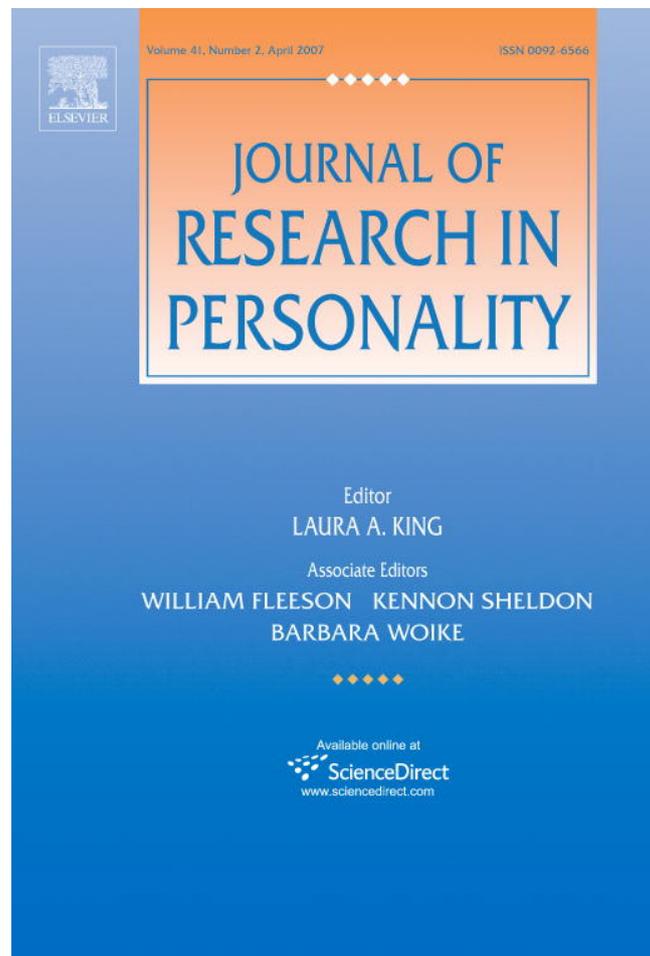


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Verbal intelligence and self-regulatory competencies: Joint predictors of boys' aggression [☆]

Ozlem Ayduk ^{a,*}, Monica L. Rodriguez ^b, Walter Mischel ^c,
Yuichi Shoda ^d, Jack Wright ^e

^a Department of Psychology, University of California, 3210 Tolman Hall, Berkeley, CA 94720, USA

^b Department of Psychology, University at Albany, State University of New York,
1400 Washington Av., Albany, NY 12222, USA

^c Department of Psychology, Columbia University, 406 Schermerhorn Hall, New York, NY 10027, USA

^d Department of Psychology, University of Washington, 119A Guthrie Hall, Seattle, WA 98195, USA

^e Department of Psychology, Brown University, 89 Waterman Street, Providence, RI 02912, USA

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Abstract

Two studies examined the interactive effect of receptive verbal intelligence measured by the Peabody Picture Vocabulary Test and self-regulatory competencies measured in the delay of gratification paradigm on boys' aggression. Study 1 participants ($N = 98$) were middle school, low-income boys primarily ethnic minority. Participants for Study 2 ($N = 59$) were drawn from a treatment camp for boys from low-income neighborhoods with behavioral adjustment problems. In both studies, the interaction between verbal intelligence and self-regulation was significant such that verbal intelligence was associated with lower aggression to a greater extent among boys who had effective self-regulatory skills than among those who had ineffective self-regulatory skills. The implications of these findings for interventions and for a theory of risk factors in aggression are discussed.

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* Corresponding author. Fax: +1 510 642 5293.

E-mail address: ayduk@berkeley.edu (O. Ayduk).

1. Introduction

It is a well-established finding in the literature that low intelligence, especially on verbal tests, is associated with higher risk for delinquency and antisocial behaviors (Camp, 1977; Warr-Leeper, Wright, & Mack, 1994; see Hirschi & Hindelang, 1977 for review). For example, poor verbal skills have consistently been associated with the early onset of antisocial behaviors and with their subsequent persistence (White, Moffitt, & Silva, 1989). In longitudinal studies, low verbal intelligence predicts an increase in delinquency even after partialling out the effects of socio-economic status and ethnicity, suggesting that verbal knowledge deficits could play a causal role in the development of delinquency (Lynam, Moffitt, & Stouthamer-Loeber, 1993).

