Article

Youth Violence and Juvenile Justice
11(3) 196-211

DOI: 10.1177/1541204012463410
yvj.sagepub.com
SAGE

IQ and Delinquency: The Differential Detection Hypothesis Revisited

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Abstract

The purpose of this study is to examine the degree to which police arrest is influenced by an offenders' level of verbal intelligence. Concomitantly, we examine whether the level of concentrated disadvantage of the neighborhood where the offender resides moderates the effect of verbal intelligence on arrest. To accomplish this, we employed the National Longitudinal Study of Adolescent Health (Add Health) to examine the extent to which persistent delinquent youths' self-reported arrests are significantly related to their verbal IQ scores. Furthermore, we also analyzed the interaction of verbal IQ scores and neighborhood disadvantage net of an array of theoretically relevant control variables.

Keywords

verbal intelligence, differential detection, arrest, delinquency

A majority of adolescents engage in conduct that, if detected by the police, could result in an arrest. Not all of them end up arrested by the police, however. This empirical reality clearly indicates that law enforcement decisions do not flow only from consideration of legal factors, but there are also certain nonlegal factors in operation. In a series of efforts to identify such nonlegal factors that might influence police officers' decision to adopt punitive sanctions, researchers have typically focused on situational factors surrounding officer–offender encounters or officer's psychological attributes (Terrill & Reisig, 2003; Worden, 1989). To a lesser extent, police scholars have investigated organizational factors and, more recently, neighborhood factors as potential determinants of police behavior (Klinger, 1997; Warner & Coomer, 2003).

Recently, Beaver, DeLisi, Mears, and Stewart, (2009) garnered considerable attention by demonstrating that a series of critical decisions of the actors in law enforcement and the court system are affected by offenders' level of self-control. Previous researchers had consistently noted that disrespectful, belligerent, obdurate, and impulsive offenders were more likely to get arrested and received harsher punishments (Black, 1976; Piliavin & Briar, 1964; Terrill & Reisig, 2003). Beaver

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et al.'s (2009) study is meaningful by showing that low self-control is what potentially induces offenders to behave disrespectfully, belligerently, and impulsively even at the immediate prospect of arrest or imprisonment. Offenders with low self-control, according to this study, were not only more likely to be stopped and arrested by the police but also more likely to be convicted than their high self-control counterparts.

On a different note, a long line of research in clinical psychology and neuroscience indicates that self-control, which is a part of a larger executive function housed in the prefrontal cortex of the brain, is closely linked to verbal intelligence (Beaver, DeLisi, Vaughn, Wright, & Boutwell, 2008; Beaver & Wright, 2007; Luria, 1961; Moffitt, Caspi, Silva, & Stouthamer-Loeber, 1995). Based on this literature, we hypothesize that offenders' verbal intelligence also plays a statistically meaningful role in shaping police officers' decision to arrest. Thus, in the present study we examine the extent to which police arrest is influenced by offenders' level of verbal intelligence. Concomitantly, we examine whether the type of neighborhood in which the offender resides moderates the effect of an offender's verbal intelligence on arrest.

Similar to Beaver et al. (2009), we use the National Longitudinal Study of Adolescent Health (Add Health). The Add Health is singular in that it offers one of the largest nationally representative longitudinal data sets of American adolescents (Udry, 1998), which includes adolescents' self-reported delinquency, arrest experiences, and verbal intelligence test scores. To foreshadow our findings, youthful delinquents with low verbal intelligence appear to be more likely to be arrested than their counterparts of normal and higher verbal intelligence. More importantly, the effect of verbal intelligence on arrest appears to be conditioned by neighborhood disadvantage.

Intelligence and Delinquency

Intelligence means dozens of different things to different people (Nisbett et al., 2012). Further, the checkered history of biases and cruel criminal justice policies that were associated with the concept of intelligence (Dugdale, 1877; Goddard, 1914) advise criminologists to remain vigilant for the misuse of it. Nevertheless, intelligence when measured through common IQ tests is a reasonably strong correlate and predictor of a range of outcomes.[1] For instance, the correlation between IQ scores and school grades is about .5, meaning that about 25% of the variance of school performance is explained by IQ scores (Neisser et al., 1996). Intelligence is also correlated with years of education ($r = .55$), job performance ($r = .54$), and other various aspects of successes and failures in life (Neisser et al., 1996).

IQ scores are also linked to delinquency, although the magnitude of the correlation is relatively weak compared to other aforementioned outcomes. Nonetheless, it is as strong as the effect of social class, and the IQ-delinquency relation holds up even after social class and race are controlled for (Hirschi & Hindelang, 1977). The IQ differences found between delinquents and nondelinquents are typically about eight points or half a standard deviation ([*SD*] Hirschi & Hindelang, 1977; Neisser et al., 1996). Contrary to some researchers' argument that the low IQ scores of delinquents merely reflect the lack of test motivation typical of delinquent youths (Tarnopol, 1970), the IQ-delinquency relation survives a statistical control of test motivation (Lynam, Moffitt, & Stouthamer-Loeber, 1993). Several studies also showed that the causal sequence flows from IQ to delinquency, and not vice versa (Lynam et al., 1993; Moffitt et al., 1995).

There has been a heated scholarly debate on why such a relationship exists. Herrnstein and Murray (1994), in their widely debated *The Bell Curve*, went so far as to suggest that IQ scores are *the* primary cause of delinquency while excluding all other salient sociological variables, a claim that was later repeatedly refuted as being pseudoscientific and politically oriented (Cullen, Gendreau, Jarjoura, & Wright, 1997). One hypothesis that has garnered most empirical support thus far is the school performance-mediation hypothesis. This hypothesis posits that intelligence and

crime are related as a consequence of school performance, where low intelligence leads to poor school performance, which, in turn, induces frustration and retards the growth of social bonds to conventional institutions that may inhibit deviance (Hirschi & Hindelang, 1977; Ward & Tittle, 1994). Research that tested this hypothesis has consistently revealed evidence in support of this position while disputing other competing hypotheses (McGloin & Pratt, 2003; McGloin, Pratt, & Maahs, 2004; Moffitt & Silva, 1988).

IQ scores encompass varying dimensions, but it is worth noting that IQ deficits of delinquents are concentrated in the verbal dimension. In contrast, youths' abilities in visual, spatial, and motor domains are generally less associated with delinquency. For instance, Moffitt et al. (1995), employing the Dunedin Longitudinal Study, a prospective study of a cohort of 1,037 children born in New Zealand, shows that verbal skills and verbal memory far outweighs other dimensions of intelligence, such as visual–spatial, visual–moor integration, and mental flexibility in their predictive ability of delinquency. Youths with low verbal IQ scores are also at risk for a range of other maladaptive developmental outcomes such as problems understanding and communicating emotions accurately, self-regulation, and difficulties in social problem-solving skills and decision making (Dionne, 2005; Moffitt et al., 1995). These findings indicate that deficits in verbal capacity are also linked to deficits in the "executive function" of the brain that regulates planning, decision making, and moderation of social behaviors of humans. Impulsive violent offenders are often found to have deficient executive functions as well as low verbal IQ scores (Lynam et al., 1993; Moffitt et al., 1995).

