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Cognitive Skills and Survey Nonresponse —Evidence from Two Longitudinal Studies in the United States*

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Abstract

This study examines the relationship between general cognitive skills (i.e., those measured by intendedly general tests of ability or aptitude) and cooperation with requests for continued participation in longitudinal studies. Using the Wisconsin Longitudinal Study (WLS) of 1957 high school graduates, we find a consistent monotonic relationship in which those with higher measured skills are less likely to refuse to participate. Analyses indicate that this result cannot be explained by family background measures and is only slightly attenuated by the inclusion of measures of subsequent educational and occupational attainment and

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social participation. Meanwhile, in the 1998 wave of National Longitudinal Study of Youth in 1979 (NLSY79), the opposite relationship is observed: those with higher cognitive skills are somewhat *more* likely to refuse to participate. Further analyses reveal that this is due to some aspect of refusal conversion, as the pattern of initial refusals in the NLSY79 is similar to that of ultimate refusals in the WLS. One important difference between the refusal conversion efforts in the two studies is that NLSY79 has used significant financial incentives and WLS does not, which may explain the difference.

Key Words: cognitive skills, cognitive ability, survey nonresponse, longitudinal surveys

The reservoir of public availability and goodwill that has served to irrigate the field of survey research is becoming ever shallower, as survey researchers continue to have increasing difficulty securing respondent participation. The generalizability of sample survey results is undermined to whatever extent pertinent characteristics of respondents and outcomes under investigation are each systematically associated with such refusals. Accordingly, understanding systematic predictors of survey refusals is a matter of increasing practical importance, both for assessing implications for estimates and for considering possible ways of improving response rates. Conceptual work toward theories of survey participation has emphasized that associations of sociodemographic characteristics likely often reflect antecedent or intervening psychology (e.g., Groves & Couper, 1998), but relatively few studies have directly examined the relationship between basic psychological characteristics and cooperation with survey participation requests.

This study considers the relationship between general cognitive skills (e.g., those measured on intendedly general skills tests) and refusal to participate in surveys. Cognitive skills already figure in theories of survey response: Krosnick (Anand & Krosnick, 2004; Krosnick, 1991), for example, proposes that those with lower cognitive skills are more likely to "satisfice" in their responses, i.e., put less cognitive effort into their response to any particular survey question. Among the empirically supported implications of this reasoning is that cognitive skills can be expected to be associated with "don't know" and related item-level nonresponse (Krosnick, 2002). From this, one could speculate that an even more complete way of minimizing the cognitive demand of surveys might be to refuse to participate in the first place.

For that matter, cognitive skills have already been implicated theoretically as a determinant of civic or prosocial engagement (Nie, Junn, & Stehlik-Barry, 1996; Wilson, 2000), and academic surveys typically (and perhaps often exclusively) appeal to prosocial motives in attempting to convince individuals to

participate. A relationship between higher cognitive skills and higher survey participation is further suggested by the association between education and survey participation that has been found in some studies (see Groves & Couper, 1998: 128), although education has many noncognitive correlates and consequences and thus associations between education and an outcome cannot be straightforwardly interpreted as resulting from cognitive differences. Considering the relationship between cognitive skills and nonparticipation may help researchers construct solicitations that reduce that relationship, and thus improve the representativeness of surveys.

Researchers can only study characteristics of nonrespondents when they have some means of obtaining or inferring information about these individuals other than the survey in which they did not participate. While this is usually impossible in cross-sectional surveys, longitudinal studies offer the possibility of studying refusals in later waves using information collected in earlier waves. The ideal longitudinal study in this respect may be one that has a "captive audience" for its first wave, so that the initial sample can be regarded as a complete representation of some well-defined population. Of course, attrition from such studies should not be confused with refusal to participate in a survey with which one has no previous relationship. In any case, such longitudinal studies are rare, and even fewer have obtained respondent scores on tests intended to measure general cognitive skills. Here we begin with the Wisconsin Longitudinal Study, a cohort sample which exemplifies this design. Then we seek to corroborate the basic finding using a much different sample, the National Longitudinal Study of Youth in 1979 (NLSY79), and instead find contrary results. The discrepancy prompts further exploration of why the studies might differ in the relationship between cognitive skills and respondent willingness to participate, which points to the possibility that cognitive gradients in longitudinal surveys may be attenuated by incentives.

I. Wisconsin Longitudinal Study

The WLS began as a questionnaire about future plans administered to all Wisconsin high school seniors graduating in 1957. From this census, investigators later drew a one-third random sample (N=10,317) that has provided the basis for later surveys. Subsequent surveys have been conducted in 1964 (mail to parents), 1975 (phone), 1993 (phone and subsequent mail survey of phone respondents), and 2004 (phone and mail). Respondents who refuse to participate in one wave of the survey are still included for fielding in subsequent waves. As the respondent population consists entirely of 1957 Wisconsin high school graduates, WLS sample members are almost entirely white, are all approximately the same age (about 65 years old in 2004), and all have at least a high school diploma. The WLS asks questions about many different domains of respondents' lives, but survey content has focused most prominently on finances, respondents' work history, marital and fertility history, educational attainment, and health, while relatively few questions have asked about political or social attitudes (Hauser & Herd, 2006). In 1993, WLS respondents were sent the mail survey after and only if they completed the telephone survey; in 2004, the same design was initially followed but, toward the end of the field period, mail surveys were also sent to those who refused participation in the telephone survey.