Although extensive research has been conducted on the potential mediators of the verbal intelligence–delinquency link (e.g., Hinshaw, 1992; Moffitt, Gabrielli, Mednick, & Schulsinger, 1981), less research has focused on moderators of this relationship. As several researchers have argued (see Freitas & Downey, 1998, and Luthar, Doernberger, & Zigler, 1993, for reviews), a single mechanism by itself rarely functions exclusively as a unitary protective or risk factor for maladjustment. Instead, it may be of value to consider any one mechanism in the context of other mechanisms, both environmental and intraindividual, and to examine their interactions in understanding personality development (Mischel, 2004).

Therefore, in the current study, we examined the interactive effect of verbal intelligence and self-regulation on boys' aggression. Previous research shows that similar to deficits in verbal skills, deficits in self-regulatory competencies (e.g., impulsivity; inability to delay gratification) are also associated with behavioral maladjustment and externalizing behaviors (e.g., Ayduk et al., 2000; Gottfredson & Hirschi, 1990; Raver, Blackburn, Bancroft, & Torp, 1999). We thus hypothesized that high verbal intelligence would serve as a protective factor against aggression particularly if combined with the availability of effective self-regulatory competencies that help inhibit potentially disadvantageous automatic responses and enable execution of adaptive goal-directed behavior.

Individual differences in self-regulatory competencies were assessed in the classic preschool delay of gratification paradigm (Mischel, Shoda, & Rodriguez, 1989). In this paradigm, children wait by themselves for a delayed reward after they have indicated preference for this reward over an immediately available but smaller, less valuable reward (e.g., one marshmallow now vs. two later). Experimental studies have shown that adaptive, strategic attention deployment in this paradigm plays a causal role in enabling goal-directed delay behavior (see Mischel et al., 1989 for review). Children can delay gratification most effectively when they distract themselves from the rewards while waiting, or when they mentally attend to the abstract, “cool” informational properties of the rewards (e.g., their shape) rather than to their arousing “hot” properties (e.g., their taste). In contrast, delay behavior is significantly hindered if attention is directed toward the rewards or when rewards are mentally represented in terms of their appetitive features (e.g., chewiness of marshmallows). Recent evidence also indicates that effective attention deployment in the delay task at age 4 predicts higher cognitive control in adolescence in standard executive function tasks (Eigsti et al., in press).

In prior research, difficulties in executive control have been associated with externalizing problems (Caspi, Henry, McGee, Moffitt, & Silva, 1995; Moffitt & Henry, 1989). By contrast, attentional control buffers children who are high in negative emotionality against

both externalizing and internalizing problems (Eisenberg, Fabes, Guthrie, & Reiser, 2002; Wills & Dishion, 2004). Longitudinally, seconds of delay at age 4 have been linked to positive outcomes 30 years later, including less bullying and aggression in individuals who are particularly prone to externalizing behavior (Ayduk et al., 2000). Consistent with these findings, male parolees who showed preference for an immediately available monetary reward over a larger amount only available after a variable longer delay behaved more aggressively in a second task (Cherek, Moeller, Dougherty, & Rhoades, 1997). Likewise, children with externalizing disorders show a preference for response options that bring about immediate gratification in laboratory-based tasks (Krueger, Caspi, Moffitt, White, & Stouthamer-Loeber, 1996; Wulfert, Block, Ana, Rodriguez, & Colman, 2002). Collectively these findings suggest that inability to delay gratification may be associated with higher risk for externalizing behaviors because such behaviors reflect difficulties with using strategic attention deployment to regulate arousal, and in substituting automatic response patterns with more controlled, reflective behaviors that serve long-term goals.

In summary then, the main effects of delay ability and verbal intelligence on externalizing behavior are well-established findings in the literature, but the key theoretical question of how these two variables are likely to interact in the development of aggressive behavior patterns has yet to be addressed. Overall, verbal intelligence and self-regulatory competencies tend to be only weakly correlated (Lynam et al., 1993; Rodriguez, Mischel, & Shoda, 1989), suggesting that although related, these are distinct constructs. It therefore seems theoretically and empirically reasonable to test whether their effects on aggression are multiplicative.