Self-control, Verbal Skills, and the Differential Detection Hypothesis

The IQ-delinquency causation hypothesis has its fair share of competing hypotheses. One of the competing hypotheses is what has been called the differential detection hypothesis. According to this, the relationship between intelligence and delinquency is essentially spurious, and the one half a *SD* IQ score differential between delinquents and nondelinquents merely reflects the fact that less intelligent delinquents are more likely to be detected and arrested by the police, while their intellectually advantaged counterparts are somehow better at avoiding detection (Moffitt & Silva, 1988; Stark, 1975). Thus, insofar as official measures of delinquency are employed, the differential detection hypothesis considers the inverse correlation between IQ scores and delinquency as being spurious. Simply put, this hypothesis suggests that IQ scores of officially detected delinquents are not representative of the IQ scores of delinquents at large (Moffitt & Silva, 1988).

To ward off the differential detection confound that may be present in studies using official measures of delinquency, self-report studies have subsequently been conducted. Contrary to the expectation that the IQ difference between delinquents and nondelinquents would be eliminated in self-report studies, the results of these studies have also manifested a statistically significant negative correlation between IQ scores and delinquency. Most of the studies, however, revealed a substantially attenuated correlation compared to studies using an official measure of delinquency (see Hirschi & Hindelang, 1977). Because a significant inverse association still remains even in self-report studies, most researchers appear to have dropped the differential detection hypothesis in their research agenda.

However, we suggest that the fact that both official and self-report studies exhibit a negative correlation between delinquency and IQ scores does not necessarily provide a definitive conclusion that police officers are no more likely to arrest low IQ delinquents than they arrest high IQ delinquents. Individuals evoke different reactions from their social environment depending on their genetic propensities, personality traits, and behaviors (Scarr & McCartney, 1983). For instance, children in the same family evoke different reactions from their parents. A child who is genetically predisposed to be irritable and oppositional will likely elicit cold and negative responses from their parents, when compared to a child who is of agreeable and affable disposition. In a similar vein, we hypothesize that verbally deficient delinquents are more likely to elicit more punitive reactions from

police officers as did delinquents with low self-control, as noted by Beaver et al.'s study (2009). Such a hypothesis is quite plausible considering the recent empirical and theoretical research into the association between language development and self-control.

Research has consistently shown that language/verbal skills are related to a wide range of adverse behavioral outcomes. Impaired language skills of children lead to delinquency, school failure, and physical aggression, while proper language development fosters emotional control and impulse regulation (Dionne, 2005; Moffitt et al., 1995). Note that the characteristics of these outcomes are quite similar to those of self-control described by Gottfredson and Hirschi (1990). In fact, a long line of research indicates that language development is closely related to self-control. Summing up the research results, Gallagher (1999, p. 5) stated that

> One of the most important functions of language is intrapersonal emotional and behavioral regulation. Children's language comprehension and expression skills are critical to their understanding, encoding, organization, and retrieval of rules that enable them to effect appropriate levels of self-control and emotional regulation.

Despite the close nexus, the precise mechanism surrounding language and self-control has not always been clear. Dionne (2005) summarizes two different perspectives that may account for the association. The first perspective—termed the shared etiology explanation—is that language skills and self-control are caused by the same but unknown factors. The causal factors could be environmental, genetic, or a combination of both factors. The second perspective—termed the causal effect explanation—is that self-control is caused by language skills. Gottfredson and Hirschi (1990) argued that self-control in children is instilled by continuous parental correction of their offspring's misbehavior. The process of correcting a child's misbehavior necessitates a minimum level of language skills on the part of the child, through which the child understands parents' commands, directions, and statements. Without the child's language skills, self-control thus would not develop. On a related note, Luria (1961; Luria & Hamskaya, 1964) posited that a child's neuronal pathways in the frontal lobes can develop properly only when the child learns to abide by parental verbal instructions and commands. Given that self-control is part of the executive function, housed in the frontal lobes of the brain (Beaver et al., 2008), it appears reasonable to assume that language skills contribute to proper development of self-control.

A recent study by Beaver and colleagues (2008) examined empirical viability of these two different perspectives using the subsample of twins from the Early Childhood Longitudinal Survey, Kindergarten Class of 1998–1999 (ECLS-K). Their findings shed some light on the research questions of the present study. First, language skills were robustly associated with self-control. The association held true both cross sectionally and longitudinally. Second, the covariation between language skills and self-control was largely accounted for by genetic factors, supporting the shared etiology explanation. Finally, their quantitative genetics model showed that, controlling for genetic effects and shared environmental effects, language skills were a significant predictor of self-control, supporting the causal effect explanation. In other words, analyses of ECLS-K data offer evidence supporting both perspectives.

Given the close connection between self-control and language skills, delinquent youths with verbal deficits may be more likely to end up resorting to quick physical or otherwise disrespectful reactions than verbally adroit youths. A plethora of studies show that officers are more likely to arrest youthful offenders who they perceive as belligerent, obdurate, disobedient, and disrespectful (Black, 1976; Piliavin & Briar, 1964; Terrill & Reisig, 2003). Piliavin and Briar (1964, pp. 210–211) note, in their classic study of police officers:

> The cues used by police to assess demeanor were fairly simple. Juveniles who were contrite about their infractions, respectful to officers, and fearful of the sanction that might be employed against them tended to be viewed by patrolmen as basically law-abiding or at least 'salvageable . . .' [I]n contrast, youthful

> offenders who were fractious, obdurate, or who appeared nonchalant in their encounters with patrolmen were likely to be viewed as 'would-be tough guys' or 'punks' who fully deserved the most severe sanction: arrest.

Given the close linkage between self-control and verbal capacity, differential detection contingent upon verbal IQ scores appears to be a plausible hypothesis. To our knowledge, however, there is only one study that has ever delved into this issue.

Utilizing the Dunedin Longitudinal Study, Moffitt and Silva (1988) compared the verbal IQ scores of the delinquents who were detected by the police according to official police records and the verbal IQ scores of delinquents who were not detected according to self-reports. They failed to find a significant difference in verbal IQ scores between the two groups of delinquents. Although methodologically sound, this study used a non-American sample; thus, whether the findings can be generalizable to an American sample is an empirical matter. In addition, no study has examined the possibility that the effect of verbal IQ may interact with other salient factors associated with police behavior, such as neighborhood disadvantage.

