberg (1985) have discussed related issues with regard to their triadic model of intellectual development in adulthood. The two-facet subtheory of the triadic model holds that tasks are differentially valid as measures of intelligence as a function of the familiarity of these tasks to the people performing them. Tasks are considered particularly appropriate for measuring intelligence when they are either relatively novel or in the process of becoming automatized. Of the three forms of novelty discussed by Berg and Sternberg (1985), it appears that the ability to operate within new conceptual systems is most likely to be associated with the development of optimal and/or unique forms of intelligence in young adulthood. The two other forms of novelty discussed (i.e., familiar problems involving novel stimuli, or application of previously acquired cognitive operations in new contexts) may occur more frequently in the common everyday problem solving exhibited by the elderly.

A third parameter deals with the distinction between explicit versus implicit conceptions of intellectual competence. Explicit theories of intelligence are developed by behavioral scientists, based on data examining individual performance on measures of intellectual functioning. Implicit theories may involve both laypersons' conceptions of competence and their perceptions of their own intellectual competence (Sternberg, Conway, Ketron, & Bernstein, 1981); perceived competence has also been related to intellectual self-efficacy (Bandura, 1982; Lachman & Jelallian, 1983). Just as there are wide individual differences in people's performance on measures used in explicit theories of intelligence, there is considerable variability in people's perceptions of the areas in which they consider themselves intellectually competent.

How then shall we derive criterial tasks for assessing practical intelligence specific to the stage of later adulthood? Our own research has employed two distinct approaches. One approach proceeds from the assumption that certain classes of everyday activities are critical for adaptive functioning in given life situations. A major concern in old age is maintenance of independent living, and the activities in this approach focus on tasks associated with independent effective functioning. For example, inability to perform tasks, such as comprehending a medicine bottle label or utilizing information in the yellow pages of a phone directory, may lead to the curtailment of independent living for many elderly. Although no exhaustive taxonomy of real-life tasks has thus far been developed at any life stage, measures have been designed to tap substantial subsets of such a taxonomy. These real-life tasks represent categories of common problems experienced by many elderly, even though specific stimuli in the test item might not have been encountered previously. It is assumed that the person applies the same relevant cognitive skills and information to the test item that he/she would in a real-life problem. It is difficult, if not impossible, to observe directly an elderly subject's performance in many real-life situations; thus, these task items attempt to simulate the way in which an elderly person might perform in daily life. In developing prototypical problems, it is important that the items indeed represent categories of situations experienced by the elderly, as documented in the gerontological research literature, and that the problems have high face validity and appear to be meaningful and relevant to the older adult.

Our second approach to the development of criterion tasks has involved the specification of a situational taxonomy for the adequate description of the kind of settings within which older adults exhibit behavioral competence. Effective functioning in different situations may demand various combinations of intellectual abilities. Moreover, situational taxonomies must be specific to a particular life stage. In this approach, a set of situations relevant to but not necessarily peculiar to the life experiences of urban older adults was developed; these situations were classified according to a taxonomy of situational dimensions (Scheidt & Schaie, 1978). Two studies that used these two approaches to the study of practical intelligence in later adulthood are briefly summarized below.

Study I. Fluid/crystallized ability correlates of practical intelligence

The objective of this study was to examine the relationship between older adults' performance on tasks of daily living and an established structural model of psychometric intelligence. The fluid-crystallized model (G_f-G_c) of intelligence is of particular interest in later adulthood, given the differential developmental patterns predicted for the two intelligence dimensions (Cattell, 1971). Fluid intelligence is said to develop in childhood and to peak in young adulthood; a normative pattern of decline is assumed to occur through middle and later adulthood. Crystallized intelligence is thought to remain relatively stable or even to increase through much of adulthood. Seven primary mental abilities were chosen to represent the G_f-G_c dimensions. Fluid intelligence is represented by primary abilities such as figural relations and

inductive reasoning. Crystallized intelligence is represented by such abilities as vocabulary and social knowledge.

The primary purpose of the research was to identify differential sets of predictors for the various real-life tasks categories. The specific abilities identified as predictors were expected to vary with the type of real-life task studied. Although most of the abilities studied were hypothesized to be significantly correlated with the real-life tasks, given the phenomenon of positive manifold, it was expected that different sets of abilities would be found to have the greatest shared variance with the various real-life tasks.

The question then arises as to the nature of the ability predictors when considered at the second-order level of fluid versus crystallized intelligence. Hypotheses were derived from the G_f-G_c theory regarding the relative importance of these two second-order dimensions in predicting performance on everyday tasks. It was hypothesized that the predominant pattern of ability predictors would be crystallized rather than fluid. Crystallized intelligence involves knowledge and skill acquired through acculturation; it is thus closely related to specific content matter and to skills (e.g., defining vocabulary words, simple mathematics) acquired in schooling. By contrast, fluid abilities are said to be relatively content free; rather, G_f focuses on the ability to identify and apply complex relationships in solving problems. As most of the real-life tasks studied involved specific types of content, required verbal ability (e.g., reading medicine bottle labels, comprehending newspaper text), and dealt with relatively common types of experiences, it was expected that the most significant predictors of real-life tasks would be crystallized in nature, although the specific G_c ability identified as a predictor was expected to vary with the content of the real-life task.

Method

Subjects. Subjects were eighty-seven (F,68; M,19) community-dwelling older adults ($\bar{X}$ age: 68.6 years; range: 60–88 years) from rural areas of Pennsylvania. Mean educational level was 11.9 years (range: 6–19 years). Subjects were recruited through community organizations and were paid ($2 per hour) for their participation.

Procedure and measures. Subjects were administered an extensive battery of psychometric ability measures and a real-life tasks measure in two testing sessions. The psychometric ability battery, shown in Table 1, was selected to represent the seven primary abilities of Figural Relations (CFR), Inductive Reasoning (I), Vocabulary (V), Verbal Analogies (CMR), Social Knowledge (EMS), Memory Span (Ms), and Perceptual Speed (Ps). A composite score was computed for each primary ability by summing the total scores for the

Table 1. *Measurement battery.*

Primary ability	Test[a]	Source
Figural Relations (CFR)	Culture Fair Test (scale 2, form A), Power Matrices (scale 3, Form A & B)	Cattell & Cattell (1957)
	ADEPT Figural Relations	Plemons et al. (1978)
	Raven's Progressive Matrices	Raven (1962)
Inductive Reasoning (I)	Induction Standard Test	Ekstrom et al. (1976); Thurstone (1962)
	ADEPT Induction Test	Blieszner et al. (1981)
Memory Span (Ms)	Visual Memory Span	Ekstrom et al. (1976)
	Auditory Number Span	Ekstrom et al. (1976)
	Auditory Number Span-Delay	After Ekstrom et al. (1976)
Verbal Analogies (CMR)	Verbal Analogies I	Guilford (1969a)
	Word Matrix	Guilford (1969b)
Social Knowledge (EMS)	Social Translations	O'Sullivan & Guilford (1965)
	Social Situations	Horn (1967)
Vocabulary (V)	Verbal Meaning (9–12)	Thurstone (1962)
	Vocabulary (V-2,V-3,V-4)	Ekstrom et al. (1976)
Perceptual Speed (Ps)	Finding A's	Ekstrom et al. (1976)
	Number Comparison	Ekstrom et al. (1976)
	Identical Pictures	Ekstrom et al. (1976)

[a] Induction and Vocabulary are composites of several subtests. Induction Standard and ADEPT Induction include subtests of Letter Sets, Letter Series, Number Series. Vocabulary includes subtests V-2, V-3, V-4 (Ekstrom et al., 1976).

tests representing that ability. Composite scores were used in the correlational and multiple regression analyses to be reported, as they provided more reliable estimates of the abilities.