We reasoned that successful inhibition of prepotent aggressive impulses requires both knowing alternative behavioral scripts (i.e., verbal intelligence), and having the ability and motivation to carry them out (i.e., self-regulatory competence; Brown & DeLoache, 1978; Mischel, Cantor, & Feldman, 1996). We thus hypothesized that the protective effect of high verbal intelligence against aggression should be stronger among children who have effective self-regulatory skills than among those who do not. In statistical terms, we expected a significant negative regression coefficient for the interaction between verbal intelligence and self-regulation. Based on prior literature, we expected high verbal intelligence and self-regulatory competencies to have main effects on aggression and for the interaction between them to be observed over and above these main effects.

Two studies comprised the current investigation. Study 1 consisted of low socio-economic status (SES) boys attending an inner-city middle school in New York City, whereas Study 2 consisted of low SES boys who resided in a summer camp facility for children with social adjustment difficulties (see Rodriguez et al., 1989). Thus, the hypothesized interaction was examined in two samples similar in SES but different in risk status—whereas participants were preselected on behavioral problems in Study 2, they were not in Study 1.

2. Study 1

Study 1 was part of a larger research program on risk and protective factors in children's development (see Ayduk et al., 2000; Downey, Lebolt, Rincon, & Freitas, 1998) and reports data on a partially overlapping sample with Ayduk et al. (2000). Data relevant to the present study were collected from all 5th and 6th grade students attending public school in a largely Hispanic, economically disadvantaged, inner-city neighborhood of the

Table 1
Descriptive statistics for and bivariate relations among the key variables

Variables	Descriptive statistics		Correlations				
		Study 1	Study 2	1	2	3	4
1. Verbal Intelligence	<i>M</i>	91.55	90.10		.34*	.39*	-.12
	<i>SD</i>	17.29	18.5				
2. Attention deployment	<i>M</i>	.66	.49	.16		.54**	-.25 [†]
	<i>SD</i>	.23	.32				
3. Delay times	<i>M</i>	1143.12	1087.59	.19 [†]	.36*		-.19
	<i>SD</i>	479.91	537.05				
4. Aggression	<i>M</i>	2.13	2.4	-.24*	-.16	-.25*	
	<i>SD</i>	1.34	.28				

Notes. * $p < .05$, ** $p < .01$, [†] $p < .10$. Correlations below the diagonal are from Study 1 and above the diagonal are from Study 2.

Bronx, New York. Table 1 presents the descriptive statistics and the bivariate relations among the main variables of the study.

2.1. Method

2.1.1. Participants

Participants were 98 boys on whom we obtained delay of gratification; verbal intelligence and teacher reported aggression data ($M = 136.51$ months, $SD = 8.61$; range: 120–156 months; see Ayduk et al., 2000 and Downey et al., 1998 for details of the sample). Ninety percent qualified for free school lunch indicating that this was a high-risk sample for behavioral problems due low SES (Luthar, 1991).

2.1.2. Procedure

Delay of gratification ability was measured using the classic delay of gratification paradigm (Mischel et al., 1989) at the beginning of an academic year when boys were either in 5th or 6th grade. At the end of the academic year, participants' homeroom teachers rated the boys' aggression on the Teacher's Checklist (Coie & Dodge, 1988). Children were individually assessed on the Peabody Picture Vocabulary Test—revised (PPVT-R); half in a separate session right before and half right after the delay task.

2.1.2.1. Delay of gratification task. Participants were tested individually in a classroom at their middle school containing a table with a desk bell, and a chair in front of the table, without any other distracting stimuli. As indicated by the standard delay of gratification procedure (see Mischel et al., 1989), the experimenter offered the child the choice of either a small pile of edible rewards of his/her choosing (e.g., small bag of M&M's) or a large pile of the preferred reward (e.g., medium bag of M&M's). All children picked the larger pile. Subsequently, the experimenter told the child that she had to go out of the room for a while and that the child would have to wait for the experimenter return without eating the rewards to have the large pile. Children were also told that they could bring back the experimenter any time they wanted by ringing the bell in front of them; however then, they could only have the small pile. After testing the child's comprehension of the contingency, the experimenter left the room, and returned when 25 min had elapsed, or as soon as the child rang the bell, left the seat, or began to eat one of the rewards.

