

Perceived Performance and Attrition in  
The Longitudinal Study of Intelligence

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Abstract

Subjective appraisals of subjects' performance on the Primary Mental Abilities (PMA) were related to attrition status in the Seattle Longitudinal Study (SLs). The current sample consisted of 817 subjects (372 men, 465 women) who participated in testing during the 1977, 1984, and 1991 sessions of the SLs, with 1991 as the attrition point. Subjects were asked to rate their current performance on 5 PMAs based upon perceived change in their performance from 1977 to 1984. Subjects who perceived themselves as performing worse on verbal meaning, inductive reasoning and spatial orientation were more likely to drop out than those who reported no change or improvement. Analyses were extended to examine congruence between subjects' actual performance and their perception using the framework described by Schaie, Willis, and O'Hanlon (1994). Congruence types did not differ by attrition status.

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The effects of attrition on research findings are important but are often not reported. The relationship between prior functioning on cognitive tasks, personality dimensions and attrition was examined for previous samples of the Seattle Longitudinal Study (SLs) and found differences between groups leaving the study and those who returned (Conroy, Schaie, & Willis, 1988). An additional issue worth consideration when conducting longitudinal research is subjective perception of performance and the effect this perception may have on the likelihood of subjects participation in future studies.

Most studies of intellectual abilities have based their findings upon the objective performance of subjects. In 1984, SLs subjects were asked to provide subjective ratings of their previous (1977) performance on the Primary Mental Abilities (PMA) (Thurstone & Thurstone, 1949). This allowed researchers to develop a scheme that crossed subjective performance with actual performance to form a typology based upon their congruence (Schaie, Willis, & O'Hanlon, 1994). Three congruence types were developed and labeled as realists (those who accurately estimated their change in performance); optimists (those who overestimated positive change); and pessimists (those who overestimated negative change). Results from this study showed that women were more likely to be pessimists on Spatial Orientation than men. Older subjects were more likely to be pessimists on Verbal Meaning and Inductive

Reasoning and more likely to be realistic on Number ability when compared to younger subjects (Schaie, et al, 1994).

Data from the 1991 wave of the SLS are now available. This allowed us to determine which of the subjects who had participated in the 1977 and 1984 waves returned for the most recent testing. Utilizing return status, the current study asked the following question: Are people who retrospectively perceive themselves as doing worse on the exams more likely to drop out of the study than those who perceive themselves as doing the same or better? This question was extended within the framework of the Schaie, et al (1994) study of congruence types and asked: Are subjects more likely to drop out if they fall into a particular congruence type (optimist, realist, or pessimist)?

#### Methods

##### Subjects

Participants for this study were drawn from the larger framework of the SLS. This study has been in progress for over 35 years and has collected data with the primary goal of assessing cognitive development across the lifespan. Subjects are members of a large Health Maintenance Organization (HMO) in the Seattle metropolitan area and are recruited at random, stratified by age and gender from this population. Testing was conducted at seven year intervals throughout the study. The sample is representative of the community dwelling population in this area and represents a

broad range of occupational, educational, and economic backgrounds (Schaie, et al, 1994).

Subjects in the current study were those who had tested in 1977 and in 1984. With the collection of the 1991 wave, the return status of these subjects was examined to derive an attrition variable (return, no return). This selection process resulted in a sample of 837 subjects (372 men and 465 women) with a mean age in 1984 of 64.93 years (SD=10.36; range 36-84). The mean education level for the sample was  $M=13.85$  years,  $SD=3.04$ , while income was  $M=\$24,240$ ,  $SD=\$9280$  (see Table 1). The sample was divided into three age-cohort groups described in Table 2.

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Insert Tables 1 & 2 here  
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##### Measures

As part of a larger battery, all subjects were given the Primary Mental Abilities (PMA) test (Thurstone & Thurstone, 1963) to examine the following cognitive abilities:

Verbal Meaning: measures subject's passive (recognition) vocabulary. Each stimulus word is matched with a word which is similar or the same from four choices.