Neighborhood Disadvantage and Police Arrest

Donald Black (1976) posits that the application of punishment (e.g., arrest) by legal agents can also be explained by social space in which the subjects of control are placed. He further suggests that the police employ more punitive action toward offenders with low socioeconomic background or marginal cultural status, such as minorities, the poor, or those from disadvantaged communities (1976). In support of Black's argument, research following the Chicago School's tradition of neighborhood ecology reveals that police coercive actions are not evenly distributed across communities (Terrill & Reisig, 2003; Warner & Coomer, 2003; Werthman & Piliavin, 1967). It appears that officers develop a kind of cognitive script based on their prior experiences through which they believe individuals in poorer communities commit more crimes than in wealthier areas. Such cognitive scripts can induce officers to behave differently depending on the type of geographical areas the police–suspect encounter takes place. In a similar vein, Werthman and Piliavin (1967) in their classic study of patrol officers' behaviors found that patrol officers come to associate neighborhoods with the frequency with which they encountered suspicious persons. Officers not only define certain people as suspicious based on their behaviors and demeanors but also define geographical areas as suspicious. Further, the police tend to attach moral liability to the suspects they encounter in the suspicious neighborhoods irrespective of their individual behavioral manifestations. Likewise, Bayley and Mendelsohn (1969) also noted that the police behave more aggressively and make more arrests in lower class and high crime neighborhoods due to a perceived greater social distance between the police and the residents.

Empirical support for this position, however, is not unequivocal. A sizable number of police researchers are in fact reluctant to endorse the notion that officers behave more aggressively and vigorously in communities marked by structural disadvantages. For example, in his study of officers in one disadvantaged community, Goldstein (1960) observed that officers took rather a lukewarm approach to serious assault cases: they rarely arrested the assaulters, much less taking an official report. In support of this finding, Klinger (1997) and Skolnick (1966) argue that police activities in high crime communities are in reality less vigorous, thus leading to fewer arrests and less coercive actions, partly due to heavy workloads and resource constraints. Sherman also notes that police agencies in high-crime districts direct their limited resources only to major crimes, not being able to respond to all criminal acts with equal vigor (1990). Police often view criminal victims in such neighborhoods undeserving of police protection because they either precipitate in their victimization or they themselves are criminals in other contexts. Officers become quite cynical, believing that, no matter what they do, crime rates will remain always high. Officers' cynicism and perceived victim undeservedness also contribute to less vigorous police actions (Klinger, 1997; Niederhoffer, 1967).

In view of such conflicting claims and empirical findings, more research is clearly needed to provide informed answers as to whether police are indeed more likely to arrest delinquents in disadvantaged communities. Given our discussion on the possible predictive effect of verbal intelligence on police arrest, one potentially fruitful area of research is to explore the extent to which the effect of verbal intelligence is conditioned by (or interacts with) the level of neighborhood disadvantage. It is illuminating to note that McCluskey, Reisig, Mastrofski, and Terrill's (1999) finding that disrespectfulness displayed by suspects was conditioned by the level of neighborhood disadvantage; that is, suspects were significantly more likely to exhibit disrespect toward officers when the police–suspect encounter occurred in neighborhoods characterized by concentrated disadvantage. Based on the argument that displays of disrespectful demeanors may be associated with low verbal IQs, we hypothesize that the neighborhoods' level of disadvantage moderates the effect of verbal IQs on arrest. To our knowledge, this issue has never been empirically examined.

The Present Study

The purpose of this study is to examine the degree to which police arrest is influenced by offenders' level of verbal intelligence. Concomitantly, we examine whether the level of concentrated disadvantage of the offender's neighborhood moderates the effect of verbal intelligence on arrest. To accomplish this, we examine the extent to which delinquent youths' self-reported arrests are significantly related to their verbal IQ scores and, further, to the interaction of verbal IQ scores and neighborhood disadvantage net of a set of theoretically relevant control variables.

Data Sources and Sample

Data for the present study comes from the National Longitudinal Study of Adolescent Health (Add Health), a longitudinal and nationally representative sample of American youths (Udry, 2003). Although four waves of data have been collected so far, only the first three waves of data are utilized in the present study. Initial data collection began in 1994–1995, when the respondents were enrolled in 7th through 12th grades. A total of one hundred thirty-two schools across the nation were sampled through multistage stratified sampling techniques. In the beginning, an in-school questionnaire was administered to students attending these schools, and more than 90,000 students completed the survey instrument.

To obtain more detailed information from the respondents, a stratified subsample was selected and reinterviewed at their home. In all, 20,745 adolescents and 17,700 of their primary caregivers were interviewed in this in-home survey. Adolescents were queried on involvement in delinquent behaviors, police contacts, and a plethora of other items pertaining to adolescent development in general (Harris et al., 2003). The second wave of data was collected from 14,738 of the respondents in 1996. Because the lapse of time between Wave I and Wave II was relatively short, most of the items in Wave 1 were also included in Wave II interviews. The third wave of data was collected in 2001–2002, when most participants reached the age of 18 and 26. As a consequence, the items in the survey instruments were redesigned to include more age-appropriate questions, such as their lifetime contact with the criminal justice system and marital status, along with other items pertaining to young adults. Overall, 15,197 participants were interviewed successfully.

To examine the research questions of the current study, we culled an analytical sample from the entire Add Health sample using two criteria. Considering the goal of the present study, the first step involved selecting adolescents who reported having engaged in a delinquent act in any of the three waves that could have resulted in an arrest. The Add Health data contain a range of items measuring delinquent acts that, if detected by the police, could lead to an arrest. For instance, youths were asked at Wave I to self-report how many times in the past 12 months they had hurt someone badly enough to need medical attention, deliberately damaged property, sold drugs, taken something from a store

without paying, painted graffiti on someone else's property, driven other's car without permission, and gotten into a physical fight. Response categories were scored as 0 = never, 1 = once or twice, 2 = 3 or 4 times, and 3 = 5 or more times. Delinquency items at Wave II are quite similar because most participants were attending schools and were still in their adolescence at the time of Wave II. At Wave III, however, most respondents had reached young adulthood. Some of the questions were dropped accordingly and others were added to reflect age-appropriate topics. For example, respondents were asked whether they had deliberately written a bad check or used someone else's credit card without permission instead of the items on joyriding and painting graffiti. Delinquency scales were computed for each wave: Wave I and II delinquency scales consisted of 14 items, while delinquency III scale consisted of 11 items. Based on the three delinquency scales, we initially selected the adolescents who scored at least 1 on any of the scale

Second, the current study's aim is to examine whether low verbal intelligence increases the odds of arrest via manifesting itself in the form of adverse attitudes or behaviors toward police officers after a delinquent act. Thus, the analytical sample should be confined to the delinquents who had had an encounter with the police. At Wave 3, adolescents were asked whether they had ever been stopped or questioned by the police for any reason other than a traffic violation. Those who responded affirmatively to this question among the delinquents selected by the first selection criterion constitute the final analytical sample of the current study ($N = 2{,}810$).