Real-life task performance was assessed by the ETS Basic Skills Test (1977). This sixty-five-item measure was developed to assess real-life competencies achieved by high school seniors. However, examination of the items indicated that they dealt with tasks encountered by adults of all ages. A total score and two subscores (Literal and Inference) are typically obtained (Educational Testing Service, 1977). The split-half reliability (KR 20) of the total score is .94. Literal comprehension items involve responses based on information present in the item stem, whereas inference items require logical induction of answers from the material presented. We were also interested in whether different abilities were associated with different types of tasks (e.g., interpreting medicine bottle labels versus reading newspaper editorials). To examine this question, the sixty-five items were clustered into eight item categories on the basis of item content and format. The eight categories were understanding labels on household articles, reading a street map, understanding charts/schedules, paragraph comprehension, filling out

forms, reading newspaper and phone directory ads, understanding technical documents, and comprehending newspaper text. The number of test items per category ranged from four to twelve. Correlations between category scores and total score were all above .70, except for map reading ($r = .41$).

An exemplar item from each category is given below:

Labels. Subject is shown the label from a plant insecticide container and asked, "How much spray should be mixed with a gallon of water?"

Maps. Subject is shown a street map and asked, "What route should you take to get to Salem College from the airport?"

Charts. Subject is shown a chart of daily dietary allowances and asked, "About how many calories does a seventy-two-pound girl need each day?"

Paragraphs. Subject is shown a paragraph about symptoms of a heart attack and asked, "What was the main theme of the passage?"

Forms. Subject is shown a portion of an income tax form and asked, "If you are getting a refund, on which line should you write the amount you are getting back?"

Advertisements. Subject is shown a page from the Yellow Pages of a telephone book and asked, "Which number could you call to buy fish for dinner?"

Technical documents. Subject is shown a guarantee for a calculator and asked, "The calculator is guaranteed for (how many days)?"

News text. Subject is shown two letters to the editor of a newspaper and asked, "Both writers agree on which of the following points?"

Results. The relationship between ability functioning and performance on the Basic Skills test was examined at three levels. First, the correlations among the Basic Skills scores (total, literal, inference) and ability composite scores were computed. All ability and Basic Skills scores were significantly correlated. However, the correlations ranged from .18 to .83, indicating a wide range in the magnitude of the ability – task relationships.

A second set of analyses examined the relationship between the Basic Skills total score and a preestablished structural model of intelligence. In previous research (Baltes et al., 1980; Cornelius et al., 1983), the structure of the ability battery used in the present study had been examined via confirmatory factor analysis. A four-factor model, shown in the upper part of Table 2, was identified as the most appropriate model, based on statistical and conceptual criteria. The four intelligence dimensions identified were: fluid reasoning, crystallized knowledge, memory span, and perceptual speed. The relationship of the Basic Skills test to these four ability factors was examined via extension analysis (Table 2). The Basic Skills test was found to have a primary loading on the fluid reasoning factor (.58) and a secondary loading on the crystallized knowledge factor (.29).

The third level of analysis was concerned with the abilities associated with specific real life task categories. Stepwise multiple regression analyses were performed for the Basic Skills total, literal, inference, and the eight task cat-

Table 2. *Extension analysis of four-factor G_f-G_c model and ETS basic skills test.*[a]

Variable	Factor[b] 1	2	3	4	Unique variance
Culture Fair (CFR)	0.800	0.0	0.0	0.0	.360
ADEPT Fig. Rel. (CFR)	0.827	0.0	0.0	0.0	.316
Raven's Matrices (CFR)	0.788	0.0	0.0	0.0	.378
ADEPT Induction (I)	0.885	0.0	0.0	−0.054	.294
Induction Standard (I)	0.868	0.0	0.0	0.0	.247
Verbal Analogies (CMR)	0.718	0.0	0.0	0.0	.484
Word Matrix (CMR)	0.676	0.0	0.0	0.0	.543
Social Translations (EMS)	0.592	0.0	0.0	0.0	.650
Social Situations (EMS)	0.336	0.422	0.0	0.0	.489
Verbal Meaning (V)	0.0	0.988	0.0	0.0	.024
Vocabulary (V)	0.0	0.908	0.0	0.0	.175
Visual Memory Span (Ms)	0.0	0.0	0.638	0.0	.572
Aud. Number Span (Ms)	0.0	0.0	0.668	0.0	.554
Aud. Number Span (Delay)	0.0	0.0	0.966	0.0	.066
Finding A's (Ps)	0.0	0.0	0.0	0.637	.594
Number Comparison (Ps)	0.0	0.0	0.0	0.747	.442
Identical Pictures (Ps)	0.0	0.0	−0.039	0.862	.284
ETS Basic Skills Test	0.577	0.287	−0.073	0.168	.156
1. Fluid Reasoning	1.000				
2. Crystallized Knowledge	0.773	1.000			
3. Memory Span	0.606	0.490	1.000		
4. Perceptual Speed	0.815	0.669	0.437	1.000	

[a] χ^2 (248) = 315.997, p = .0008.
[b] Underscored factor loadings are significant.

egory scores. The seven ability composite scores, age, and education were the predictor variables. As expected, both fluid and crystallized abilities were found to be predictors of the total, literal, and inference scores. The most significant predictor variable for five of the eight task categories was a fluid ability.

An index of level of difficulty was also computed for the eight task categories. The mean percentage of items answered correctly in each task category was computed (mean items correct divided by total items in category). The mean percentage of items answered correctly per category was understanding labels (67%), reading maps (74%), understanding charts (66%), paragraph comprehension (63%), filling out forms (63%), reading ads (64%), technical documents (54%), news text (25%). The lower level of performance on items involving news text is attributable to the fact that most items within

this cluster occurred toward the end of the Basic Skills test and were attempted by only 32% of the subjects.

A final question focused on the frequency with which subjects encountered the types of tasks included on the Basic Skills test. Subjects were presented with verbal descriptions of tasks from each of the eight task categories and asked to rate how often they did these tasks on a five-point scale (daily, weekly, monthly, rarely, never in the past year). For five of the task categories (labels, charts, ads, news text, paragraphs), subjects reported doing those types of tasks at least weekly, on average. The average frequency rating for the forms category was monthly, and for technical documents and maps the frequency rating was rarely.