Cognitive skills in the WLS were measured using the Henmon-Nelson test of Mental Ability (hereafter HN), a 90-item intendedly general aptitude test that was administered during respondents' freshman and junior years of high school and obtained from the Wisconsin State Testing Service. Common HN items include simple definitions ("To *marry* is to . . ."), antonyms ("*Grieve* is the opposite of . . ."), analogies ("Poem is to poet as portrait is to . . ."), and number series ("512, 256, 128, 64, 32, . . . What two numbers should come next?"). We use respondents' normalized and

standardized junior year score when available and their adjusted freshman year score otherwise. Although cognitive skills should not be considered immutable over the life course, general measures do empirically exhibit very high rank-order stability over midlife relative to other basic psychological characteristics (Schaie, 1996). In the half century since HN was administered to WLS participants, the importance of collecting multiple aspects of cognitive ability has become widely recognized, even though measures of individual aspects are invariably positively correlated; the current study would be stronger if WLS included multiple aspects from ability measured in adolescence, but this was not done.

Table 1 presents data on noncontact, telephone survey refusal, and mail survey nonreturn rates for the 1975, 1993, and 2004 waves of the WLS.[1] Refusal rates are conditional on the respondents' household being contacted, and nonreturn rates are conditional on a mail survey being sent. Rates are provided for the bottom, middle, and top quintiles of the distribution of cognitive skills scores in the sample. Marginal effects are also included; these are the change in probability of refusal associated with a standard deviation increase in cognitive skills score evaluated at its mean. While noncontact rates are not the focus of this study, we note that noncontact is inversely associated with cognitive skills, which is expected given that respondents with low education are typically harder to find in longitudinal studies. This result for noncontacts is also significant in logistic regression models using the same covariates as in the analysis of refusals presented later (all $p < .01$; not shown).

[1] "Noncontact" refers to the failure of the survey center to request participation from a fielded case (the main example of which is a respondent for whom correct contact information exists but who are never individually reached for the survey). In the NLSY analyses, we will consider "unable to locate respondent," which is much more common in the NLSY given the younger age of respondents and the higher prevalence of low socioeconomic status respondents.

Table 1 Cognitive Test Scores and Nonparticipation Rates in the Wisconsin Longitudinal Study

	Bottom Quintile	Middle Quintile	Top Quintile	Marginal Effect	N
Noncontact rates					
1975	.076	.062	.053	-.007**	10127
1993	.091	.061	.046	-.015***	9729
2004	.048	.031	.021	-.009***	8542
Telephone refusal rates					
1975	.058	.040	.020	-.013***	9525
1993	.104	.061	.032	-.026***	9084
2004 (phone and mail complete in 1993)	.122	.067	.041	-.029***	6357
2004 (phone but no mail in 1993)	.358	.194	.115	-.080***	1232
2004 (no phone in 1993)	.755	.712	.833	.015	326
Mail nonreturn rates					
1993	.248	.183	.113	-.045***	8328
2004 (completed phone in 2004)	.140	.111	.098	-.013**	7064
2004 (no phone in 2004)	.565	.563	.561	.008	1339
Any phone refusal or mail nonreturn if contacted all three waves	.532	.387	.274	-.092***	8652

* $p < .05$, ** $p < .01$, *** $p < .001$. Marginal effects are of a standard deviation change in HN score and are evaluated at the sample mean.
Source: Table compiled by the authors.

Looking at the telephone refusal rates, we can see that in 1975, 6% of contacted respondents in the lowest test score quintile refused to participate in the survey, as opposed to 2% of respondents in the top quintile. That respondents in the middle quintile refused at rates between these two percentages prefigures a more general pattern for nonparticipation in this sample: the relationship between cognitive skills and nonparticipation is a

monotonic *gradient* across the observed range of ability, as opposed to only reflecting a higher propensity for nonparticipation among the lowest scoring respondents. In 1993, refusal rates were higher overall, but refusal rates among the lowest scoring quintile (10.4%) remained almost three times larger than for those in the highest quintile (3.2%).

Enough respondents did not participate in both the phone and mail survey in 1993 that, for 2004, we can stratify the data according to whether respondents completed both 1993 phone surveys, completed the 1993 phone survey but did not return the mail survey, or did not participate at all in 1993. Among those who participated fully in 1993, refusals in 2004 also occurred at roughly three times the rate for those in the lowest quintile (12.2%) as the highest quintile (4.1%). A similar pattern is observed among those who did not return the mail survey. For nonparticipants in 1993, meanwhile, solicitations in 2004 were equally ineffective regardless of cognitive skills.