Dependent Variable

The dependent variable of this study is whether a delinquent who had an encounter with a police officer has been arrested. To measure whether delinquents in our sample have ever been arrested by the police, a single item at Wave 3—Have you ever been arrested or taken into custody by the police?—was used. Out of the 2,810 delinquents who had an encounter with the police, 57% reported that they had been arrested or taken into custody.

Independent Variables

Verbal intelligence. Verbal intelligence is measured using the Peabody Picture Vocabulary Test–Revised (PPVT-R). The PPVT is among the most well-established indicators of verbal intelligence (Baker, Keck, Mott, & Quinlan, 1993). Furthermore, the PPVT-R has been regarded as a sufficient proxy for other generalized tests of intelligence, such as the Wechsler Preschool and Primary Scale of Intelligence for young children (Vance, West, & Kutsick, 1989). Add Health respondents were administered an abridged version of a 78-item PPVT-R test at Wave 1 and Wave 3, respectively. Every other item in the original PPVT-R was selected for use, and basal and ceiling rules were modified to take into account the smaller number of items. As in standard PPVT administration, the respondents were to select one picture among four illustrations that best illustrated the meaning of the word that was read by an interviewer. The raw scores were age-standardized and converted to the IQ metric, with a mean of 100 and a *SD* of 15 by the Add Health research team. We conducted an exploratory iterated principal factor analysis on Wave I and Wave III PPVT scores to create a single measure of verbal intelligence for Add Health respondents. The two scores loaded heavily on a single latent factor (Wave I = 0.72 and Wave III = 0.72, respectively). Thus, extracted factor scores were used as a measure of verbal intelligence.

Neighborhood disadvantage. A neighborhood disadvantage scale was constructed by using items drawn from Add Health's Wave I contextual data file. This file included information on neighborhood structural disadvantages at the block level from the 1990 Census. The 5 items used for the neighborhood disadvantage scale are proportion of single parent-headed households, proportion of households with income less than $15,000, proportion of households receiving public

assistance, proportion of African Americans, and the unemployment rate in the neighborhood. Because of potential collinearity, the items were factor analyzed, all of which loaded on a single factor (eigenvalue = 2.95, factor loadings > .64). Factor scores were used to construct the neighborhood disadvantage scale. This scale is similar to the ones used by other researchers analyzing neighborhood-level conditions (Cleveland, 2003; Sampson, Raudenbush, & Earls, 1997). Higher values on this scale indicated greater levels of neighborhood disadvantage.

Control Variables

The control variables are age (in years), Black (0 = non-Blacks, 1 = Blacks), non-Black minority (0 = Whites/Blacks, 1 = non-Black minority), sex (0 = female, 1 = male), and household income. Household income was created by a parent's report of the total household income in 1994. In addition, we included two theoretically and empirically relevant control variables—self-control and delinquency at Wave I—to help ensure that any relationships revealed were not the result of spuriousness.

Self-control. Research shows that low self-control, a potentially robust precursor to delinquency and other analogous behaviors, is linked to low verbal intelligence (Beaver et al., 2008; Luria, 1961; Moffitt, 1990), indicating a common deficit in executive function in the brain (Beaver & Wright, 2007; Moffitt, 1990). Thus, when confronting the police, not only the low self-control delinquents but also the verbally deficient delinquents are likely to display, or be perceived by officers as displaying, disrespect to the police. Thus, given the conceptual overlap between self-control and verbal intelligence, a statistical control of self-control allows a conservative estimate of the effect of verbal intelligence.

Gottfredson and Hirschi (1990) argued that self-control is characterized by variations in factors such as impulsivity, a preference for simple tasks, an avoidance of mental activities, a preference for physical activities, and self-centeredness. We employed a 5-item additive scale to measure the degree of self-control of Add Health participants. Adolescents at Wave I responded on a 5-point Likert-type scale to following statements: Have they had problems or trouble "keeping their mind on what they were doing," "getting their homework done," "paying attention in school," and "getting along with their teachers." These items tap into preference for simple tasks and physical activities, impulsivity, and temper components of self-control. In order to tap the self-centeredness component, respondents were asked whether they felt they were "doing everything just about right." Responses to these items were summed to form a low self-control scale (Cronbach's $\alpha = .63$). The same measure of self-control has been used by previous researchers analyzing the Add Health data (Beaver, 2010; Perrone, Sullivan, Pratt, & Margaryan, 2004). The self-control scale was coded in a way that high scores indicated lower levels of self-control.

Delinquency at Wave I. The analytical sample of the current study includes delinquents only. Yet, it is reasonable to assume that variation in the frequency of delinquency even among the delinquents affects the probability of arrest. To take into account this possibility, delinquency at Wave I was included as a statistical control. The Wave I delinquency scale consists of the same 14 delinquency items (Cronbach's $\alpha = .85$) that were used to cull the analytical sample of this study. Table 1 includes the descriptive statistics for the variables and scales used in the analyses.

Plan of Analysis

The analyses for the current study proceeded in two related steps. First, a multivariate logit equation was estimated with the arrest measure (no arrest = 0 and ever been arrested = 1) as the dependent variable. We included verbal IQ scores, neighborhood disadvantage, and control variables as covariates. This model provided initial evidence of the association between verbal intelligence and

Table 1. Descriptive Statistics ($N = 2,810$).

Variable	Mean	*SD*	Minimum	Maximum
Dependent variable				
Arrest	.57	.49	0	1
Independent variables				
Verbal intelligence	.08	.70	−3.68	1.62
Neighborhood disadvantage	−.09	.91	−1.35	4.82
Control variables				
Age	15.89	1.75	12	21
Black	.20	.40	0	1
Non-Black minority	.15	.35	0	1
Sex	.73	.44	0	1
Household income	48.27	46.91	1	999
Low self-control	7.26	3.26	0	20
Wave I delinquency	6.90	6.90	1	45

the probability of arrest, while controlling for neighborhood disadvantage and other controls. The second step entailed examining the interaction between verbal intelligence and neighborhood disadvantage in the odds of arrest. An interface of research from two separate areas suggests that verbal intelligence may be more strongly associated with the likelihood of arrest when it is paired with concentrated neighborhood disadvantage (Moffitt et al., 1995; Terrill & Reisig, 2003; Werthman & Piliavin, 1967; Wilson & Herrnstein, 1985). In light of these findings, we hypothesized that verbal intelligence effects are more pronounced in the presence of concentrated neighborhood disadvantage, thereby leading to a higher likelihood of arrest of low verbal IQ delinquents.