Discussion. The primary focus of this study was the examination of differential ability–real-life task relationships. Given the phenomenon of positive manifold, it was expected and found that there were significant correlations among the abilities and all task categories. Research across the life-span has indicated a positive correlation among psychometric abilities (Anastasi, 1976); moreover, several studies suggest that the covariance among ability factors increases in later adulthood (Baltes et al., 1980; Cunningham, 1980; Reinert, 1970). In order to identify differential sets of ability predictors for various task categories, it was necessary to go beyond simple correlational procedures and to examine the amount of variance shared between the primary abilities and tasks, via extension and regression analyses.

In the extension analysis, the relationship between the Basic Skills total score and the preestablished intellectual dimensions (factors) of fluid reasoning, crystallized knowledge, memory span, and perceptual speed was examined. It was hypothesized that the Basic Skills test would load on both fluid and crystallized intelligence factors, given the phenomenon of positive manifold, and the fact that real-life tasks are complex and would be expected to share variance with multiple primary abilities. However, our concern was with the relative size of the loadings on the fluid and crystallized factors. We predicted that the most significant loading would be on the crystallized factor with a secondary loading on the fluid factor. Our hypothesis was not confirmed, however. The Basic Skills measure loaded primarily on the fluid reasoning factor and secondarily on the crystallized knowledge factor.

Regression analyses were conducted in order to examine the ability predictors of the eight task categories (Table 3). It was predicted that multiple abilities would be identified as predictors for each task category and also that the specific ability predictors would vary according to task category because of the differing content of categories. Moreover, we hypothesized that for most task categories, the most salient predictor ability would be crystallized, although the specific crystallized ability accounting for the most shared variance would vary across the categories depending on content.

Table 3. *Summary of multiple regression analyses: seven primary abilities, age, and education as predictor variables.*

Criterion variable	Significant predictors	*F*	r^2	Mult *R*
Total score	Figural Relations	8.43	.80	.89
	Vocabulary	7.13		
	Social Knowledge	5.06		
Literal score	Figural Relations	7.42	.74	.86
	Vocabulary	5.44		
	Perceptual Speed	4.04		
Inference score	Figural Relations	8.02	.78	.88
	Social Knowledge	6.21		
	Vocabulary	5.14		
Labels	Inductive Reasoning	9.06	.51	.71
	Verbal Analogies	3.28		
Maps	Figural Relations	5.67	.28	.52
Charts	Figural Relations	7.39	.52	.72
Paragraphs	Vocabulary	8.49	.64	.80
	Social Knowledge	7.59		
Forms	Figural Relations	8.25	.59	.77
Ads	Figural Relations	5.88	.49	.70
Tech. documents	Social Knowledge	8.10	.70	.83
	Figural Relations	6.50		
	Vocabulary	2.97		
News text	Education	11.13	.58	.77
	Perceptual Speed	8.77		
	Verbal Analogies	3.75		
	Vocabulary	3.27		

Again, our hypotheses were only partially confirmed. Multiple ability predictors were found for four of the test categories; a single ability predictor was identified for the remaining four categories. For five of the eight task categories (labels, maps, charts, forms, and ads), the most significant ability predictor was a fluid ability. Paragraph comprehension was the only task category for which only crystallized abilities were the significant predictors. The task categories of labels and technical documents included both fluid and crystallized predictors. The finding of perceptual speed as a significant predictor of the news text category is congruent with the fact that only 32% of the subjects completed the news text items that appeared toward the end of the measure.

It is noteworthy that age was not found to be a significant predictor in any of the regression analyses. Education was a significant predictor only for the news text category; this finding must be interpreted with caution, given the small percentage of subjects answering these items. Although age and education are not identified as significant predictors in most analyses, this does not indicate that these variables are uncorrelated with practical tasks. Age and education are index variables and provide little information on the specific factors or processes associated with practical intelligence; in this case they accounted for little additional variance once that associated with the primary abilities was extracted.

In summary, the data suggest strong relationships between traditional psychometric intelligence measures and performance by the elderly on a variety of practical tasks. The correlation between the Basic Skills total score and Figural Relations, a relatively "pure" G_f ability, was .83; the correlation with vocabulary was .78. The magnitude of these correlations are on the order of those found among the primary abilities; moreover, significant proportions of variance associated with practial task performance was accounted for by these abilities (Table 3). It should be noted that the correlations among abilities and between abilities and the Basic Skills test are somewhat higher than might be expected in younger age groups; these higher correlations are congruent with the greater covariances found in previous cognitive aging research.

Study II: age differences in perceived competence in everyday situations and ability correlates

The second study focused on age differences in the perception of competence in dealing with situations experienced by the elderly. Ability correlates of these perceptions of competence were also examined. In addition to focusing on implicit rather than explicit models of intelligence, this study involved a different approach to the conceptualization of criterion tasks of practical intelligence, and was rooted more directly in a contextual view of cognitive functioning. It was assumed that situations involving intellectual competence would vary with the developmental level of the individual and the idiosyncratic changes occurring across the individual's life course and roles. Given the wide individual differences in life experiences in adulthood, it was assumed that there was no one plausible criterion situation, but that the attributes of multiple situations in which intellectual competence was displayed would need to be examined. A Q-sort measure involving a taxonomy of situations commonly experienced by the elderly (Scheidt & Schaie, 1978) was used to examine age differences in a person's perceived competence in these situations.

Method

Subjects. Participants were 234 adults, divided into four age groups: young (n = 27, $\bar{X}$ age = 33.6 years, SD = 1.9, range: 29–36); middle-aged (n =

68, $\bar{X}$ age = 59.5 years, SD = 2.8, range: 53–64); young–old (n = 86, $\bar{X}$ age = 69.7, SD = 2.5, range: 65–74); and old–old (n = 53, $\bar{X}$ age = 78.2, SD = 2.7, range: 75–84). There were 110 men and 124 women. Subjects were members of a health maintenance organization in southern California. Quota sampling resulted in approximately equal representation of the membership for all groups except the oldest birth years. As expected, there was a significant difference in education among the groups given the cohort differences: young ($\bar{X}$ = 16.3 years); middle-aged ($\bar{X}$ = 14.1 years); young – old ($\bar{X}$ = 12.8 years); old – old ($\bar{X}$ = 11.3 years). There was a significant difference between the middle-aged and young sample in self-reported health; the middle-aged and the two elderly samples did not differ significantly.

