Intellectual, Self-related, and Affective Predictors of Everyday Problem Solving

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[OH1: Title]

In the current study, we examined cognitive and personality-related predictors of problem solving performance on three different measures of everyday problem solving. Although our own work has focused primarily on cognitive components of older adults' everyday functioning, the current study emerges from an ongoing theoretical discussion about just how cognitive everyday functioning really is. We have argued elsewhere (e.g., Marsiske & Willis, 1995; Marsiske & Willis, in press) that, although the construct label "everyday problem solving" implies a fairly unitary construct, in practice the theoretical and empirical definitions of everyday problem solving have been quite heterogeneous, as reflected in the many different measures designed for the assessment of this construct. One question is whether this diversity among measures may be attributed, in part, to the differential salience of cognitive and non-cognitive competencies for performance on different kinds of problem solving tasks.

[OH2: Conceptual models of everyday problem solving]

Before discussing the study in more detail, I want to highlight two major, and somewhat contradictory, theoretical positions on the cognitive nature of everyday task performance, particularly in later adulthood. One view, which has been most strongly associated with Richard Wagner and Robert Sternberg (1986), suggests that the problems confronted by adults in the everyday world are substantially different from the kinds of problems confronted by children and adolescents in the more formalized world of education. Everyday problems, they argued are fundamentally ambiguous, ill-defined, and ill-structured. Moreover, the problems of daily life frequently lack one single best solution. From this view, everyday problem solving performance should have little relationship to the more formal and logical problems of academic contexts—problems which have also dominated mainstream

research on cognitive aging (see also Labouvie-Vief for alternative formulations of a related argument). Correspondingly, much of the recent research on everyday problem solving has concerned itself with difficult dilemmas of daily life, and researchers have focused on the coping styles and ways of responding that adults demonstrate. Indeed, research in this tradition (Hess, Berg, Blanchard-Fields) has often not even addressed itself to how well individuals perform everyday tasks, arguing that the efficacy of solutions must be judged from the perspective of individual goals and needs.

An alternative perspective has been most consistently advanced by Sherry Willis and her colleagues (Willis & Schaie, 1986; Willis & Marsiske, 1991; Willis, 1991; Willis, 1996). I can only précis a few major points of the argument here: First, although ill-structured and ambiguous tasks of daily living may be prevalent in adulthood, it seems incorrect to assert that there are no well-structured problems with well-defined correct answers. Indeed, many of these tasks—like filling out a tax form or social security application, or preparing a poultry dish that is throughly cooked, or understanding the age-graded dosage chart on an over-the-counter medication—may have specific survival value. Second, Willis has conceptually distinguished the concept of everyday competence from the concept of everyday cognition or problem solving. In Willis' (1991, 1996) model of everyday competence, components of everyday competence are discussed, and cognition is one of those components. For older adults, it is argued that a common consensus definition of everyday competence is the "ability or potential to manage those tasks critical for living on one's own" (Willis, 1991).

One synthesis of these different conceptual views of everyday problem solving is that successful everyday functioning in adulthood may—in the words of Staudinger, Lopez and Baltes—exist at the interface of cognition and personality related functioning. Exactly how the interplay of cognition and aspects of the self and affective system play out in daily life becomes an intriguing question. Do, for example, elements of non-cognitive functioning like task-specific motivation, self-efficacy, or openness to new experiences mediate the expression of cognitive competencies in daily life (e.g., Willis, 1991)?

Can this interplay be seen in the prediction of everyday problem solving performance from indices of both cognitive and self/personality functioning?

[OH3: Research Question 1]

I will begin, then, by addressing the question: "What is the relative salience of basic intellectual, cognitive and personality variables for predicting performance on a measure of everyday reasoning and document literacy"?

[OH4: Sample 1]

The sample for our first set of findings consisted of 202 older adults who were community-dwelling residents of a continuing care retirement community in southwestern Florida. Participants averaged around 78 years of age, and had approximately 15 years of education, on average. Average self-ratings of health, hearing, and vision were good to very good.