To test for an interaction effect, we employed a split-sample method. The multiplicative interaction term typically used in linear models can be problematic in nonlinear models because the magnitude of the interaction effect does not equal the marginal effect of the interaction term and can be of opposite signs (Ai & Norton, 2003). Thus, we chose to use a more parsimonious and suitable split-sample model instead of a hierarchical regression model involving a multiplicative interaction term. We estimated multivariate logit models predicting the probability of arrest for two subsamples, one sub-sample living in neighborhoods with a low structural disadvantage and the other with high disadvantage.

To be specific, we converted the neighborhood disadvantage scale into a dichotomous variable based on the mean score. Delinquents that lived in a neighborhood whose neighborhood disadvantage score was at or higher than the mean were called the disadvantaged neighborhood sample, while those who lived in neighborhoods whose score was below the mean were called the adequate neighborhood sample. With split-sample models, an interaction effect exists if the logit coefficient for one sample is different from the coefficient for the other sample. We hypothesized that verbal intelligence would be significantly related to arrest in the disadvantaged neighborhood sample but not in the adequate neighborhood sample. The split-sample method has been used by delinquency researchers especially for detecting interactions between biological and environmental factors in the etiology of deviant behaviors (Beaver, Wright, & DeLisi, 2008; Turner, Hartman, & Bishop, 2007).

The Add Health employs a stratified, multistage cluster design, whose clusters include region, urbanicity, and schools. Such a sampling design inevitably introduces nested observations, which violate the regression assumption of independence in observations. Resulting heteroscedastic error terms artificially deflate standard errors and tend to bias tests of statistical significance for the coefficients. Our approach to address this problem was to estimate robust standard errors by adopting Huber/White/Sandwich estimator of the variance (White, 1980). Robust standard errors typically take into account minor violations of regression assumptions, including correcting the covariance matrix of the estimates for heteroscedasticity. Compared with traditional standard error

Table 2. Logistic Regression Equation Examining the Effects of Verbal Intelligence and Neighborhood Disadvantage on Arrest ($N = 1,972$).

Variable	B	*SE*	Odds ratio
Verbal intelligence	–.33*	.08	.72
Neighborhood disadvantage	–.01	.06	.99
Control variables			
Age	–.08*	–.03	1.08
Black	–.18	–.14	.92
Non-Black minority	–.51*	.15	.60
Sex	.79*	.10	2.22
Household income	–.01	.01	.99
Low self-control	.05*	.02	1.04
Wave I delinquency	.06*	.01	1.06

* Significant at the .05 level, two tailed.

models, when robust standard errors are used, coefficient estimates typically remain the same but standard errors become larger, making it harder to reject the null hypothesis (White, 1980).

Results

The analysis began by estimating a multivariate logit regression equation, where the dichotomous arrest variable was used as the dependent variable. This model included verbal intelligence as measured by PPVT-R score, neighborhood disadvantage, and six control variables as covariates. As an initial step, we estimated the model on the full sample. Table 2 shows the results of the logit estimation. As Table 2 shows, verbal intelligence maintains a statistically significant and negative association with arrest, indicating that delinquents with low verbal IQ scores are more likely to be arrested by the police. The significance of verbal intelligence was obtained by controlling for Wave I delinquency. To further test the robustness of the findings, we ran additional models controlling for Wave II delinquency and Wave III delinquency, respectively. A quite similar pattern was revealed, showing the significance of the association between verbal intelligence and arrest in both of the models (results not shown). Yet, neighborhood disadvantage did not exhibit any statistically meaningful association with arrest. Nonetheless, in order to examine possible interaction between verbal intelligence and neighborhood disadvantage, we estimated split-sample models. The full sample was split at the mean of the neighborhood disadvantage scale. An interaction would be detected if verbal intelligence was associated with arrest in one sample but not in the other.

The first model in Table 3 estimated a logit equation for the adequate neighborhood sample, while the other model estimated for the disadvantaged sample. In both models, three of the covariates—non-Black minority, being male, and Wave I delinquency—increased the odds of arrest. Age was significant only in the adequate neighborhood sample, while low self-control was significant only in the disadvantaged neighborhood sample. Verbal intelligence, the key variable in this study exhibited a statistically significant negative association with arrest in the first equation. Yet, such an association did not hold true in the second model. These findings counter our hypothesis in that verbally deficient delinquents are more likely to be arrested *in adequate neighborhoods* but not in disadvantaged neighborhoods. Nevertheless, the findings do suggest that verbal intelligence interacts with neighborhood disadvantage in the likelihood of being arrested.

To determine whether our findings were robust, we ran a model using a different cutoff value on the neighborhood disadvantage scale. Previous researchers using the Add Health data suggested that value of the 75th percentile on the neighborhood disadvantage scale may indicate a tipping point at which neighborhood disadvantage becomes so stressful that it triggers a variety of aversive consequences

Table 3. Effect of Verbal Intelligence on Arrest by Neighborhood Disadvantage Classification.

	Adequate neighborhood sample (n = 1,342)			Disadvantaged neighborhood sample (n = 714)		
Variable	B	*SE*	Odds ratio	B	*SE*	Odds ratio
Verbal intelligence	–.41*	.10	.66	–.17	.12	.84
Control variables						
Age	.11*	.04	1.11	.05	.05	1.05
Black	–.15	.19	.86	–.04	.18	.96
Non-Black minority	–.48*	.19	.61	–.69*	.25	.50
Sex	.81*	.17	2.25	.80*	.18	2.22
Household income	–.01	.01	.99	–.01	.00	1.00
Low self-control	.03	.02	1.03	.06*	.03	1.06
Wave I delinquency	.06*	.01	1.06	.04*	.02	1.04

* Significant at the .05 level, two tailed.

(Beaver, Gibson, DeLisi, Vaughn, & Wright, 2011; Cleveland, 2003). We reestimated the equations employing the 75th percentile cutoff value. The results were essentially identical to those reported in Table 3; verbal intelligence was statistically significant only in the adequate neighborhoods ($p = .000$) but not in the disadvantaged neighborhoods ($p = .206$). We employed the split-sample method to detect interaction effects. Given that there could be some disagreement with using split-sample approaches to the study of interactions, we additionally tested the equality of coefficients across the two models in Table 3. A difference-in-coefficients *z*-test, following the equation suggested by Paternoster, Brame, Mazerolle, & Piquero (1998), showed that the effect sizes for verbal intelligence were different between the two samples, but the difference was marginally significant ($p = .06$).