Procedure and measures. Subjects were administered a battery of ability tests plus a measure of perceived situational competence in a two and one-half hour session. The seven ability tests involved in the present analyses represented four primary abilities: Spatial Orientation: PMA Space (Thurstone, 1948); Object Rotation (Krauss, Schaie, & Quayhagen, 1980; Schaie, 1985); Inductive Reasoning: PMA Letter Series (Thurstone, 1948); Word Series (Schaie, Gonda, & Quayhagen, 1981; Schaie, 1985); Vocabulary: PMA Verbal Meaning (Thurstone, 1984); Memory: Immediate Recognition Recall, Delayed Recognition Recall; Delayed Free Recall. Composite scores (sum of scores on marker tests) were formed for the Induction, Space, and Memory abilities to represent more stable markers of performance on these abilities.

Scheidt and Schaie (1978) developed a taxonomy of competency-requiring situations of daily living for a sample of community dwelling elderly. From interviews with more than 100 elderly subjects in a large metropolitan area, 300 situations of daily living were identified. Elderly judges rated each situation according to a set of situational attributes derived from the social–psychological literature. Four reliable attribute dimensions were identified: social–non social, active–passive, common–uncommon (for older persons), and supportive–depriving. A Q-sort instrument was then developed and validated that contains eighty prototypical situations, five for each of the sixteen possible attribute classes.

Examples of situations from eight of the sixteen attribute classes are given below:

Social–active–common–supportive: being visited by son or daughter and grandchildren
Social–active–common–depriving: pressured by a salesperson to buy merchandise
Nonsocial–active–common–supportive: gardening
Nonsocial–active–common–depriving; climbing steps to building entrance

Social–passive–common–supportive: seeking advice/aid from a friend
Social–passive–common–depriving: hearing from a friend that she or he is ill
Nonsocial–passive–common–supportive: browsing through family photo album
Nonsocial–passive–common–depriving: worrying about financial expenses

Subjects completed the Q-sort measure of perceived competency individually. They were instructed to rate each of the eighty situations as to how competent they would be to handle that situation. Situations were first sorted into the categories of most competence and least competence and in between. Situations were then subsorted into an eleven-point quasinormal distribution from least to most competent.

Results. First, we will discuss findings regarding age and gender-based differences in perceived competence on the situational dimensions studied. Second, we will examine ability correlates of perceived situational competencies. For the total sample, subjects perceived themselves to be somewhat more competent in Nonsocial, Common, and Supportive situations than in Social, Uncommon, or Depriving situations. Across the four major dimensions, the young and middle-aged groups reported greatest competence in Supportive situations and least competence in Depriving situations. The young–old and old–old groups reported greatest competence in Common situations and least competence in Uncommon situations.

Age differences in perceived competence. Age differences in perceived competence will be reported for the four main situational dimensions and for the two-way interactions. Significant age differences were found for all four of the main dimensions (Fig. 1). Significant positive age effects were found for the Social and Common dimensions. Significant negative age effects were found for the Active and Supportive dimensions. Given that ratings on one end of a dimension are the inverse of ratings on the opposite end of that dimension, it follows that there are positive age trends for the Passive and Depriving dimensions and negative age trends for the Nonsocial and Uncommon dimensions. When differences between successive age groups are examined, significant age differences between the young and middle-aged and the middle-aged and young–old are found for the Active–Passive and Common–Uncommon dimensions. The young and middle-aged differ on the Supportive–Depriving dimension. The young–old and old–old differ significantly on the Social–Nonsocial dimensions.

Turning now to the two-way dimension interactions, we found significant age differences on fourteen of the twenty-four possible two-way interactions (Table 4). For seven of these interactions, there is a positive age effect. The older age groups perceived themselves to have greater competence than did the young in Social–Common, Passive–Common, Passive–Depriving,

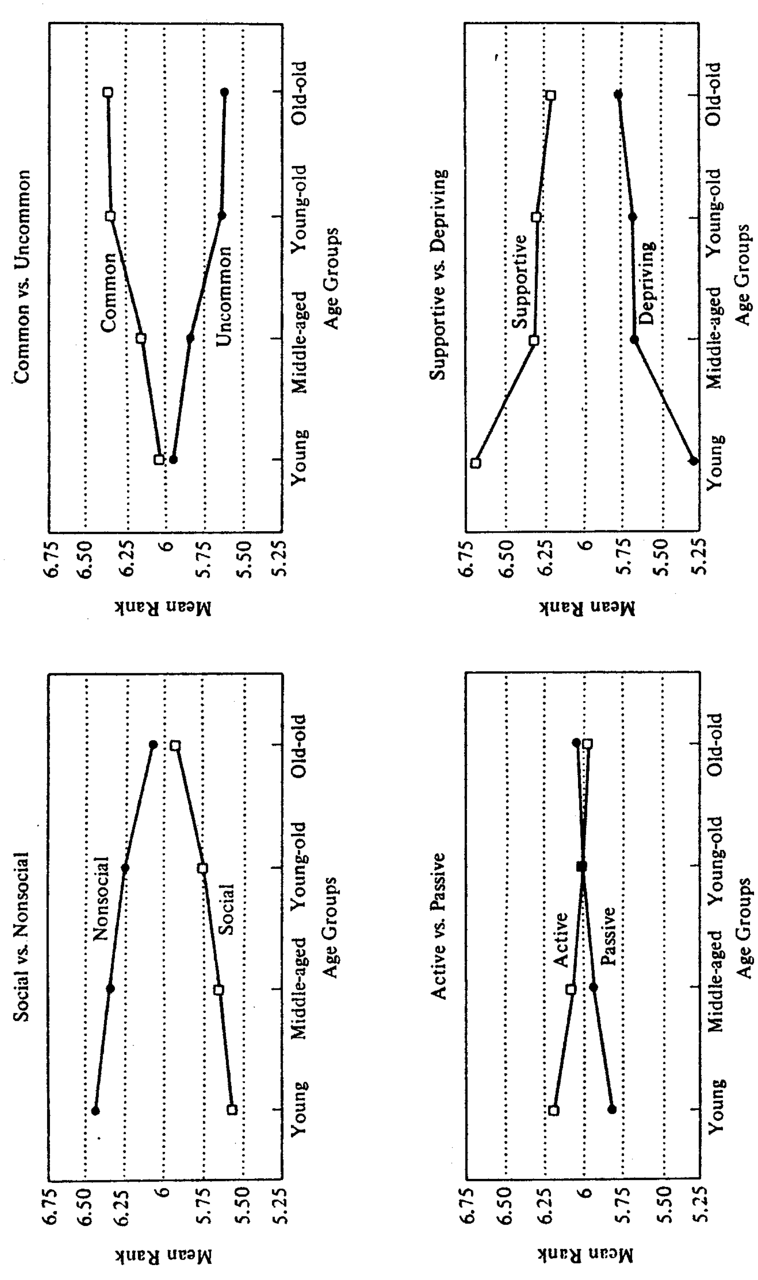

Figure 1. Age effects for main situational dimensions.