2.1.3. Measures

2.1.3.1. Teachers' ratings of aggression. Teacher's Checklist (Coie & Dodge, 1988) is a 20-item questionnaire that assesses different aspects of students' academic, interpersonal, and psychological functioning. Teachers rated children's aggression on a 5-point scale ranging from *not at all true* (1) to *very true* (5) on the following 4 items: "threatens and bullies to get his/her own way," "uses physical force to dominate others," "starts fights with other children," and "says means things and threatens others." Ratings across these items were averaged to index aggression ($\alpha = .71$, $M = 2.13$, $SD = 1.34$).

2.1.3.2. Delay time. Number of seconds children were able to wait during the delay task without eating the rewards and without leaving their seats was measured ($M = 1143.12$ seconds, $SD = 479.71$ seconds). Similar to findings reported by Ayduk et al. (2000), delay times were negatively skewed: 53.76% of the participants delayed for the entire 25-min waiting period. Results reported in the main analyses did not change appreciably when delay times were used as a categorical variable (full delay vs. partial delay); thus, we report results using the continuous scores.

2.1.3.3. Attention deployment strategies during delay. Converging evidence has identified distraction (e.g., re-directing attention away from arousing stimuli) as a central mechanism in the executive function system in young children (e.g., Derryberry & Rothbart, 1997; Field, 1981; Mischel et al., 1989; Vaughn, Kopp, Krakow, Johnson, & Schwartz, 1986). We therefore examined the relationship between attention deployment strategies during the delay task (i.e., how much time children spent distracting and looking away from the rewards as opposed to looking at the rewards) and externalizing behavior, in addition to the actual amount of time children were able wait.

Participants were unobtrusively videotaped during the delay period. Each child's spontaneous attention deployment was coded with regard to attention to "rewards" and to the terminating signal (i.e., 'the bell'), as well as attention to distractions and away from these two temptations (i.e., 'elsewhere'). Any looking, touching, or talking, directed at the rewards, the bell, or elsewhere, was recorded continuously by an observer using an event-recording software specifically developed for this purpose. The attentional strategies of 17 participants were rated by 4 other coders; the mean inter-rater agreement among the 5 coders was $r = .94$ for attention elsewhere, $r = .98$ for attention to bell, and $r = .81$ for attention to rewards.

Following Rodriguez et al. (1989), an effective attention deployment index was created ($M = .66$, $SD = .23$) by subtracting the proportion of delay time a child spent directing attention towards the bell or the rewards ($M = .23$, $SD = .15$) from the proportion of time they spent distracting themselves from the rewards ($M = .77$, $SD = .15$). As expected, delay times were positively related to this index ($r(96) = .36$, $p < .001$).

2.1.3.4. Verbal intelligence. We focused on one aspect of verbal intelligence, receptive vocabulary knowledge, which was measured by the Peabody Picture Vocabulary Test—Revised (PPVT-R; Dunn & Dunn, 1981). This widely used standardized test evaluates the child's receptive vocabulary and provides a verbal intelligence score (Standard Score Equivalent). The child's task is to choose from among several pictures the one that best describes the meaning of a word by pointing to it. As a measure of receptive language, the PPVT-R has been especially used in samples in which there may be deficits in generating a

definition, even though verbal knowledge is present and it correlates moderately with the WISC (Smith, Smith, & Dobbs, 1991).

In this sample, the PPVT-R was administered in English for children who indicated in an initial interview that they preferred to speak in English in general and who also showed a preference to take the test in English during the testing session (65% of the sample). Whenever there was a discrepancy between these two preferences, children were administered both the English and the Spanish versions of the PPVT-R (35%). However, only the higher of the two scores was used in data analyses (24% English version, 11% Spanish version). Thus, overall, for 89% of the sample, the scores came from the English version of the PPVT-R.

The mean score across the whole sample was 91.55 ($SD = 17.29$). Verbal intelligence was associated with delay times and attention deployment in the expected direction although these relationships did not reach statistical significance ($r(96) = .18, p = .06$ and $r(96) = .16, p > .10$, respectively).

2.2. Results

2.2.1. Verbal intelligence and attention deployment

To allow for comparison of the findings across the two studies all predictors were standardized and used as continuous variables. We first conducted regression analyses on aggression only with verbal intelligence, and attention deployment as the main effects. In this model, verbal intelligence was a significant predictor of aggression ($\beta = -.22, p < .05$) and although the effect of attention deployment did not reach significance it was in the theoretically expected direction ($\beta = -.13, ns$).