[OH5: EPT]

For this study, which was part of a larger program of research on everyday problem solving in later life directed by Sherry Willis, we designed the Everyday Problems Test. In this measure, older adults saw 42 printed materials which were selected to represent domains which have been identified in the gerontological literature as critical for maintaining independent functioning, including food preparation, financial management, and telephone use. For each printed stimulus, participants were presented with two questions about the material in that stimulus. Scores were the number of correct responses generated by participants.

[OH6: Predictors]

For this study, we examined two categories of predictors. Cognitive predictors consisted of a battery of 15 cognitive and intellectual measures designed to measure seven ability factors, listed here. The factors included primary abilities identified as both crystallized and fluid, as well as measures of spatial orientation, memory, speed, and number addition. Non-cognitive predictors were taken from

Lachman's (1981) Personality-In-Intellectual-Aging Contexts Inventory or PIC. The measure consisted of six subscales, three of which represented domain-specific locus-of-control beliefs about participants' intellectual performance in everyday life. The remaining three subscales, Anxiety, Achievement Motivation, and Attitude toward Intellectual Aging, were designed to capture more affective and motivational aspects of individuals' beliefs about their everyday intellectual performance.

[OH7: Hierarchical regressions]

To examine the relative contributions of cognitive and non-cognitive predictors to performance on the Everyday Problems Test, we conducted a hierarchical multiple regression. In the first block, we examined the predictive salience of ability predictors alone. As you can see here, the abilities alone accounted for 65% of the variance in this measure. What happens when we add the PIC scales? The explained variance does increase, but only by a little more than 2%.

The pie-chart shows the same analyses where a hierarchical communality analysis has been used to partition the unique and shared variance components of the two predictor blocks. Basically, by subtracting how much each predictor block explains alone from how much they explain together, we arrive at estimates of their relative predictive salience. As this pie chart shows, of the explained variance, only 2% is uniquely associated with the PIC scales. Another 40%, the largest predictive component, is uniquely associated with the ability measures. Finally, about 25% of the explained variance is shared by cognitive and non-cognitive predictors. This last piece makes particular sense since the PIC reflects, in part, what Ellen Skinner has called "capacity beliefs" about everyday intellectual performance. In other words, when individuals rate themselves of the PIC, some of these ratings reflect their actual performance competencies.

What I hope you can take away from this is that the EPT was designed to provide a relatively direct measurement of the cognitive competencies required for particular everyday tasks and, in fact, its

correlational pattern suggests it is much more strongly allied with measures of basic ability than it is with measures of control beliefs, motivation, and affect.

[OH8: Research Question 2]

So what about other measures of "everyday problem solving"? Elsewhere, we have shown that—at least in terms of patterns of correlation with intellectual ability—other measures are much less closely related to the intellectual abilities. Are these measures more reflective of non-cognitive aspects of everyday competence? (Question is: "What is the relative salience of basic intellectual, cognitive and personality variables for predicting performance on other measures of everyday problem solving?"

[OH9: Sample 2]

The participants for these additional analyses was a subsample of 110 individuals from the larger retirement community group I just described. Relative to the 92 participants who did not take these additional measures, subsample participants were significantly younger, and performed significantly better on our intellectual ability measures.

[OH10: Cornelius & Caspi]

One of the additional problem solving measures was the Everyday Problem Solving Inventory, designed by Cornelius and Caspi (1987). In this measure, which contained 48 problems, most of the items focused on interpersonal difficulties individuals might encounter in work, home, or other social contexts. For each problem, Cornelius and Caspi provided participants with four possible solutions, and scores reflected the extent to which the chosen solutions mirrored an optimal pattern which had been generated by an independent panel of judges.

[OH11: Denney]

Participants also received the Practical Problems of Denney and Pearce (1989). This instrument consisted of ten problems identified by a panel of older adults as relevant for their age peers. The

problems tended to emphasize major life adjustment and adaptation issues in later life, like relocation or widowhood. Participants were asked to generate as many safe and effective solutions as they could for each of these problems; scores were the number of acceptable solutions generated according to scoring criteria outlined by Denney.