Table 4. *Significant age differences on two-way situational dimensions of perceived competence.*

Situational dimension	Young adult	Mean values: Middle-aged	Young-old	Old-old	*F* ratio	*p* value
Social–Passive	5.41	5.58	5.88	5.98	11.48	<.001
Nonsocial–Active	6.66	6.40	6.29	6.09	5.70	.001
Social–Common	5.43	5.77	6.05	6.29	20.28	<.001
Nonsocial–Uncommon	6.27	6.19	5.92	5.80	6.05	<.001
Social–Depriving	4.90	5.33	5.43	5.78	11.62	<.001
Nonsocial–Supportive	7.19	6.63	6.53	6.36	8.16	<.001
Active–Uncommon	6.10	5.86	5.57	5.56	10.62	<.001
Passive–Common	5.80	6.03	6.19	6.34	6.82	<.001
Active–Supportive	6.64	6.24	6.18	6.00	7.00	<.001
Passive–Supportive	6.76	6.36	6.43	6.38	2.64	.05
Passive–Depriving	4.89	5.52	5.57	5.70	9.35	<.001
Common–Depriving	5.53	5.84	5.91	6.06	5.64	.001
Uncommon–Supportive	6.88	6.15	5.98	5.74	19.28	<.001
Uncommon–Depriving	5.07	5.56	5.40	5.56	3.38	.02

Uncommon–Depriving, Social–Passive, and Social–Depriving situations. The younger age groups perceived themselves to have greater competence than did the old in Nonsocial–Uncommon, Active–Uncommon, Nonsocial–Active, Active–Supportive, Passive–Supportive, Uncommon–Supportive, and Nonsocial–Supportive situations. Figure 2 graphically presents two of these significant interactions.

Gender-based differences in perceived competence. Across all dimensions, men perceived themselves most competent in Nonsocial situations and least competent in Social situations, and women perceived themselves most competent in Supportive situations and least competent in Depriving situations. Gender-based differences were found for three of the four major dimensions. As would be expected, women perceived themselves more competent than did the men in Social, Common, and Supportive situations; men rated themselves more competent than did the women in Nonsocial, Uncommon, and Depriving situations. Significant gender-based differences were found for seventeen of the twenty-four possible two-way interactions (Table 5). Females perceived themselves to be more competent in Social–Common, Social–Uncommon, Passive–Common, Active–Supportive, Passive–Supportive, Common–Supportive, Social–Active, Social–Passive, and Social–Supportive. Age × gender interactions appear to be relatively minimal. The same pattern of significant gender-based differences (for the four major dimensions and the seventeen two-way dimensions) was found for persons over 60 years of age as for the total sample.

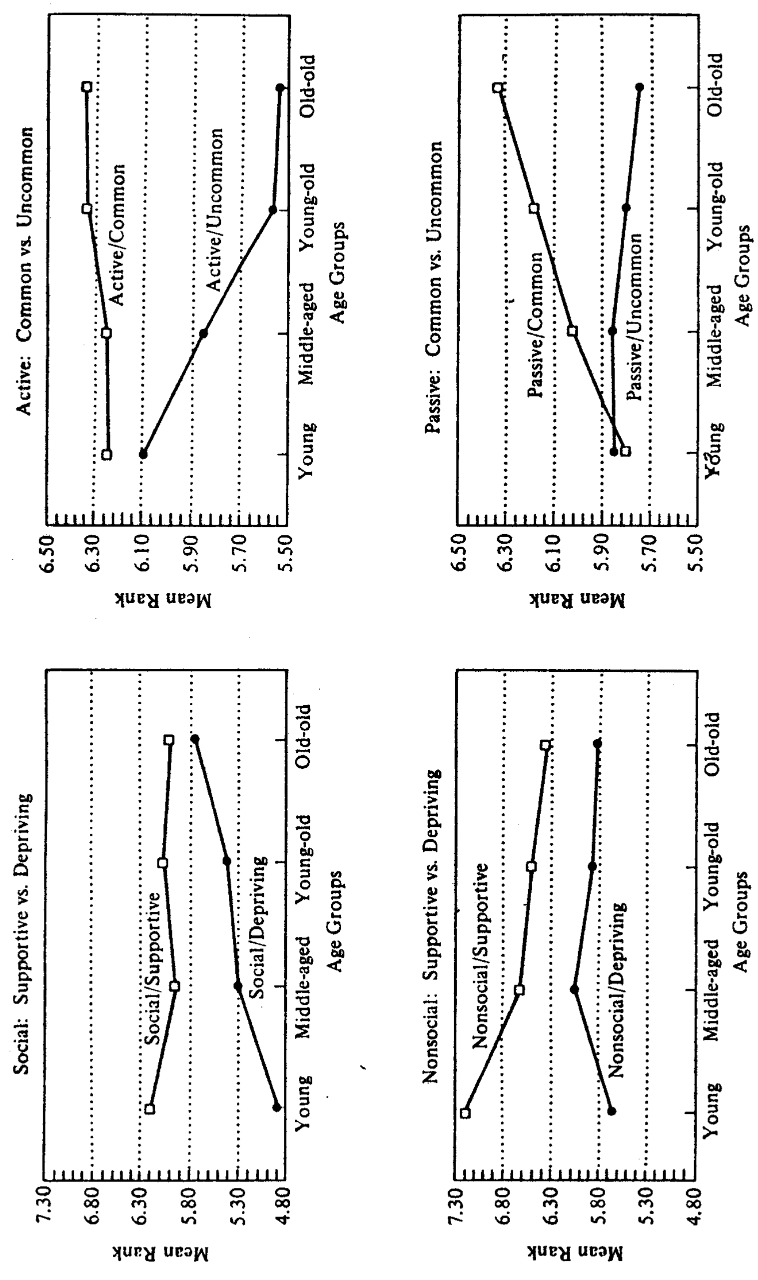

Figure 2. Age effects for two-way situational dimensions.

Table 5. *Significant gender-based differences on two-way situational dimensions of perceived competence.*

Situational dimension	Mean value Males	Females	*t* ratio	*p* value
Social–Active	5.62	5.78	6.91	.009
Social–Passive	5.59	5.91	20.05	<.001
Nonsocial–Active	6.42	6.23	5.04	.02
Nonsocial–Passive	6.30	6.08	12.26	<.001
Social–Common	5.81	6.08	13.87	<.001
Social–Uncommon	5.41	5.61	10.24	.002
Nonsocial–Uncommon	6.30	5.75	51.50	<.001
Social–Supportive	5.86	6.22	20.61	<.001
Nonsocial–Depriving	6.16	5.67	28.02	<.001
Passive–Common	5.96	6.29	20.03	<.001
Passive–Uncommon	5.94	5.70	14.26	<.001
Active–Supportive	6.12	6.29	4.60	.03
Passive–Supportive	6.30	6.56	9.75	.002
Active–Depriving	5.92	5.72	6.82	.009
Passive–Depriving	5.60	5.42	3.78	.05
Common–Supportive	6.39	6.72	13.93	<.001
Uncommon–Depriving	5.69	5.23	23.25	<.001

Ability correlates of perceived competence. The ability predictors of perceived competence were examined via a series of stepwise multiple regression analyses (Table 6). In all the regression analyses, four ability predictor variables were employed (PMA Verbal Meaning, Induction composite, Space composite, and Memory composite). The criterion variables were scores of perceived competence on the four major situational dimensions and the twenty-four two-way dimensions.