Next, we examined the multiplicative effect of verbal intelligence and effective attention deployment by including the interaction term. This analysis yielded a significant negative interaction term ($F(1, 94) = 3.85, p = .05$; see Table 2, Panel A) and the results are illustrated in Fig. 1. Simple slope analyses tested at 1 SD above and below the mean on the predictors (Aiken & West, 1991) indicated that among boys high in effective attention deployment, verbal intelligence was significantly related to lower aggression ($\beta = -.41, p < .01$). However, high and low verbal intelligent boys did not differ in their aggression if they were also low in effective attention deployment ($\beta = -.01, ns$).

2.2.2. Verbal intelligence and delay times

The main effects only model indicated that both verbal intelligence and delay times are unique predictors of boys' aggression ($\beta = -.20, p < .05$ and $\beta = -.21, p < .05$, respectively). The multiplicative model did not yield a significant interaction term between intelligence and delay times ($\beta = -.11, F = 1.14, p > .20$; see Table 2, Panel B); however, because we had a priori hypotheses about the nature of this possible interaction, we nevertheless conducted simple slope analyses. Consistent with our hypothesis, verbal intelligence was negatively related to aggression among boys with high delay times ($\beta = -.32, p < .05$) but not among low delay boys ($\beta = -.11, ns$).

2.2.3. Summary of Study 1

Study 1 found the expected pattern such that verbal intelligence served as a protective factor against aggression among boys who had effective self-regulatory competencies but this effect was significantly attenuated among those who had deficits in self-regulation. The

Table 2

Standardized parameter estimates for verbal intelligence and self-regulatory competencies from multiple regression analyses predicting aggression

Dependent measure	Aggression	
	Study 1: Bronx	Study 2: Wediko
<i>Panel A</i>		
Verbal intelligence	-.21*	.09
Effective attention	-.18 [†]	-.44**
Verbal int. × effective attention	-.20*	-.33**
Effect size <i>r</i> for the interaction	.20	.38
Total <i>R</i> ²	.11**	.24**
<i>Panel B</i>		
Verbal intelligence	-.22*	-.06
Delay time	-.23*	-.31*
Verbal int. × delay time	-.11	-.29*
Effect size <i>r</i> for the interaction	.11	.29
Total <i>R</i> ²	.11**	.17*

* $p < .05$.

** $p < .01$.

[†] $p < .10$.