General cognitive skills are also related to mail survey participation. In 1993, respondents were only sent the mail survey if they completed the telephone survey. Consequently, any observed cognitive gradient in mail participation is *in addition to* the cognitive differences observed for 1993 telephone survey participation. Nonetheless, 24.8% of those in bottom test score quintile did not return the mail survey, compared to only 11.3% of those in the top quintile.

In 2004, despite a doubling of the length of the mail survey (from 24 to 50 pages), mail survey participation among those who had completed the phone survey actually increased from 1993. This was perhaps due to the inclusion of a $10 incentive with the initial mailing, which was the first use of monetary incentives in the WLS. Refusal rates were again inversely associated with cognitive skills, although note that the relative difference between the top and bottom quintiles was lower. If literacy or linguistic burden was responsible for the cognitive gradient in the WLS, one might expect the lengthening of the mail survey to increase the cognitive

gradient; that the gradient appears to have decreased instead raises the possibility that the addition of the incentive was differentially effective among those with lower cognitive skills.

Two questions prompted by these results are the extent to which the associations with cognitive skills may reflect the spurious influence of socioeconomic status of respondents' family of origin, and the degree to which the associations are resolved by the effect that cognition has on subsequent educational or occupational attainment. Because participation in 1975 was so high, we use information obtained in 1975 and earlier to study participation in 1993 and 2004. As measures of family background, family income in 1957 is measured from administrative tax records. Parental education and occupation (1970 Duncan SEI) in 1957 are based on the respondent's 1975 report. As measures of post-high school attainment, educational attainment (in years) and occupational prestige (1970 Duncan SEI) are based on the 1975 survey. Given the earlier results, 2004 phone participation is examined conditional on 1993 phone survey participation, and 2004 mail participation is also conditional on 2004 phone survey participation.

Table 2 includes results for a model with respondent's sex and family background characteristics (Model 1) and a model that adds educational attainment, occupational prestige in 1975, and social participation in 1975 as measured by number of reported organizational memberships (Model 2; see Hauser, 2005 for discussion of social participation as covariate). The coefficient for the simple bivariate logistic regression of the outcome on HN score is included for reference at the bottom of the table. The most basic result is that cognitive skills have a strong relationship on survey participation that persist net of all these variables.

If we compare the results for cognitive skills in Model 1 to the bivariate coefficients, we can see that the addition of family background controls and respondent's sex makes little difference. Indeed, the estimates for cognitive skills increase in size for two of the four outcomes. These results indicate that the apparent effect of cognitive skills appears not at all accounted for by respondents'

Table 2 Logistic Regression Coefficients for Models of Telephone and Mail Nonparticipation in 1993 and 2004 Wisconsin Longitudinal Study

	1993 Telephone Refusal		1993 Mail Non-Return		2004 Telephone Refusal		2004 Mail Non-Return	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
HN score (*z*)	-.441***	-.328***	-.340***	-.315***	-.461***	-.380***	-.173***	-.154**
	(.054)	(.059)	(.033)	(.036)	(.042)	(.046)	(.044)	(.048)
Female	-.179	-.366**	-.056	-.079	.075	-.061	-.100	-.177
	(.101)	(.117)	(.061)	(.068)	(.078)	(.087)	(.081)	(.092)
Parental education (0 = < HS)								
Parent HS only	-.143	-.136	.065	.076	-.098	-.054	-.099	-.102
	(.114)	(.117)	(.070)	(.070)	(.086)	(.087)	(.095)	(.096)
Parent some college	-.558*	-.417	-.129	-.107	-.399**	-.283	-.216	-.220
	(.220)	(.222)	(.113)	(.114)	(.152)	(.154)	(.149)	(.151)
Parent college degree	-.067	.131	.059	.109	-.464*	-.304	.189	.201
	(.210)	(.217)	(.123)	(.125)	(.182)	(.186)	(.152)	(.156)
Parent occupational prestige, 1957	.001	.003	.004*	.004*	-.001	.000	.004*	.004
	(.003)	(.003)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
Logged parental income, 1957 ($thousands)	-.042	.023	-.092	-.076	.038	.084	-.018	-.012
	(.111)	(.115)	(.067)	(.067)	(.085)	(.087)	(.087)	(.088)
Education								
Some college		-.353		.075		-.281*		.299*
		(.182)		(.095)		(.131)		(.120)
College degree		-.520**		-.113		-.500***		.017
		(.193)		(.099)		(.140)		(.128)
Occupational prestige		-.008		.000		-.002		-.004
		(.005)		(.003)		(.004)		(.004)
Participation in 1-2 organizations, 1975		-.348**		-.285**		-.449***		-.137
		(.134)		(.088)		(.105)		(.125)
Participation in 3 or more organizations, 1975		-.645***		-.370***		-.563***		-.228
		(.150)		(.092)		(.113)		(.129)
Bivariate logit coefficient for HN score		-.461***		-.327***		-.496***		-.146***
		(.005)		(.031)		(.040)		(.042)
N		8437		7882		7306		6475

* $p < .05$, ** $p < .01$, *** $p < .001$. Standard errors in parentheses. Models include terms for missing parental education and missing occupation (Model 2). Coefficients for 2004 survey are conditional on 1992 phone participation, and coefficients for 2004 mail are also conditional on 2004 phone survey participation.