Although we presented odds ratios along with logit coefficients in Table 3, even interpreting odds ratios could be misleading since they do not equal to probability. To facilitate interpretation of the findings in Table 3, we calculated predicted probabilities of arrest against the verbal intelligence score for the two separate groups, while holding all other variables at their respective means. Figure 1 is the graphical representation of the calculated probabilities for the two groups. As shown, while both groups exhibit a decrease in the probability of arrest as verbal intelligence score increases, the decrease is more pronounced for the adequate neighborhood group than for the disadvantaged group.

Discussion

Beaver et al.'s (2009) recent research suggested that offenders' level of self-control influences the decisions of law enforcement and court officials. Given prior theorizing and empirical research showing that self-control is linked to verbal intelligence, we examined whether delinquents' verbal intelligence was also associated with the likelihood of arrest. Encapsulated as the "differential detection hypothesis," the link between intelligence and the probability of arrest had been previously studied, but quite limitedly, by early scholars (Cullen et al., 1997; Moffitt & Silva, 1988). Although these studies had produced contradicting findings, research interest in this issue has been considerable abated among later scholars, since they increasingly endorsed the position that IQ does not influence the probability of arrest. Our analyses, focusing only on the verbal dimension of intelligence, revealed a different picture: verbal intelligence, as measured by the PPVT-R, did have a bearing on whether an offender was more likely to be arrested.

Specifically, our study showed that lower verbal intelligence predicted a greater likelihood of arrest. The effect of verbal intelligence on arrest withstood a set of controls including delinquency frequencies, which indicated that the observed effect was net of any effect verbal intelligence might

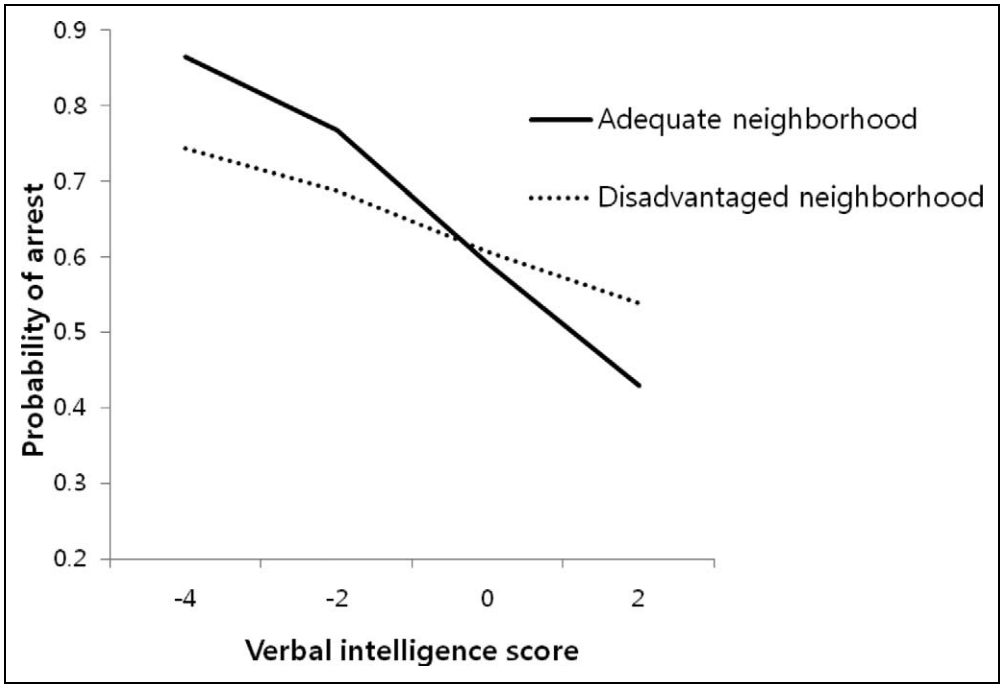

Figure 1. predicted probability of arrest by verbal intelligence: adequate versus disadvantaged neighborhood.

have on delinquency involvement. Such an effect also held up even the control of self-control. This is to say that low verbal intelligence explains arrest over and beyond what is explained by low self-control. Regarding the causal mechanism surrounding language skills, self-control, and arrest, our results do not support the position that language skills cause self-control. If that had been the case, the significance of the coefficient of verbal intelligence would have disappeared or shrunk substantially after the inclusion of self-control in Table 2.

Our findings have implications on the differential detection debate in particular and the intelligence–crime linkage research in general. The general approach of prior researchers on differential detection hypothesis was choosing a right answer between two mutually exclusive options—either low intelligence individuals commit more crime or they are merely more arrested by police even though they do not particularly commit more crime than their normal intelligence counterparts. We argue that this either-or position does not reflect what actually occurs in the real world. Low intelligence does have a causal relationship with crime, whether it is indirect or direct, as numerous empirical studies have consistently revealed (Hirschi & Hindelang, 1977; Lynam et al., 1993; Moffitt et al., 1995; Nisbett et al., 2012). At the same time, low intelligent offenders are more likely to get arrested by the police, as our research indicates. That is to say that these two phenomena are not mutually exclusive but occur concomitantly.

Importantly, our analyses also showed that variations in neighborhood disadvantage across physical spaces conditioned the effect of verbal intelligence on arrest. However, the findings were not in the hypothesized direction, revealing that verbal IQ was a significant predictor of arrest only in adequate neighborhoods but not in disadvantaged neighborhoods.

At first flush, this unexpected finding seems counterintuitive, but it may in fact be consistent with empirically reality. Consider McCluskey et al.'s (1999) finding that suspects behaved in a more disrespectful manner toward officers when the encounter occurred in disadvantaged communities. Also consider the research findings that demonstrated that police acted less vigorously in

disadvantaged, high crime areas due to workloads, resource concerns, and cynicism (Goldstein, 1960; Klinger, 1997; Skolnick, 1966; Niederhoffer, 1967). Then, even if verbally deficient delinquents are rightfully or wrongfully perceived by officers as disrespectful and obdurate, officers will encounter such delinquents more frequently in the disadvantaged neighborhoods. Saddled with workloads, high crime rates, and successive encounters with ostensibly disrespectful suspects, officers in such communities may react to another disrespectful delinquent with a less vigor and be less inclined to arrest her or him. In such contexts, legal factors (e.g., severity of delinquent act) may play a far dominant role in determining whether a delinquent will be arrested or not. In contrast, consider an officer responding to a verbally inept and disrespectful offender in an adequate neighborhood. In this neighborhood, the officer will typically encounter disrespectful suspects far less frequently and less crime is considered as normal. To the officers who have more time on their hands and are less cynical about the crime rates of the neighborhood, the seemingly disrespectful and unremorseful demeanor of a verbally inept delinquent may appear "out of context," less salvageable, or symptomatic of a "would-be-tough guy," thus deserving of an official sanction.