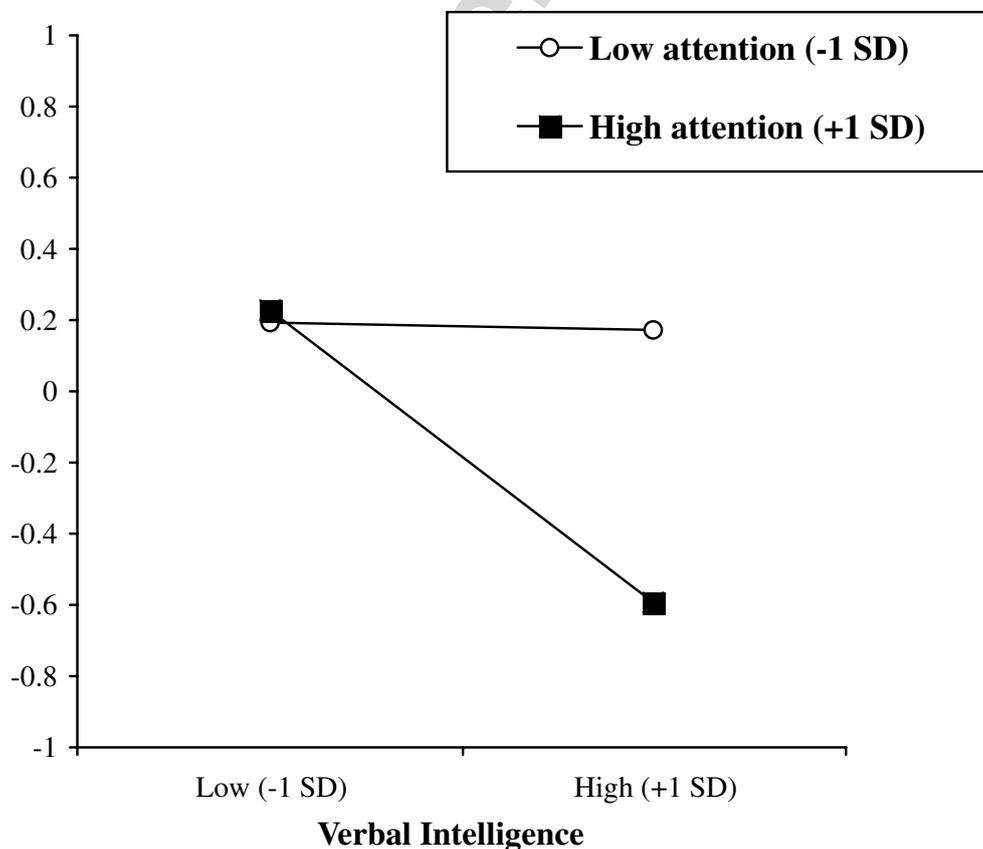


Fig. 1. Aggression in the Bronx sample as a function of attention deployment and verbal intelligence.

pattern of findings was similar across the two self-regulation indices—attention deployment and actual waiting times during the delay of gratification task, albeit stronger for the former than for the latter.

3. Study 2

The goal of Study 2 was to replicate Study 1 findings and extend them to a clinical sample consisting of boys demographically similar to the participants in Study 1 but who were preselected on behavioral adjustment problems. The study took place at Wediko Children's Services summer facility in Hillsboro, New Hampshire, with a sample that has been described in detail in previous related research with this population (e.g., Rodriguez et al., 1989; Shoda, Mischel, & Wright, 1993). Children with behavioral and social adjustment difficulties lived for 6 weeks in this summer camp setting in 1986. They resided together in groups of 8–10 same-sex peers and participated in a highly structured daily program during which their behavior was observed by adult staff. Table 1 presents the descriptive statistics and the bivariate relations among the key variables of the study.

3.1. Method

3.1.1. Participants

Participants were 59 boys ($M = 122.28$ months, $SD = 18.7$; range: 77–154 months), who resided full-time in the camp setting. The majority of the children came from low to middle income families in the Boston area, and the sample was diverse in ethnicity with approximately 50% of the sample being Caucasian and 40% African-American. They were referred to the summer program by school counselors, by their parents, or by other agencies for social adjustment problems they experienced at school and/or at home. All of the children had received special counseling at school, and/or some form of individual or group therapy (see Wright & Mischel, 1987).

3.1.2. Procedure

Camp counselors observed children six days a week during the six-week summer program in their daily camp activities as has been previously described (Rodriguez et al., 1989; Shoda et al., 1993). The counselors were all undergraduates or recent college graduates who were told that the research was designed to improve our understanding of children's behavior, but were not informed of its specific goals. Prior to data collection all counselors were trained on the use of the behavior rating system. Assessments of laboratory self-regulatory competencies were obtained during the first 2 weeks of the summer. Each child was individually assessed in the laboratory delay of gratification paradigm and administered the PPVT-R (see measures described below).

3.1.2.1. Delay of gratification task. Counselors told the children that they could voluntarily participate in a fun activity. Volunteers (59 out of 60 available children) were escorted individually from a camp activity to the experimental room in a mobile trailer parked on the campgrounds. The experimental room was a small chamber in the trailer containing a table with a desk bell, and a chair in front of the table, and other distracting stimuli were deliberately removed. The rest of the procedure for the delay task was similar to Study 1, with the exception that whether the rewards were exposed (available for attention) vs. covered,

(unavailable for attention) was experimentally manipulated. However, this factor did not significantly effect delay times or any of the results reported below (Rodriguez et al., 1989), and will therefore not be discussed further.

3.1.3. Measures

3.1.3.1. Delay time. Number of seconds children were able to wait during the delay task without eating the rewards and without leaving their seats were measured to index delay of gratification ability ($M = 1087.59$ seconds, $SD = 537.05$ seconds). Similar to Study 1, 31 of the 59 participants (52.5%) delayed for the entire 25-min waiting period. Results reported below did not change appreciably when the analyses were conducted using a categorical delay variable (full-delayers vs. partial-delayers).