Source: Table compiled by the authors.

family backgrounds. (Analyses we will subsequently discuss for NLSY, presented in Table 6, also show that adding family background measures to the model does not affect the relationship between cognitive skills and survey nonresponse.)

The addition of education and occupation yields modest decreases in the estimated direct effect of cognitive skills on telephone refusal in both 1993 and 2004, but has little consequence for nonreturn of the mail surveys. The attenuation that is observed is almost entirely due to educational attainment, which shows a significant effect on telephone participation in its own right.[2] In other words, subsequent educational attainment seems to have only a very modest role in explaining why adolescent cognitive skills are so strongly related to the propensity of WLS respondents to refuse to participate when in their mid-fifties (1993) or mid-sixties (2004) (these results are consistent with Hauser's [2005] analysis of the 1993 wave only). On the other hand, prior cognitive skills do account for a substantial part of the apparent relationship of education on WLS participation, especially for the mail surveys.

A different issue we considered was whether the surveys appear to impose different time burdens for participants, which might be taken as suggestive of the surveys being generally more taxing for respondents of lower cognitive skills. In both 1993 and 2004, respondents in the highest quintile actually took slightly longer to finish the phone survey than respondents in the lowest quintile (63.0 vs. 59.7 minutes in 1993; 76.3 vs. 74.6 minutes in 2004). This appears to be due to higher-scoring respondents following longer skip patterns through the survey (e.g., in the questions about assets). In 1993, a set of items measuring personality

[2] The observed coefficients of having some college and having a college degree on phone participation in 1992 and 2004 are about a third smaller than the coefficients in models that exclude HN scores but otherwise include the same covariates as Model 2 (see also Hauser, 2005).

and psychological well-being included no skip patterns; the average length of time to complete these items decreased as cognitive skills increased (ranging from 4.41 minutes for the highest quintile to 4.75 minutes for the lowest quintile). For both the 1993 and 2004 mail survey, respondents in the lowest quintile reported taking substantially longer to complete the instrument (means of 36.0 vs. 49.1 minutes in 1993, and 115.9 vs. 140.5 minutes in 2004). Regarding the possibility that anticipation of this differential burden explains the difference in willingness to participate, we did not observe any evidence of an independent relationship between time to complete any survey and refusal to participate in a subsequent survey, and thus these differences per se cannot account for any of the observed cognitive gradient in willingness to participate.

The bias in empirical work resulting from an inverse cognitive gradient in refusals depends on the relationships between cognition and both the characteristics and outcomes of interest. Even those critical of an overemphasis on cognitive test scores in some settings still acknowledge substantial relevance of these scores for a wide variety of outcomes (e.g., Fischer et al., 1996). Even so, the consequentiality of the gradient reported here should not be overstated. The mean test score among only respondents with a complete record of response is only about .14 SD (approximately 1 IQ point) higher than the mean for all respondents who were alive in 2004. The proportion of WLS respondents who ever attended college is estimated as 44.8% from the sample who completed all surveys, compared to 40.9% estimated from all living WLS respondents provided information about educational attainment in 1964 or 1975. The difference in the correlations between father's education (as reported by the student in 1957) and respondent years of education is .324 when analyzed with only respondents with complete participation and .341 for all respondents. Assessments of the consequentiality of biases of these magnitudes depend on the precision demanded by particular investigations.

II. National Longitudinal Study of Youth in 1979

One might wonder whether the above results are unique to the WLS. For this reason, we turned to the NLSY79. Conducted by the United States Bureau of Labor Statistics, NLSY79 is based on a national sample of Americans who were 14-22 in 1979 (see Center for Human Resource Research [CHRR], 2004 for a detailed discussion of the sampling and fielding of NLSY79). Like the WLS, the NLSY79 asks questions about a large number of different domains, but focuses most prominently on economic, familial, educational, and health outcomes, and it contains relatively few questions about political or social attitudes (CHRR, 2004). We use only the NLSY79 sample that was drawn as a fully representative panel of its cohorts (called the "cross-sectional sample"), although the substantive results do not change when the study's supplemental samples are included. The survey did not have a "captive audience" for its first wave, but 90% of those designated for interviewing in the cross-sectional sample participated (N=6,111 of 6,812). NLSY had surveyed respondents either in person (preferentially for most waves) or by phone annually until 1994 and biennially since. As with WLS, respondents who did not participate in one wave were still fielded for participation in the next. Analyses here will focus on the 1998 NLSY, which at the time the main analyses were initially conducted was the most recent wave in complete public release. In 1998, 5,159 of 5,840 attempted cases were completed (88.3%), with 490 respondent refusals (8.4%) and 191 attempted cases that were not completed for reasons other than refusal (3.2%).