Significant predictors were found for the major dimensions of Social–Nonsocial and Active–Passive. Spatial ability was found to be the most significant predictor of perceived competence on these dimensions. Spatial ability is a positive predictor of competence in Nonsocial situations and a negative predictor of perceived competence in Social situations. That is, a low performance on Spatial ability is a significant predictor of perceived competence in Social situations. Spatial and Inductive Reasoning abilities are positive predictors of competence in Active situations; Verbal ability is a significant negative predictor of competence in Active situations. Conversely, Verbal ability is a positive predictor of competence in Passive situations, and Spatial and Reasoning abilities are negative predictors of competence in passive situations.

Significant predictors were identified for thirteen of the twenty-four two-way dimensions (Table 6). Spatial ability and Inductive Reasoning were each

Table 6. *Summary of multiple regression analyses: four primary abilities predictor variables.*

Criterion variable	Predictors	β	*F* ratio	r^2	Multi *R*
	Major dimensions				
Social	Vocabulary	.043	.31	.08	.27
	Induction	−.037	.16		
	Space	−.237	8.96		
	Memory	−.055	.48		
Active	Vocabulary	−.237	9.40	.12	.34
	Induction	.171	3.63		
	Space	.261	11.30		
	Memory	−.048	.38		
	Two-way dimensions				
Social–Common	Vocabulary	.060	.61	.09	.30
	Induction	−.148	2.67		
	Space	−.161	4.22		
	Memory	−.088	1.26		
Nonsocial–Uncommon	Vocabulary	−.012	.02	.07	.26
	Induction	.000	.00		
	Space	.275	11.96		
	Memory	−.059	.55		
Passive–Common	Vocabulary	−.017	.05	.05	.22
	Induction	−.085	.83		
	Space	−.190	5.58		
	Memory	−.122	2.29		
Active–Uncommon	Vocabulary	−.247	10.66	.11	.33
	Induction	.128	2.03		
	Space	.231	8.82		
	Memory	.090	1.39		
Active–Supportive	Vocabulary	−.142	3.33	.05	.23
	Induction	.231	6.16		
	Space	.064	.63		
	Memory	−.015	.03		
Passive–Uncommon	Vocabulary	.258	10.94	.05	.23
	Induction	−.060	.42		
	Space	−.064	.64		
	Memory	−.120	2.22		
Passive–Depriving	Vocabulary	.074	.91	.06	.24
	Induction	−.227	6.00		
	Space	−.058	.53		
	Memory	.000	.00		
Uncommon–Supportive	Vocabulary	−.015	.04	.08	.28
	Induction	.269	8.57		
	Space	−.012	.02		
	Memory	.047	.35		
Social–Passive	Vocabulary	.166	4.94	.13	.36
	Induction	−.207	5.37		
	Space	−.265	11.77		
	Memory	.060	.60		
Nonsocial–Active	Vocabulary	−.108	2.00	.09	.30
	Induction	.086	.88		
	Space	.256	10.59		
	Memory	.028	.13		
Social–Depriving	Vocabulary	.012	.03	.08	.29
	Induction	−.122	1.79		
	Space	−.197	6.22		
	Memory	−.017	.05		
Nonsocial–Supportive	Vocabulary	−.063	.65	.05	.22
	Induction	.247	7.06		
	Space	−.203	.08		
	Memory	.017	.05		
Nonsocial–Depriving	Vocabulary	.010	.02	.04	.20
	Induction	−.135	2.08		
	Space	.249	9.54		
	Memory	−.025	.09		

found to be significant predictors in eight situations. Verbal ability was a significant predictor in four situations, and Memory was a significant predictor in two situations. Spatial ability was found to be the most significant predictor in seven situations, Induction in four situations, and Verbal ability in two situations.

The question arises of whether there are age differences in the pattern of ability predictors for various situational dimensions. That is, do ability predictors of perceived competence vary by age/cohorts? Given the limited number of subjects in each of the four age groups, it was not possible to run separate regression analyses by age group. However, regression analyses on the subject sample over 60 years were computed and compared with findings for the total sample. Given the smaller number of subjects, there were fewer significant predictors found for the 60+ years sample. Where significant predictors were found, however, the pattern of predictors for the total and the older sample was quite similar.

Discussion

A primary purpose of this study was to examine age/cohort and gender-based differences in perceived competence on eighty situations of daily living, classified according to a taxonomy of situational dimensions. A secondary purpose of the study was to identify ability predictors of perceived competence for these situational dimensions.

Significant age differences in perceived competence were found for the four major situational dimensions and for fourteen of the two-way situational categories. With regard to the four major dimensions, significant positive age/cohort differences were found in perceived competence for Social, Common, Passive, and Depriving situations and negative age effects for the inverse dimensions of Nonsocial, Uncommon, Active, and Supportive. The onset of these effects across successive age/cohorts is also of interest, given that the timing of occurence differs by situational dimension. Since the findings on age differences for the two-way categories generally support the findings for the four major dimensions, our discussion will focus primarily on age differences for the four major dimensions.

The finding of the greater perceived adeptness of the elderly in social settings, when compared with other age/cohorts, is in agreement with the literature on the relevance and importance of social competence for the aged (Dittman-Kohli & Baltes, in press). Studies of self-efficacy (Lachman & Jelalian, 1984) have found the elderly to report greater perceived competence on tests of verbal ability, critical in social situations, than on tests of abstract fluid reasoning.

It should be further noted that the greatest difference in perceived competence between Social and Nonsocial situations occurs for the young sample. Young subjects perceive themselves to be significantly more competent in Nonsocial situations than in Social situations. The difference in ratings of perceived competence in Social and Nonsocial situations decreases with age. Many individuals spend greater amounts of time in solitary activity with increasing age (Gordon, Gaitz, & Scott, 1976); while valuing social competence they may perceive themselves to be equally competent in nonsocial situations.

Likewise, the finding that older age groups perceive themselves to be more competent in "common" situations is congruent with previous findings in the gerontological intelligence literature. A number of studies have reported little or no age differences in problem-solving or memory tasks involving content or skills familiar or commonplace to the elderly (Botwinick & Storandt, 1980; Hanley-Dunn & McIntosh, 1984). The strongest negative age effects occur on problem-solving tasks involving novel and abstract content. Pairwise comparisons of perceived competence between successive age groups indicate that the only significant difference occurs between the middle-aged and young–old samples. Restriction in the lifespace and increased routinization of daily activities attributable to retirement or to debilitating health occur with greater frequency during the transition from middle age to old age and may be associated with a decrease in perceived competence in Uncommon situations.