3.1.3.2. Attention deployment strategies during the delay task. During the delay period, the child was observed unobtrusively through a one-way mirror from an adjacent room in the trailer. The child's spontaneous attention deployment (i.e., attention to rewards, the bell, and elsewhere) was recorded continuously by an observer using event-recording software specifically developed for this purpose. Inter-rater reliability among 3 observers for the second-by-second attention deployment records of 5 participants yielded an overall median phi coefficient of .73 for attention to the rewards, .67 for attention to the bell, and .74 for attention elsewhere.

Attention deployment data were missing for six children because of computer failures. One child's second-by-second attentional data were omitted because his behavior was unique and uncodable (dismantling of the bell). Thus, in analyses including attention deployment variables the number of participants was 52. Children who did not have attention deployment data were not different from those who did in their verbal intelligence or their delay times ($F_s < 1$).

Similar to Study 1, an effective attention deployment composite ($M = 48.67$, $SD = 31.09$) was calculated as the difference between percentage of time spent distracting/looking elsewhere ($M = 74.33$, $SD = 15.55$) and percentage of time spent attending to rewards or the bell ($M = 25.66$, $SD = 15.54$). Effective attention deployment was significantly related to delay times ($r(50) = .49$, $p < .001$).

3.1.3.3. Verbal intelligence. PPVT-R (Dunn & Dunn, 1981) was administered individually to each participant either before or after the delay task, by trained adult staff ($M = 90.1$; $SD = 18.5$). Verbal intelligence was significantly related to both delay times ($r(57) = .39$, $p < .01$) and effective attention deployment index ($r(50) = .27$, $p < .05$).

3.1.3.4. Counselors' ratings of aggression. Similar to behavior rating measures obtained from studies conducted at this and other camp settings (e.g., Kaufman & Cicchetti, 1989; Wright & Mischel, 1987), a short behavioral questionnaire was used to assess the children's social behaviors. The counselor conducting the hourly activity completed the questionnaire at the end of each activity period. The items "teased, provoked, threatened," and "hit, pushed, physically harmed," were used to assess verbal and physical aggression, respectively. These ratings were based on the child's overall frequency of aggressive behavior during each activity and were made on a 4-point scale (1 = 'not at all characteristic of the child's behavior,' 4 = 'highly characteristic.'). Verbal and physical aggression ratings (averaged across all ratings made by multiple counselors throughout the camp period) were highly correlated ($r(57) = .74$, $p < .0001$) and therefore, averaged into a composite aggres-