Cognitive skills in the NLSY79 were measured in 1980, the year after the first wave of the survey, through a special administration of the Armed Services Vocational Aptitude Battery (ASVAB) in which 94% of respondents participated (see National Longitudinal Study of Youth, n.d. for considerable general and technical information on the administration of this test in the

study). The ASVAB consists of a set of ten multiple-choice tests, and as with the HN test, was intended as a general measure of cognitive skills. We use the NLSY79 transformation of results from the arithmetic reasoning, paragraph comprehension, word knowledge, and mathematics knowledge components of the ASVAB into the 1989 revision of the Armed Forces Qualifying Test score (AFQT) (CHRR, 2004). For the regression-based analyses below, we include dummy variables for cohort to account for the different ages of NLSY79 respondents when the test was administered. Mother's and father's education were measured as the number of years completed from zero to 20; we coded missing values to 12 years and included a dummy variable to indicate replacement. Mother's and father's socioeconomic index (SEI) scores were based on the three-digit 1970 Census occupational code, with missing values coded to zero and a dummy again included to denote replacement.[3] Respondents' education was measured as the highest completed grade reported between 1979 and 1998, and SEI scores were based on the highest three-digit 1980 Census occupational code recorded between 1982 and 1998.[4]

Table 3 presents refusal rates for the 1998 NLSY for all contacted respondents, and also divides these results by whether or not the respondent participated in the previous wave of the study. Looking at the first row of the table, we see exactly the opposite of the pattern observed for the WLS: respondents with higher cognitive test scores were *more* likely to refuse to participate in the NLSY79 survey. In all, refusals were almost twice as common among those in the highest quintile (9.5%) than the lowest quintile (5.0%). This result is not at all attenuated in a logistic regression

[3] SEI scores for both parents' and respondents' occupations were obtained from those used by the General Social Survey (for more description, see Davis & Smith, 2009). The scale runs from zero through 100.

[4] 1980 census scores were first introduced in the NLSY in 1982; between 1979 and 1982, 1970 census scores were used.

Table 3 Cognitive Test Scores and Refusal Rates for the 1998 Wave of the National Longitudinal Study of Youth in 1979 Cross-Sectional Sample

	Bottom Quintile	Middle Quintile	Top Quintile	Marginal Effect	N
Unable to locate respondent	.038	.019	.009	-.008***	5766
Final refusal rates					
All contacts	.050	.086	.095	.014***	5649
Completed interviews in prior wave	.018	.031	.022	.001	5149
Refusals in prior wave	.710	.730	.795	.012	398
Initial refusal rates					
All contacts	.347	.340	.238	-.050***	5649
Completed interviews in prior wave	.315	.286	.160	-.065***	5149
Refusals in prior wave	.903	.973	.964	.010	398
Any noncompleted surveys in waves to 1998	.250	.260	.199	-.024***	5649
Any refusals in waves to 1998	.154	.201	.162	-.004	5649

* $p < .05$, ** $p < .01$, *** $p < .001$. Cohort dummies included in logistic regression model for computing marginal effects. Marginal effects are evaluated at the sample means of variables.
Source: Table compiled by the authors.

subsequent education (marginal effect of test score at mean= .014 for model with test scores and cohort, .015 for a model also adding years of mother's and father's education as available, and .016 for a model also adding respondent's own years of education). As the last two rows of the table indicate, those with lower cognitive skills are underrepresented among those for whom complete data is available over the 18 waves from 1979 to 1998, but this difference is entirely attributable to noncontacts of one kind or another and is not the result of cognitive differences in rates of refusal.

In trying to understand this difference, one might point to any

of various differences between the WLS and NLSY, such as the ages and birth years of sample members, the geographic area represented, the number and frequency of interviews, or the interview mode. We chose to focus first on methods of refusal conversion. The 1993 WLS attempted to convert refusals just by having especially skilled interviewers place a second call. The 2004 WLS engaged in a much more extensive effort to convert refusals, including sending a packet that included the 1993 respondent report and a CD of popular songs from 1957 before attempting conversion (and sometimes attempting more than once). Even so, conversion rates for respondent refusals in the 2004 was only 19.4%, and there was no relationship between conversion and cognitive skills ($p = .32$ in the direction of those with higher cognitive skills being *more* likely to be converted).

NLSY79 refusal conversion efforts in 1998, meanwhile, included a discretionary and variable increase in the financial incentive to participate (Olsen, 2005; precise amounts used in such conversions are not publicly available). Designations of cases as converted or as refusals indicate that 72.6% of initial refusals in 1998 were successfully converted. NLSY79 refusal conversion was not only successful but was differentially successful: respondents with lower cognitive skills who initially refused were more likely to participate following the refusal conversion effort than were those with higher ability. This can be seen by looking at the initial (i.e., pre-conversion) refusal rates in the NLSY79 in Table 4. While 34.7% of respondents in the lowest quintiles initially refused, only 23.8% of those in the highest quintile did (indicating a difference of 85% vs. 60% in refusal conversion rates). As with the earlier models of ultimate refusal, the effect of adolescent cognitive ability was not at all attenuated in a logistic regression model by the addition of controls for parents' prior or respondents' subsequent education.