The negative age effect for perceived competence in Active situations is of particular interest because of its early occurrence. Note in Figure 1 that

the difference in perceived competence between Active versus Passive situations occurs only in young adulthood. There is little difference in ratings of perceived competence in middle or old age for Active versus Passive situations.

An unexpected finding was that older adult cohorts perceived themselves to be more competent in Depriving situations, compared with results among the younger cohorts. Again, note that this age difference occurs early, primarily between young adulthood and middle age. Having assumed increasing responsibilities across the life course and having encountered more of life's "hard knocks," middle-aged and older adults may perceive themselves as having become more competent to cope with depriving situations. For example, some of the literature on coping styles (Vaillant, 1977; McCrae, 1982) suggests that the coping strategies used by older adults may become increasingly more effective and less distorting of reality.

The findings on gender-based differences in situations of perceived competence are quite congruent with those from the traditional sex-role literature. Women reported greater perceived competence in Social, Common, and Supportive situations. A substantial literature indicates the female's concern for social competence, for acquiring the approval of others, and for avoiding competitive conflict situations. The data also support the traditional sex-role findings for males with regard to instrumental behaviors; men reported greater perceived competence in Nonsocial, Uncommon, and Depriving situations. There appear to be few age by sex interactions, suggesting that these gender-based differences are not significantly moderated by cohort differences in sex-role attributions.

We turn now to the data on ability predictors of perceived competence in various situational dimensions. Multiple ability predictors were found for the major dimension of Active–Passive and for about one-half of the two-way dimensions with significant predictors. In a number of instances, low ability performance is a significant predictor. Fluid abilities (i.e., Spatial Orientation, Inductive Reasoning) were found to be the most significant predictors for eleven of the two-way situational dimensions (Table 6). High fluid ability performance was found to be a significant predictor of perceived competence in Nonsocial, Uncommon, and/or Depriving situations, whereas low fluid ability was shown to be a significant predictor in Social, Common, and Passive situations. Findings are less clear with regard to the nature of Verbal ability as a predictor of perceived competence. Vocabulary was found to be a significant predictor of perceived competence in four situational types. High verbal ability performance is a significant predictor of perceived competence in Passive–Uncommon situations, whereas low verbal ability is a significant predictor of perceived competence in Active contexts (i.e., Nonsocial–Active, Active–Supportive, and Active–Uncommon situations).

Some concluding remarks

Ability correlates of practical intelligence

A major issue in the study of practical intelligence is the magnitude and nature of the relationship with traditional conceptions of intelligence. The range of individual differences increases with age for many traditional abilities (Schaie, 1983; Willis, 1985); however, it is an unanswered question as to how much of the variance in practical intelligence can be accounted for by variability in traditional intelligence measures. The studies presented in this chapter provide some relevant data. Significant ability correlates were identified for both explicit (i.e., Basic Skills test) and implicit (i.e., perceived competence) conceptions of practical intelligence. However, the traditional ability measures accounted for much more variance when actual performance in practical tasks was used as the criterion variable than when perceived competence was the criterion. The lower correlation between abilities and attributions is congruent with the personality literature (Lachman et al., 1982; Mischel, 1977). The amount of variance accounted for by psychometric abilities is impressive; 80% of the variance on the Basic Skills test was accounted for by the three primary abilities of Figural Relations, Vocabulary, and Social Knowledge (see Table 3). The multiple correlations in Table 3 are comparable to the magnitude of relationships found among primary abilities.

Our concern was not only to establish the presence of a relationship between traditional and practical intelligence, but to examine the nature of these relationships. Specifically, we wished to identify differential patterns of ability predictors for various categories of practical tasks. We were interested in examining ability–task relationships not only at the primary ability level, but with regard to hierarchical models of intelligence, such as the G_f-G_c model as well.

Multiple ability predictors were identified that included both fluid and crystallized abilities. In study I, fluid abilities were the significant predictors of performance on practical tasks of comprehending labels, reading maps, interpreting charts, completing forms, reading advertisements, and understanding technical documents. Crystallized ability predictors were found for paragraph comprehension, understanding technical documents, and reading news text. In study II both fluid and crystallized abilities were predictors of perceived competence on the Active–Passive dimension, and the fluid ability of Space was a significant predictor for the Social–Nonsocial dimension.

What surprised us, however, was the saliency of the fluid predictors. We had hypothesized that crystallized abilities would be particularly significant in the study of practical intelligence. The solution of real-life tasks would seem to require knowledge and skills acquired through sociocultural experiences. In both studies, however, fluid abilities (i.e., Figural Relations, Induction, Space) were found to be the more frequent and significant ability predictors.

Cattell (1971) has drawn the following conceptual distinctions between fluid and crystallized intelligence:

> Crystallized ability (G_c) expressions operate in areas where the judgments have been taught systematically or experienced before. The differences between the words . . . "definite" and "definitive" in a synonyms test, or in a mechanical knowledge primary test, between using an ordinary wrench or a box spanner on part of one's automobile, requires intelligence for the initial perception and learning of the discrimination (therefore some never will learn it). But thereafter it becomes a crystallized skill, relatively automatically applied.... Fluid ability, by contrast, appears to operate whenever the sheer perception of complex relations is involved. It thus shows up in tests where borrowing from stored, crystallized skills brings no advantage. As far as logic is concerned, it seems to spread over all kinds of relationships . . . In short, fluid intelligence is an expression of the level of complexity of relationships which an individual can perceive and act upon when he does not have recourse to answers to such complex issues already stored in memory. (pp. 98–99)

Although the content involved in the practical problems studied is crystallized in nature, these problems cannot be solved simply by automatized retrieval of previously acquired knowledge. Rather, the subject must identify the relationships among the variables in the task and must determine an appropriate strategy for solving the problem. These operations represent fluid aspects of the tasks. Practical intelligence often involves several complex forms of relationships, as evidenced by the multiple ability predictors identified. The particular types of fluid relationships that must be called upon to solve problems successfully (e.g., part–whole, causal relations, inductive reasoning, spatial relations) will vary by task.

In a similar vein, Sternberg (1981) has suggested that intelligence may better be assessed by "nonentrenched" tasks, requiring new conceptual systems. In his triadic model of intelligence, Sternberg suggests that appropriate measures of intelligence should involve a degree of novelty and tasks that are only in the process of becoming automatized. How might the concepts of automatization and novelty relate to the study of practical intelligence? Automatization implies that the knowledge to be retrieved is content bound and that the organization of the knowledge is relatively static. Previously acquired information is applied in a routinized manner to a variety of problem situations. As noted above, the solution of many practical tasks involves more than the retrieval of static information. Herein may lie part of the difficulty experienced by older adults in solving practical tasks. Since the content or type of task appears familiar, the older person recalls previous experiences with this type of content or task and applies the recalled information in a predetermined manner. The content of the practical task, however, does not dictate the types of relationships and strategies to be applied in problem solution. The relationships and strategies are "fluid" and thus may be applied to a variety of different content areas. Moreover, various instances of a task may involve different fluid relations. For example, one instance of the task, "comprehending medicine labels," may require sequential relations (e.g., the order of steps in taking a medication), whereas another instance of the task may involve inferential reasoning (e.g., if only the adult dosage is stated, what would be the appropriate child dosage).