In summary, our research suggests that officers may take less vigorous and assertive actions against verbally deficient suspects in structurally disadvantaged neighborhoods than they would in advantaged neighborhoods. In regard to variation in police behaviors across physical space, then, our study partly supports the notions of Goldstein (1960) , Klinger (1997), and Skolnick (1966), while countering the views of Terrill & Reisig (2003) and Werthman & Piliavin (1967). Admittedly, our interpretation is at best ad hoc in nature. Nevertheless, our findings hint at potential benefits that can accrue to future researchers of differential detection hypothesis if they include in their research schema the context in which police–delinquent encounters take place. Scientists typically seek parsimony, but they also need to be cautious about using simple models that do not consider context. Since the environment can influence human behavior, it behooves scholars to consider the environment.

Although our results were obtained through a large nationally representative sample that allowed for the inclusion of important statistical controls, we would be remiss if we did not mention the limitations of our study. First, the Add Health data are derived from a school-based sample. It is possible that adolescents who had low verbal skills and police arrest records were disproportionately likely to miss school or simply drop out (see Hirschi, 1969). These youths missing from the analyses may have influenced the research results in some unpredictable ways. Second, we construed, based on the theoretical linkage between self-control and verbal intelligence, that deficits in verbal intelligence would induce delinquents to behave in a manner that attracts punitive responses more from law enforcement agents. Yet, the Add Health data did not contain any information on the actual demeanors of delinquents during police encounters. Nor did it contain information on whether youths with low verbal intelligence recklessly engaged in delinquency regardless of high likelihood of detection by the police. This means that we were not able to examine whether verbal intelligence in fact influenced the manner in which youths engaged in offenses or they interacted with the police. Future research with qualitative components can elucidate these connections in detail. Third, our analyses could not incorporate detailed information regarding the circumstances of the police–delinquent encounter, such as victim requests or presence of witnesses. These factors could certainly moderate the effect of verbal intelligence on arrest. Finally, both measures of delinquency and arrest in this study were derived from self-reported data, which means the degree to which the validity and reliability of the responses may have been influenced by forgetfulness or dishonesty of the subjects is unknown. Multiple sources of delinquency and arrest would have made this study stronger in this regard. Despite these shortcomings, the present study examined an issue that the research community has been relatively slow to evaluate. Thus far, only one study has examined the effects of verbal intelligence on police arrests, and there is none that has tested an interactive effect of verbal intelligence and neighborhood context. In this regard, our study meaningfully contributes to the field by showing the existence of verbal intelligence–arrest association employing a nationally

representative sample of adolescents. It also illustrates the importance of examining the interactions between verbal intelligence and neighborhood context.

Acknowledgments

This research uses data from Add Health, a program project designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris, and funded by a Grant P01-HD31921 from the National Institute of Child Health and Human Development, with cooperative funding from 17 other agencies. Special acknowledgment is due to Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Persons interested in obtaining data files from Add Health should contact, Add Health, Carolina Population Center, 123 W. Franklin Street, Chapel Hill, NC 27516, USA (addhealth@unc.edu). No direct support was received from grant P01-HD31921 for this analysis.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This study was supported by research fund from Chosun University, 2013.

Note

1. Technically speaking, intelligence and IQ scores are not the same. Intelligence is a theoretical construct that is associated with the general ability to reason, solve problems, and understand the world around us, while IQ is a score on an intelligence test. However, these two terms have been used interchangeably in the literature often for the ease of readers' understanding. Since distinguishing them overly technically did not seem to fit the goal of the current study, we also took the liberty of using them interchangeably.

References

Ai, C., & Norton, E. C. (2003). Interaction terms in logit and probit models. *Economics Letters*, *80*, 123-129.

Baker, P., Keck, C., Mott, F., & Quinlan, S. (1993). *NLSY child handbook*. Columbus, OH: Center for Human Resource Research.

Bayley, D., & Mendelsohn, H. (1969). *Minorities and the police: Confrontation in America*. New York, NY: Free Press.

Beaver, K. (2010). The effects of genetics, the environment, and low self-control on perceived maternal and paternal socialization: Results from a longitudinal sample of twins. *Journal of Quantitative Criminology*, *27*, 85-105.

Beaver, K., DeLisi, M., Mears, D., & Stewart, E. (2009). Low self-control and contact with the criminal justice system in a nationally representative sample of males. *Justice Quarterly*, *26*, 695-715.

Beaver, K., DeLisi, M., Vaughn, M., & Boutwell, B. (2008). The relationship between self- control and language: Evidence of a shared etiological pathway. *Criminology*, *46*, 939-970.

Beaver, K., Gibson, C., DeLisi, M., Vaughn, M., & Wright, J. (2011). The interaction between neighborhood disadvantage and genetic factors in the prediction of antisocial outcomes. *Youth Violence and Juvenile Justice*, *10*, 25-40.

Beaver, K., & Wright, J. (2007). The stability of low self-control from kindergarten through first grade. *Journal of Crime & Justice*, *30*, 63-86.

Beaver, K., Wright, J., & DeLisi, M. (2008). Delinquent peer group formation: Evidence of a gene x environment correlation. *The Journal of genetic psychology*, *169*, 227-244.

Black, D. (1976). *The behavior of law*. New York, NY: Academic Press.

Cleveland, H. (2003). Disadvantaged neighborhoods and adolescent aggression: Behavioral genetic evidence of contextual effects. *Journal of Research on Adolescence*, *13*, 211-238.

Cullen, F., Gendreau, P., Jarjoura, G., & Wright, J. (1997). Crime and the bell curve: Lessons from intelligent criminology. *Crime & Delinquency*, *43*, 387-411.

Dionne, G. (2005). Language development and aggressive behavior. In R. Tremblay, W. Hartup & J. Archer (Eds.), *Developmental origins of aggression* (pp. 330-352). New York, NY: Guilford Press.

Dugdale, R. (1877). *"The Jukes": A study in crime, pauperism, disease, and heredity: also further studies of criminals*. New York, NY: G.P. Putnam's Sons.

Gallagher, T. (1999). Interrelationships among children's language, behavior, and emotional problems. *Topics in Language Disorders*, *19*, 1-15.

Goddard, H. (1914). *Feeble-mindedness*. New York: Macmillan.

Goldstein, J. (1960). Police discretion not to invoke the criminal process: Low-visibility decisions in the administration of justice. *Yale Law Journal, 69*(4), 543-594.

Gottfredson, M., & Hirschi, T. (1990). *A general theory of crime*. Stanford, CA: Stanford University Press.