Evidence of serial conversion in NLSY79 raises the possibility that some respondents might initially refuse to participate with the expectation they can hold out and receive more money. Specifically,

Table 4 The Relationship Between Cognitive Test Scores and Both Initial and Ultimate Refusals, 1980—2004 Waves of the National Longitudinal Survey of Youth in 1979

	Initial Refusal Rate			Survey Refusal Rate			
Year	Lowest Quintile	Highest Quintile	Marginal Effect	Lowest Quintile	Highest Quintile	Marginal Effect	N
1980	.027	.013	-.005*	.016	.004	-.003*	6026
1981	.039	.011	-.007***	.012	.004	-.002**	6025
1982	.033	.018	-.006**	.010	.008	-.001	5962
1983	.037	.016	-.007***	.013	.008	-.001	6005
1984	.054	.041	-.007*	.017	.024	.001	6018
1985	.063	.069	.000	.019	.032	.004*	5931
1986	.072	.079	-.001	.021	.048	.007**	5917
1987	.206	.125	-.028***	.033	.049	.006*	5824
1988	.136	.093	-.016***	.038	.056	.005	5848
1989	.231	.136	-.039***	.033	.057	.007**	5887
1990	.202	.134	-.027***	.030	.072	.011***	5883
1991	.244	.145	-.041***	.030	.058	.010***	5872
1992	.319	.166	-.058***	.036	.065	.010***	5876
1993	--	--	--	.031	.069	.012***	5569
1994	--	--	--	.038	.081	.013***	5550
1996	.233	.197	-.019**	.046	.098	.017***	5776
1998	.347	.238	-.050***	.050	.095	.014***	5649
2000	.198	.209	-.002	.082	.149	.019***	5717
2002	.145	.156	-.000	.092	.126	.007	5459
2004	.107	.186	.019***	.076	.164	.026***	5476

* $p < .05$, ** $p < .01$, *** $p < .001$. Initial refusal information not available in the NLSY79 public release for 1993 or 1994.
Source: Table compiled by the authors.

the percentage of converted respondents in one wave who initially refused in the next wave increased from about 20% in the 1981 NLSY79 to over 70% by the 1998 NLSY. This serial conversion does not undermine the basic result, as presumably, without the added incentive, most initial refusals would have ended up ultimate refusals sooner or later. Thus, it seems that the use of significant financial incentives in NLSY79 might plausibly be credited with preventing the cognitive gradient in refusal rates observed in the

WLS.[5]

We can adduce further evidence for this possibility by expanding the analysis to include all NLSY79 reinterviews from 1980 to 2004 (Table 4; sample sizes here exclude attempted cases that were neither completed interviews nor refusals). As it happens, after 1998, NLSY79 switched to fielding strategies in which the use of differential incentives in refusal conversion was decreased. In 2000, an experiment involving increased initial incentives for all remaining respondents ($40 or $80) was conducted after an across-the-board $20 incentive appeared to yield higher ultimate refusal rates (Olsen, 2005). In 2002 onward, respondents are offered the opportunity for a higher incentive by contacting NORC upon receipt of the advance mailing instead of waiting to be contacted (a difference of $80 vs. $40), and reluctant respondents are not readily offered more cash but instead told that they can receive a higher incentive in the next round by participating then in this "early bird" program. NLSY79 respondents thus experienced an increase in the initial incentive offered either in 2000 or 2002 (or both). As Table 4 indicates, initial refusals for those in the lowest quintile decreased dramatically from 1998 onward, eliminating (at least for the time being) the inverse cognitive gradient in initial refusals. While all this is only indirect evidence that incentives per se explain observed differences between the WLS and NLSY79, the sharp difference in NLSY79 results before

[5] Given the lack of available data on whether particular respondents were converted by persuasion of by offering incentives, these results cannot speak to the Lengacher, Sullivan, Couper, & Groves (1995) finding that respondents offered a large incentive in the inaugural wave of the Health and Retirement Study (HRS) were not more likely to refuse to participate in the second round than reluctant respondents converted by persuasion alone. Regardless, respondents in later waves of NLSY79 probably had much stronger grounds for inferring that refusals would be followed by an increased incentive than did HRS respondents, if the first and second waves of a longitudinal study are experienced as much more distinct than the tenth and eleventh waves.

and after 2000 would suggest the difference cannot be attributed to any stable advantage in the persuasion skills of NORC interviewers versus WLS interviewers with lower ability populations.