[OH12: Regression tables]

In this table, which summarizes the hierarchical regression results, we have put the relative proportions of variance explained by intellectual abilities (entered first), and then by the PIC scales (entered second). We have also put the EPT back up here, now with the analyses conducted on the the subsample of 110 individuals who took all three measures. What you can see is that the predictors, separately and together, account for much less of the variance in either the Cornelius or the Denney measures. What you can also see is that, because of the slightly positive restriction of the range of intellectual ability in this subsample, the abilities account for a slightly smaller proportion of the variance in the EPT, but they still account for most of the explained variance, and the total explained variance is the same.

[OH13: Pie charts]

Turning now to the pie charts, where we sketch out the unique and shared components of the predictive variance. For the Denney measure, none of the explained variance is shared, and 5% is associated with the PIC and 6% is associated with the abilities. For the Cornelius measure, 3% variance is uniquely explained by the PIC, 5% is uniquely explained by the abilities, and 6% is shared. What this means is that 11-out-of-14% explained variance in the Cornelius measure is either explained by abilities or shared with abilities. For the Everyday Problems Test, a similar pattern obtains, albeit with much higher proportions of explained variance, with about 59-out-of-67% explained variance either explained by abilities or shared with abilities.

[OH off]

Taken together, our results suggest that different operational definitions of everyday problem solving vary substantially in the magnitude of their relationships with either ability or self-related predictors. One measure, which we designed to specifically assess everyday reasoning and document literacy, was clearly dominantly related to the abilities, with only a small proportion of variance added by non-cognitive predictors. Two other measures of everyday problem solving are less related to both the abilities and to personality constructs. The Cornelius measure also showed a pattern of greater relatedness to ability than non-ability predictors, and the Denney measure was roughly evenly, and independently, explained by the two predictor domains. Important caveats to our findings include (1) our relatively narrow measurement of the self and personality domain, consequently potentially underestimating its importance, (2) our somewhat advantaged sample, with potential resultant range restrictions in predictor and outcome variables, and (3) analyses conducted at the observed—not latent—level allowing for potential differences in the reliability (and resultant predictive power) of our two predictor blocks.

With these caveats in mind, it really cannot be said that we have found very compelling evidence for an "interface" argument in the three measures of everyday problem solving we studied. Even in two measures designed to assess performance with complex, real-world dilemmas, we are more struck by the relative paucity of explained variance by a set of very powerful predictors, than the breadth of the predictive variance. We suspect that future research will need to better articulate (1) how cognitive and non-cognitive factors operate in everyday functioning; for example, are non-cognitive variables better understood as factors which mediate the expression of cognitive abilities in everyday tasks, (2) what specific aspects of everyday problem solving are being examined by a particular measure, and (3) what specific real-world criteria particular everyday problem solving measures are supposed to assess. Only when we have done this will be able to arrive at better predictions about when everyday functioning truly represents the interplay of cognitive, affective, and other competencies. What I hope the current

findings may do is raise the intriguing question of whether cognition is a particularly strong "engine"

that drives—more than other aspects of psychological functioning, individual differences in everyday

competence.

There are alternative theoretical definitions of *everyday problem solving* in adulthood.

1. Distinct from academic abilities:
- ill-structured
- open-ended
- multiple correct solutions

2. Related to academic abilities (sometimes):
- some problems are well-structured
- sometimes there is a correct answer
- e.g., tax forms, job applications, food safety

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Research Question

What is the relative salience of basic intellectual, cognitive, and personality variables for the prediction of performance on a measure of everyday reasoning and document literacy (i.e., the Everyday Problems Test, Willis & Marsiske, 1993)?