Harris, K., Florey, F., Tabor, J., Bearman, P., Jones, J., & Udry, J. (2003). *The national longitudinal study of adolescent health: Research design*. Retrieved June 29, 2009, from http://www.cpc.unc.edu/projects/addhealth/design

Herrnstein, R., & Murray, C. (1994). *The bell curve: Intelligence and class structure in American life*. New York, NY: Free Press.

Hirschi, T. (1969). *Causes of delinquency*. Berkeley, CA: University of California Press.

Hirschi, T., & Hindelang, M. (1977). Intelligence and delinquency: A revisionist review. *American Sociological Review*, *42*, 571-587.

Klinger, D. (1997). Negotiating order in patrol work: An ecological theory of police response to deviance. *Criminology*, *35*, 277-306.

Luria, A. (1961). *The role of speech in the regulation of normal and abnormal behavior*. New York, NY: Basic Books.

Luria, A., & Homskaya, E. (1964). Disturbance in the regulative role of speech with frontal lobe lesions. In J. M. Warren & K. Akert (Eds.), *The frontal granular cortex and behavior* (pp. 353-371). New York, NY: McGraw-Hill.

Lynam, D., Moffitt, T., & Stouthamer-Loeber, M. (1993). Explaining the relation between IQ and delinquency: Class, race, test motivation, school failure, or self-control? *Journal of Abnormal Psychology*, *102*, 187-196.

McCluskey, J., Reisig, M., Mastrofski, S., & Terrill, W. (1999). Nasty as t hey wanna be? An investigation of suspect aggression during police encounters. Presented at the 51st Annual Meeting of the American Society of Criminology, November. Toronto, Canada.

McGloin, J., & Pratt, T. (2003). Cognitive ability and delinquent behavior among inner-city youth: A life-course analysis of main, mediating, and interaction effects. *International Journal of Offender Therapy and Comparative Criminology*, *47*, 253-271.

McGloin, J., Pratt, T., & Maahs, J. (2004). Rethinking the IQ-delinquency relationship: A longitudinal analysis of multiple theoretical models. *Justice Quarterly*, *21*, 603-635.

Moffitt, T. (1990). Juvenile delinquency and attention deficit disorder: Boys' developmental trajectories from age 3 to age 15. *Child Development*, *61*, 893-910.

Moffitt, T., Caspi, A., Silva, P., & Stouthamer-Loeber, M. (1995). Individual differences in personality and intelligence are linked to crime: Cross-context evidence from nations, neighborhoods, genders, races, and age-cohorts. In J. Hagan (Ed.), *Current perspectives on aging and the life cycle. Vol. 4. Delinquency and disrepute in the life course*. Greenwich, CT: JAI Press.

Moffitt, T., & Silva, P. (1988). IQ and delinquency: A direct test of the differential detection hypothesis. *Journal of Abnormal Psychology*, *97*, 330-333.

Neisser, U., Boodoo, G., Bouchard, T. Jr., Boykin, A., Brody, N., Ceci, S., ... Halpern, D. (1996). Intelligence: Knowns and unknowns. *American Psychologist*, *51*, 77-101.

Niederhoffer, A. (1967). *Behind the shield: The police in urban society*. Garden City, NY: Doubleday.

Nisbett, R., Aronson, J., Blair, C., Dickens, W., Flynn, J., Halpern, D., & Turkheimer, E. (2012). Intelligence: New findings and theoretical developments. *The American psychologist*, *67*, 130-59.

Paternoster, R., Brame, R., Mazerolle, P., & Piquero, A. (1998). Using the correct statistical test for the equality of regression coefficients. *Criminology*, *36*, 859-866.

Perrone, D., Sullivan, C., Pratt, T., & Margaryan, S. (2004). Parental efficacy, self-control, and delinquency: A test of a general theory of crime on a nationally representative sample of youth. *International journal of offender therapy and comparative criminology*, *48*, 298-312.

Piliavin, I., & Briar, S. (1964). Police encounters with juveniles. *American Journal of Sociology*, *70*, 206-214.

Sampson, R., Raudenbush, S., & Earls, F. (1997). Neighborhoods and violent crime: A multilevel study of collective efficacy. *Science*, *277*, 918-924.

Scarr, S., & McCartney, K. (1983). How people make their own environments: A theory of genotype environment effects. *Child Development*, *54*, 424-435.

Sherman, L. (1990). Police crackdowns: Initial and residual deterrence. In M. Tonry & N. Morris (Eds.), *Crime And Justice: A review of research*, *Vol. 12*, (pp. 1-48). Chicago, IL: University of Chicago Press.

Skolnick, J. (1966). *Justice without trial*. New York, NY: John Wiley & Sons.

Stark, R. (1975). *Social problems*. New York, NY: Random House.

Tarnopol, L. (1970). Delinquency and minimal brain dysfunction. *Journal of Learning Disabilities*, *3*, 200-208.

Terrill, W., & Reisig, M. (2003). Neighborhood context and police use of force. *Journal of Research in Crime and Delinquency*, *40*, 291-321.

Turner, M., Hartman, J., & Bishop, D. (2007). The effects of prenatal problems, family functioning, and neighborhood disadvantage in predicting life-course-persistent offending. *Criminal Justice And Behavior*, *34*, 1241-1261.

Udry, J. (1998). *The national longitudinal sample of adolescent health*. Chapel Hill, NC: Carolina Population Center, University of North Carolina.

Udry, J. (2003). *The national longitudinal study of adolescent health (Add Health), Waves I and II, 1994–1996; Wave III, 2001–2002 [Machine-readable data file and docu-mentation]*. Chapel Hill, NC: Carolina Population Center, University of North Carolina.

Vance, B., West, R., & Kutsick, K. (1989). Prediction of wechsler preschool and primary scale of intelligence iq scores for preschool children using the peabody picture vocabulary test-r and the expressive one word picture vocabulary test. *Journal of Clinical Psychology*, *45*, 642-644.

Ward, D., & Tittle, C. (1994). IQ and delinquency: A test of two competing explanations. *Journal of Quantitative Criminology*, *10*, 189-212.

Warner, B., & Coomer, B. (2003). Neighborhood drug arrest rates: Are they a meaningful indicator of drug activity? A research note. *Journal of Research in Crime and Delinquency*, *40*, 123-138.

Werthman, C., & Piliavin, I. (1967). Gang members and the police. In D. Bordua (Ed.), *The police: Six sociological essays* (pp. 56-98). New York, NY: John Wiley.

White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica*, *48*, 817-838.

Wilson, J., & Herrnstein, R. (1985). *Crime and human nature*. New York, NY: Simons and Schuster.

Worden, R. (1989). Situational and attitudinal explanations of police behavior: A theoretical reappraisal and empirical assessment. *Law Society Review*, *23*, 667-711.

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