Spatial Orientation: measures the ability to visualize and rotate objects in two-dimensional space. Subjects choose direct relations of the stimulus object from among six options.

**Inductive Reasoning:** involves the ability of subjects to determine rules or principles. Letter series are used that require subjects to determine one or more rules to solve the series.

**Number:** reflects the ability to work with numbers quickly and accurately using simple arithmetic problems.

**Word Fluency:** measures active vocabulary by presenting a stimulus letter and asking subjects to write as many words beginning with the stimulus during a timed period.

Upon completion of the 5 PMA tests in 1984, subjects answered the Primary Mental Abilities Retrospective Questionnaire (PMARQ). This questionnaire reminded participants that they had completed the PMA seven years earlier and asked them to compare their current performance with their previous performance. To answer the first question asked by the current study, contingency tables were calculated which crossed subjects perception of their performance (better, same, worse) with attrition status (return, no return). This was examined for all five PMAs. Follow up tests were conducted to determine significant differences in proportions of subjects answering better, worse, and the same for those who returned and those who dropped from the study.

Extending the analyses to examine congruence type, contingency tables were calculated which looked at congruence type (optimist, realist, pessimist) versus attrition status (return, no return). Analyses were also conducted for gender by attrition status, and age group by attrition status.

## Results

Of the 837 subjects who answered the Retrospective PMA Questionnaire in 1984, 545 (males=240, females=305) subjects returned for testing in 1991. Dropping out of the SLS during this period were a total of 292 subjects, comprised of 112 males and 180 females. Those who dropped out were significantly older ( $M=70.5$ ,  $SD=8.85$ ) than those who returned ( $M=62.3$ ,  $SD=10$ ). Other demographic characteristics were examined including income and education to determine whether significant differences existed (see Table 1). Subjects who returned had a significantly higher level of education than those who dropped out. Among those who returned, males had significantly higher education than females. Subjects who returned also had higher income than those who did not return. Gender differences were found with males earning more than females regardless of return status.

Contingency table analyses were performed examining the subjects' subjective perception of their performance on the 5 PMAs and attrition status. Significant results were found for Verbal Meaning, Inductive Reasoning, and Spatial Orientation (see Table 3). Results for Verbal Meaning ( $\chi^2(2)=22.46$ ,  $p<.001$ ) revealed that subjects who dropped out were more likely to feel they had done the same (65%) or worse (19%), while over 91% of those who returned in 1991 felt they had done the same (72%) or better (20%).

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Insert Table 3 here  
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A similar pattern was true for Spatial Orientation ( $\chi^2(2)=14.05, p<.001$ ), with subjects who dropped out more likely to feel they had declined (32%) or remained the same (53%), while 70% of those who remained in the study reported doing the same (56%) or better (33%). Results for Inductive Reasoning ( $\chi^2(2)=7.38, p<.03$ ) showed a slightly different pattern. Subjects who did not return in 1991 perceived themselves as doing worse (40%), or the same (42%), with only 10% reporting feeling better about their performance. Among returning subjects, 38% reported doing worse with only 14% answering better and 47% answering "same". Group differences for Number Ability and Word Fluency were not significant.

Analyses were conducted to examine gender differences in attrition status with results reported in Table 3. Gender by return status differences were noted for Verbal Meaning, Spatial Orientation (males only), and for Word Fluency (males only). Examining Verbal Meaning for males ( $\chi^2(2)=13.43, p<.001$ ), those who dropped from the study were more likely to report feeling worse (18%) about their performance than those who returned (5%). Females ( $\chi^2(2)=10.14, p<.006$ ) followed a similar pattern for Verbal Meaning, with 20% of those who dropped out reporting doing worse compared to 10% for returnees. Ninety percent of those who returned felt the same (70%) or better (20%) about their performance.

Over 37% of males who dropped out reported doing worse on Spatial Orientation ( $\chi^2(2)=11.37, p<.003$ ), while the distribution

of subjects was even in reporting better or worse performance for those who returned (21% vs. 22%). For Word Fluency ( $\chi^2(2)=11.37, p<.003$ ), males who dropped out were significantly higher in reporting feeling worse (31%) about their ability than returning subjects (20%), and were also less likely to report feeling the same about their performance (43% vs. 55%).