The "novelty" involved in each instance of a seemingly familiar task lies in the need to determine the appropriate set of fluid relations and strategies. The concept of novelty has often been used to indicate unfamiliar content/stimuli or to denote qualitatively new forms of conceptual systems. Given the large proportion of variance accounted for by traditional psychometric measures, it appears to us that practical intelligence may involve not so much the acquisition of "new" conceptual systems, but facility in identifying and utilizing multiple logical relationships. A second type of difficulty for the older adult may be related to the multiplicity of relations or strategies involved in solving a task. Whether in solving practical problems, these multiple relations are applied simultaneously or sequentially remains a topic for future research. However, research on working memory suggests there may be age-related decremental changes in the facility with which one can simultaneously deal with multiple bits of information (Hartley, Harker, & Walsh, 1980).

The logical consistency of the relationships between psychometric abilities and judgment of perceived competence found in Study II suggests that older adults may be much more proficient in accurately appraising their ability to handle the intellectual load of behavioral situations than they are often given credit for. Additional support for this inference is provided by recent work on intellectual self-efficacy (Lachman & Jelallian, 1984). It seems reasonable to speculate from these findings that the observed average age differences in perceived competence may well be a direct consequence of the congruent age differences in those abilities that provide the basic resources for solving the cognitive aspects of a given situation. A direct test of this proposition would be to examine whether training interventions that have been shown to reverse intellectual decline, of the type used by us in other contexts (Schaie & Willis, in press; Willis, Blieszner, & Baltes, 1981), would also lead to a reversal of the observed age differences in perceived competence.

Methodological issues. Both of the studies summarized in this chapter involve the examination of practical intelligence in relation to a broad ability battery with known factorial structure. We argue for the importance of this methodological approach for two reasons. First, ability–task relationships need to be studied at the *construct* level, rather than at the level of individual

measures. In much of the previous research employing only a very limited number of measures of an ability or cognitive process, it has been impossible to differentiate test-specific variance from variance common to the ability construct. Thus, the relationship between a single ability measure and a single example of a real-life task may reflect communality of content or stimuli, rather than a significant relationship at the construct level. The importance of knowing the factorial structure of the independent variables and of examining ability–task relationship at the construct level is not restricted to the psychometric approach but should be an essential feature of any rigorous examination of the relationship between intellectual functioning and real-life tasks, whatever cognitive framework is chosen. Second, the examination of ability–task relationships within a structural framework permits identification of differential patterns of relationships. As we noted earlier in our discussion of Study I, most practical tasks were significantly correlated with all the primary abilities because of positive manifold and the increasing covariances among abilities noted in intellectual aging. Where all ability–task relationships are statistically significant, differential patterns of relationships can best be examined within a structural measurement framework.

Ecological validity and criterion tasks. When practical intelligence focuses, as in our research, on real-life tasks of daily living, there is the question of the extent to which the criterion tasks are indeed ecologically valid. How representative of everyday experiences of the target population are the items/problems on the criterion tasks? The age and possibly the cohort of the target population must be considered. However, there are wide individual differences in today's elderly cohort, and many of these individual differences are only moderately correlated with age. No one set of criterion tasks will be equally representative for all elderly persons. In our own research we have attempted to define a normative set of criterion tasks critical to independent living in our society and cutting across a wide variety of situational contexts. In some instances, however, particularly if policy decisions or intervention procedures are to be derived, criterion tasks specific to a particular subpopulation of the age/cohort will need to be developed.

There is also the issue of the similarity between the cognitive demands and characteristics of the criterion tasks and the actual tasks of daily living experienced by the elderly. For example, the items on the Basic Skills measure involve one "right" answer, and thus are largely limited to problems involving linear thinking. Virtually no research has been done to determine the proportion of daily living tasks that involve primarily linear thinking. Likewise, for many of the Basic Skills items the relevant reference materials (e.g., maps, news text) are available to the subjects as they solve the problem. Thus, the memory demands for the tasks may be quite low, as suggested by the nonsignificant loading on the memory span factor in the extension analysis and the absence of memory span as a significant predictor in the regression analyses. The specific memory demands of most daily living tasks remains to be investigated. In addition, the paper-and-pencil nature of the Basic Skills measure limits its assessment of socially oriented tasks, an important competence area for the elderly.

Summary

This chapter has examined issues related to practical intelligence in later adulthood. Practical intelligence has been defined as real-life tasks of daily living experienced by a specific age/cohort. A major focus of this chapter is on the relationship between practical intelligence and traditional forms of intelligence. The types of practical tasks we have studied would seem to involve previously acquired knowledge and skills, rather than truly novel or recently developed forms of cognition. Psychometric intelligence involving the "products" of behavior may be particularly applicable. Moreover, because much of the previous longitudinal work on adult intelligence has been conducted within the psychometric approach, links with previous research can be drawn more easily.

Two studies examining the relationship between selected aspects of practical intelligence and psychometric abilities have been reported. The first study examined the relationship between fluid/crystallized intelligence and performance on eight categories of real-life tasks. Significant correlations were found between these tasks and both fluid and crystallized abilities. Extension analyses and multiple regression analyses suggest that more variance was accounted for by fluid abilities than by crystallized abilities. This differential pattern of relationships was found across a wide variety of real-life tasks varying in content. The second study examined perceived competence along a number of situational dimensions with regard to age and gender-based differences and ability correlates. The Thurstonian primary abilities studied were Verbal, Space, Number, Memory, and Inductive Reasoning. Significant age- and gender-related differences were found. Positive age effects were found for Social, Common, Passive, and Depriving situations. Negative age trends were found for Nonsocial, Uncommon, Active, and Supportive dimensions. Verbal, Space, and Inductive Reasoning have been identified as significant predictors of perceived competence for various situational dimensions. Similar to the findings in the first study, fluid abilities were found to account for more variance in perceived competence than were nonfluid abilities.

Traditional/academic forms of intelligence were originally developed with regard to critical developmental tasks of the early portion of the lifespan, such as schooling. But academic achievement is not a salient developmental task throughout much of the adult life course, particularly in old age. Nevertheless, these traditional intelligence measures have dominated research on cognition across the life course; much of our scientific knowledge about adult intellectual ability is thus based on these traditional conceptions of intelligence. The examination of relationships between traditional and practical forms of intelligence and the possible identification of new forms of cognitive functioning remain critical research themes for the coming decade.

Notes

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An adapted version of the Basic Skills test is now marketed by CTB McGraw-Hill.

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Part IV

Cross-cultural approaches to practical intelligence