This could be examined more directly with specific information on the differential incentives offered in different rounds in the NLSY79. Moreover, data from the 2000 incentives experiment, especially compared to the respondents not included in the experiment, could be used to see where cognitive skills moderated effects of the presence or size of an increased financial incentive. For that matter, acceptances of the 2004 Early Bird offer could be used to see if this option is relatively attractive to lower ability respondents who had been subject to serial conversion efforts before. None of these data are presently available in the NLSY79 public release and thus could not be examined in this study. Researchers with access to this information in NLSY79 or comparable information in other longitudinal data with good measures of respondent cognition, however, are urged to consider how cognition is related to differential response to incentives and its implications for overall response rates.

We show also in Table 5 how baseline sociodemographic characteristics differ among the original NLSY79 sample, the sample that would result had initial refusals not been converted (N=3863), and the final sample after refusal conversion efforts were made (N=5159, the number of completed cases). Important to note here is that, for both the measures of quantitative and verbal ability, the refusal conversion efforts in the 1998 NLSY reduced the discrepancy between the initial refusal means and the full sample means by 90% (a discrepancy of .763 in the quantitative ability mean was reduced to .054, and a discrepancy of .624 in the verbal ability mean was reduced to .061). For the other characteristics presented in Table 5, however, refusal conversion efforts did not consistently yield final sample means closer to the full sample mean than was the initial sample means. In such cases, the principal benefit of refusal conversion is the retention of sample size, rather than reduction of bias.

Table 5 Summary Statistics for Baseline Characteristics, NLSY

	Full Sample	Initial Sample 1998	Final Sample 1998
Female	.509	.526	.523
	(.500)	(.499)	(.500)
Mother's years of education	11.553	11.655	11.568
	(2.765)	(2.711)	(2.709)
Father's years of education	11.811	11.910	11.796
	(3.600)	(3.542)	(3.563)
Mother's SEI score	36.474	36.464	36.301
	(13.992)	(14.201)	(13.970)
Father's SEI score	41.122	41.292	40.933
	(13.781)	(13.840)	(13.718)
ASVAB quantitative	49.331	50.094	49.277
	(9.5049)	(9.496)	(9.456)
ASVAB verbal	48.767	49.391	48.706
	(10.153)	(9.896)	(10.119)
Observations	6111	3863	5159

Standard deviations in parentheses.
Source: Table compiled by the authors.

In considering the reasons for a cognitive gradient in refusals in the absence of significant financial incentives, one might again consider surveys more burdensome for those with more limited verbal ability. Unlike the HN test for the WLS, which provides only a general score, the ASVAB contains subscales that allow for comparative evaluation of verbal and quantitative skills on the probability of initial refusal.

Results are shown in Table 6 (sample sizes are lower than in the above analyses of NLSY 1998 due to listwise deletion of cases missing on test scores). Surprisingly, for a model including verbal and quantitative skills along with gender and cohort indicates that the significant relationship between cognition and initial refusal in the 1998 NLSY79 is entirely explained by *quantitative* ability, with verbal ability having no significant effect on initial refusal net of quantitative ability (marginal effects of standard deviation increase in ability on probability of refusal being −.059 for quantitative ability

Table 6 Logistic Regression Coefficients for Models of Initial and Final Nonparticipation in 1998 NLSY79+

	Initial Refusals			Final Refusals		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
ASVAB verbal score (*z*)	.002	.024	.017	.223**	.247**	.237**
	(.046)	(.047)	(.048)	(.086)	(.089)	(.089)
ASVAB quant score (*z*)	-.260***	-.288***	-.304***	.012	-.040	-.038
	(.046)	(.048)	(.051)	(.077)	(.080)	(.086)
Female		-.162**	-.185**		-.267*	-.308**
		(.061)	(.062)		(.105)	(.107)
Parental Education (< HS omitted)						
Parent HS only		-.020	-.022		.060	.058
		(.085)	(.085)		(.158)	(.159)
Parent some college		.076	.058		-.109	-.121
		(.116)	(.117)		(.212)	(.214)
Parent college degree		.040	.026		.087	.108
		(.122)	(.124)		(.209)	(.212)
Parent occupational prestige, 1979		.001	.001		.004	.005
		(.003)	(.003)		(.005)	(.005)
Education (HS or lower omitted)						
Some college			.105			.092
			(.081)			(.138)
College degree			.053			-.103
			(.097)			(.161)
Occupational prestige			.006			.016**
			(.004)			(.006)
N		5357			5357	

* $p < .05$, ** $p < .01$, *** $p < .001$. Standard errors in parentheses.
+Parental education and SEI are measured as the highest value reported by either parent. Models include a full set of dummy variables for cohort, and terms for missing parental SEI or education data and missing respondent's own SEI.
Source: Table compiled by the authors.