Age groups differences were also examined with little difference in attrition status found. The only significant finding was for the oldest cohort group on Verbal Meaning ( $\chi^2(2)=11.37, p<.003$ ). Twenty five percent of those who dropped out reported feeling worse about their performance compared to 15% for those who returned. Subjects who later attrited were also less likely to report feeling the same about their ability than those who returned (60% vs. 76% respectively). Results for the post-hoc tests for proportional differences are reported in Table 4.

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Models were extended to examine congruency types (optimist, realist, pessimist) by return status. No significant results were found.

Discussion

Results from this study suggest a relationship between perception of performance on cognitive tests and the likelihood to return for future test sessions. For 3 of the 5 PAAs (verbal

meaning, inductive reasoning and spatial orientation), results showed those individuals who rated their performance as declining were more likely to drop from the study. Accuracy of perception, measured as congruence type in this study, did not show any differences between those who returned and those who did not return. It seems reasonable that individuals would follow their beliefs about their own performance in the absence of knowledge about the accuracy of these perceptions.

This study serves as a first step examining the effects of attrition in the latest wave of the SLS. The SLS collects data using a seven year cycle, a relatively lengthy time-span during which many subject circumstances could change. Further analyses will be performed to test for differences in level of performance between returnees and those who attrite, and most importantly, to examine cause-specific attrition effects. Based upon previous results from the SLS (Cooney, et al., 1988), one might expect that morbidity would influence congruence types, either by altering subject's perception of performance or their actual performance.

The results provide support for the importance of retrospective performance evaluations as a possible indicator factor for attrition and suggest the usefulness of such tests in future work.

#### References

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Table 1: Sample Demographics

Variable	Return		No Return		Grand Total (N=837)		
	M (N=240)	F (N=305)	Total (N=545)	M (N=132)		F (N=160)	
Education	14.67*	14.00	14.30#	12.88	13.01	12.95	13.85
Age (in 1984)	62.47	62.20	62.32#	71.09	69.91	70.46	64.93
Income	\$28,340*	\$25,740	\$26,900#	\$21,780*	\$16,720	\$19,040	\$24,200

# = significant difference between returns/no returns  
 \* = significant gender differences by return status

Table 2: Cohort Group Description

Birth Years	Mean Age 1984	Range
Old (N=298)	75.86	70-84
Middle (N=379)	64.00	57-69
Younger (N=160)	49.15	36-56

Table 3) Chi-Square Analyses for Perceived Performance by Attribution Status

Ability	Chi-Square	df	Probability
Verbal Meaning	22.48	2	.001
Inductive Reasoning	7.38	2	.025
Spatial Orientation	14.05	2	.001
Gender			
<b>Male</b>			
Verbal Meaning	13.43	2	.001
Spatial Orientation	11.37	2	.003
Word Fluency	6.67	2	.036
<b>Female</b>			
Verbal Meaning	10.14	2	.006
Age-group			
Verbal Meaning	8.15	2	.017

Note: Only significant models shown.

Table 4) Post-Hoc Analyses for Perceived Performance by Attribution Status

Ability	Chi-Square	df	Probability
Verbal Meaning (Worse)	22.28	1	.001
Verbal Meaning (Same)	5.15	1	.023
Inductive Reasoning (Worse)	6.67	1	.010
Spatial Orientation (Better)	6.72	1	.010
Spatial Orientation (Worse)	11.20	1	.001
Gender			
<b>Male</b>			
Verbal Meaning (Worse)	13.92	1	.001
Spatial Orientation (Worse)	10.36	1	.001
Word Fluency (Worse)	5.34	1	.021
Word Fluency (Same)	5.18	1	.023
<b>Female</b>			
Verbal Meaning (Worse)	10.14	1	.001
Age-group			
Verbal Meaning (Worse)	5.10	1	.024

Note: Only significant models shown.