Participants

The sample consisted of 202 older adults (66 males, 136 females). All participants lived independently in a continuing care retirement community in southern Florida. On average, participants reported their health, hearing, and vision to be "good" or "very good".
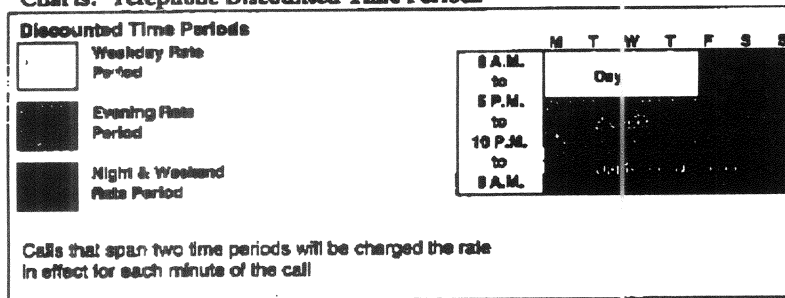
	Mean	(SD)	Range
Age	77.8	(6.1)	66 - 93
Years of Education	15.0	(2.4)	7.0 - 22.0

Everyday Problems Test
(Willis & Marsiske, 1993)

Charts: Telephone Discounted Time Periods

Calls that span two time periods will be charged the rate
in effect for each minute of the call

61. Your son and daughter live in the same city out-of-state. You call your daughter at 11:37 am on Saturday. You call your son at 9:30 pm on Wednesday. Both calls last 5 minutes. Which call is cheaper?

62. If your call begins at 4:57 pm on Monday, and lasts for 7 minutes, what is/are the applicable rate(s) for your call?

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Predictors

Block 1: Intellectual and Cognitive Abilities
- Verbal Ability
- Figural Relations
- Spatial Orientation
- Inductive Reasoning
- Memory Span
- Perceptual Speed
- Number Addition

Block 2: Personality-In-Intellectual Aging
  Contexts (PIC) Inventory (Lachman, 1981)
- Intellectual Locus of Control - Internal
- Intellectual Locus of Control - Chance
- Intellectual Locus of Control - Powerful Others
- Achievement Motivation
- Anxiety
- Attitude toward Intellectual Aging

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Subsample of Participants

A subsample of 110 older adults (44 males, 67 females), out of the original $N = 202$, agreed to take additional tests of everyday problem solving. This subsample was significantly younger and evinced better ability performance than the 92 individuals who did not return for further testing.

	Mean	(SD)	Range
Age	76.8	(5.6)	67 - 93
Years of Education	15.2	(2.4)	7.0 - 22.0

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Everyday Problem Solving Inventory
(Cornelius & Caspi, 1987)

After inviting a friend out to lunch, you discover when you are ready to pay the bill that you have forgotten your billfold	definitely would not do	probably would not do	uncertain, may or may not do	probably would do	definitely would do
A. Excuse yourself and make a phone call to someone to bring you money.	1	2	3	4	5
B. Leave your watch or other valuable property as security and return to pay the bill later.	1	2	3	4	5
C. Ask the restaurant manager to give you credit.	1	2	3	4	5
D. Ask your friend to pay the check, explaining the predicament.	1	2	3	4	5

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Practical Problems
(Denney & Pearce, 1989)

1. Let's say that a 67-year old man's doctor has told him to take it easy because of a heart condition. It's summertime, and the man's yard needs to be mowed, but the man cannot afford to pay someone to mow the lawn. What should he do?

2. Let's say that a 65-year old woman has just been widowed and lives alone. What can she do to continue associating with people?

Hierarchical Regression Results: All Three Problem-Solving Measures
(N=110)
Increase in % Variance Explained in:

	Cornelius & Caspi	Denney & Pearce	Willis & Marsiske
Step 1: Ability variables entered	11%	5%	59%
Step 2: PIC variables entered	3%	5%	8%
Combined:	14%	10%	67%

In both the EPT (Willis & Marsiske, 1993) and the EPSI
(Cornelius & Caspi, 1987), most of the variance accounted for
can be attributed to intellectual abilities or variance shared with
the abilities. For the PP (Denney & Pearce, 1989), the
contributions of ability and PIC variables are relatively low, but
also relatively similar.

Cornelius & Caspi (1987)
PIC Alone(3%)
Abilities Alone(5%)
Shared(6%)
Unexplained(86%)

Denney & Pearce (1989)
PIC Alone(5%)
Abilities Alone(5%)
Shared(0%)
Unexplained(90%)

Willis & Marsiske (1993)
PIC Alone(8%)
Abilities Alone(15%)
Unexplained(33%)
Shared(44%)

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