[$p < .001$] and +.004 [$p = .652$] for verbal ability). This result is inconsistent with any explanation of the relationship between cognitive skills and survey participation that focuses on linguistic burden. As one possibility, because the NLSY79 asks many economic questions—as well as questions about the dates of events—it could be said to contain more quantitative content than many other surveys, which could potentially lead to quantitative

ability figuring more importantly in initial response rates for the NLSY79 than elsewhere. At the same time, the puzzling earlier finding that cognitive skills are positively related with final refusals in NLSY79 is driven entirely by differences in verbal scores, not quantitative scores. Data from other surveys with multiple dimensions of cognitive skills data and recruitment metadata are needed to show whether these effects are idiosyncratic to NLSY, or reflect a broader pattern of how verbal and quantitative skills are differentially implicated in survey nonresponse.

III. Discussion

Survey methodologists have long recognized that people participate in surveys for different reasons. A possibility suggested by our results is that nonfinancial appeals may be more effective among respondents with higher cognitive skills. Cognitive factors are already thought to be important for explaining the relationship between education and civic-minded activities like voting (Luskin, 1990; Nie et al., 1996), political participation (Neuman, 1986) or volunteering (Wilson, 2000). Why this is so remains largely unexplained: cognitive advantages may lead to life advantages beyond those accounted for in standard socioeconomic measures and thereby provide even stronger incentives to endorse civic virtues, or the same tendencies involved in later civic-mindedness might encourage more motivated behavior in school or specifically on tests. In any case, given the known association between cognitive skills and prosocial and civic behavior, we might expect cognitive skills to be positively associated with response to prosocial-spirited appeals. If true, a practical implication would be that financial incentives do not simply improve response rates but may also improve representativeness.

The result might be confined to longitudinal studies. Important to recognize is that the WLS and NLSY79 both have very high response rates relative to less elaborately fielded cross-

sectional studies, indicating that some participants in these studies can be expected to refuse other kinds of survey participation requests. Appeals about the special character of the longitudinal studies—how such data is uniquely important or how individual respondents "cannot be replaced" by anyone else—might be more readily appreciated and thus more effective among respondents with higher cognitive skills. Differential appeal phrasing has been found to significantly impact response rates (Tourangeau & Ye, 2009), although specific conjectures about appeals are most readily resolved by further experiment. That said, the content of the survey on which such an experiment was conducted might also be important: surveys with a strong focus on life outcomes, especially if they began recruiting when respondents were in school, could be differentially appealing to respondents who did well in school. A practical implication of this is that survey designers need to think carefully about how incentives and survey content might influence representativeness.

Although not intended (at least originally) as a study of incentives, the results suggest that incentives may mitigate any tendency for those with lower cognitive skills to be more likely to refuse to participate in surveys. This finding would be consistent with others that incentives may be disproportionately effective among those with lower education or lower income, as well as among those who had previously declined to participate in previous panel study waves (Zagorsky & Rhoton, 2008). If those with lower cognitive skills are otherwise more likely to refuse to participate, incentives can thus improve the representativeness of surveys, reducing total nonresponse error (see Singer, Groves, & Corning, 1999; Singer, Van Hoewyk, & Maher, 2000; Peytchev, Baxter, & Carley-Baxter, 2009). Indeed, this study suggests that cognitive skills may be vital to understanding the psychological factors that underlie these earlier results about the differential effect of incentives by education and income. In any case, the example of WLS suggests that even surveys that have successfully attained high response rates without incentives might consider

employing them to reduce possible biases due to nonresponse.[6] Because cognitive ability measurement is typically unavailable in surveys, the extent to which this bias is introduced in recruitment and retention practices is typically unable to be detected and unable to addressed by poststratification reweighting. Further work with panel studies containing cognitive skills data is needed to determine whether the patterns observed here are more general and, if so, how the form and magnitude of incentives affect ultimate cognitive gradients in participation.

[6] The WLS cannot implement differential incentives in the refusal conversion process as simply as the NLSY, as many WLS respondents are in contact with one another (but see Singer et al., 1999 on respondent attitudes toward information about differential incentives).

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認知能力與拒絕受訪的關係：以美國的兩個貫時性社會調查為例

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摘 要

本研究分析受訪者參與貫時性社會調查的持續性是否與認知能力的高低有關。「威斯康辛長期追蹤研究」多次追蹤一批於1957年高中畢業的學生至今。筆者分析這項調查資料發現，能持續多次參與長期追蹤調查的受訪者，通常認知能力較高，而且這個關係並不受家庭背景的影響。只有在控制受訪者的教育成就、職業地位及社會參與程度之後，這兩者之間的關係才略為降低。然而，在「美國1979年青少年長期追蹤研究」(NLSY79) 之1998年波次的資料中卻呈現相反的關係：認知能力較高的人比較可能拒絕參與調查。筆者進一步分析NLSY79的資料發現，其實認知能力較低者，一開始也是比較容易拒絕參與調查，只是後來被訪員所說服，轉變成願意參與調查。NLSY79提供金錢誘因，使部份剛開始表示拒絕受訪的人，後來能願意接受訪問。然而WLS並沒有提供這樣的金錢誘因。這或許能解釋為何這兩項資料會呈現不同的研究結果。

關鍵詞：認知能力、拒絕受訪、貫時性研究