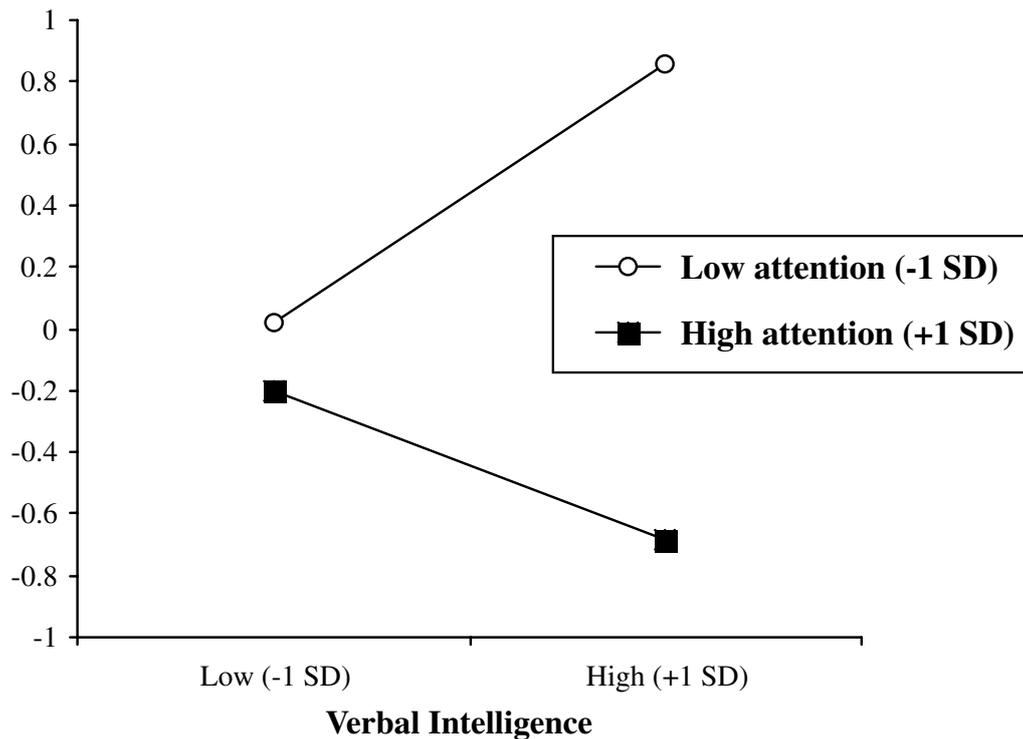


Fig. 2. Aggression in the Wediko sample as a function of attention deployment and verbal intelligence.

sion index ($M = 2.43$, $SD = .28$). Counselors were blind to the delay and the PPVT-R scores of the children.

Counselors were instructed to evaluate children's behavior only during the particular activity itself, immediately following a given activity period. An observer would typically assess 8–10 children during each period. Each counselor observed the children in their own group across 11 activities and the Cronbach alphas based on these 11 activities were .87 for both physical and verbal aggression.

3.2. Results

3.2.1. Verbal intelligence and attention deployment

Similar to Study 1, all variables were standardized.¹ In the main effects only model, controlling for age, the effect of attention deployment was significant ($\beta = -.33$, $p < .05$) but the effect of intelligence was not ($\beta = .008$, ns). The regression analysis for the multiplicative model revealed a significant interaction term between verbal intelligence and effective attention deployment for aggression ($F(1,47) = 7.70$, $p < .01$; see Table 2, Panel A). As Fig. 2 illustrates, the relation between verbal intelligence and aggression was more negative among boys with higher effective attention deployment strategies. Furthermore, for boys with high effective attention deployment strategies, the relationship between verbal intelligence and aggression was in the theoretically expected direction but not statistically significant ($\beta = -.24$, $p > .10$). In contrast, boys with low effective attention deployment strategies were more aggressive if their verbal intelligence was higher ($\beta = .42$, $p < .05$).

¹ In Study 2 to eliminate random noise introduced by the experimental manipulation in the delay task (rewards exposed vs. covered), delay times and attention deployment data were standardized within each experimental condition.

3.2.2. Verbal intelligence and delay times

The main effects model revealed neither a significant effect of delay time ($\beta = -.23$, $p > .11$) nor of intelligence ($\beta = -.03$, *ns*). The multiplicative model was tested next and this analysis yielded a significant interaction between verbal intelligence and delay times ($F(1,54) = 5.06$, $p < .03$; see Table 2, Panel B). The pattern was highly similar to that depicted in Fig. 2. Among high delayers, there was a marginally significant trend for verbal intelligence to be negatively related to aggression ($\beta = -.33$, $p < .09$); intelligence and aggression were not significantly related for low delayers ($\beta = .21$, *ns*).

3.2.3. Summary of Study 2

The pattern of findings in Study 2 was consistent with our overall hypothesis that high intelligence would be associated with reduced aggression in children with more effective self-regulatory competencies indicated by the negative interaction term. However, the expected main effect of intelligence on aggression was not found in this study. Consequently, when simple slopes analyses were conducted, we found that high intelligence not only ceased to be a potentially protective factor in children who lacked effective regulatory skills (as we originally hypothesized and found in Study 1), but in fact further increased their risk for aggression. We discuss possible reasons for this unexpected finding in more detail in the general discussion.

4. General discussion

In two studies, we examined the hypothesis that the protective effect of high verbal intelligence against prepotent aggressive tendencies should be stronger in children who have effective self-regulatory skills than in those who do not. In statistical terms, we hypothesized a negative regression estimate for the interaction term between verbal intelligence and self-regulatory competencies. Detecting moderator effects in field studies is difficult due to the lower efficiency of the moderator parameter estimates and the lower statistical power of the test of the interaction term in multiple regression (McClelland & Judd, 1993). Nevertheless, the predicted negative interaction term was found in both studies such that verbal intelligence was associated with greater reduction in aggression in children who were more effective in self-regulation.

There were also differences across the two studies in the findings revealed by simple slopes analyses, which reflect both main effects and interactions. In Study 1, verbal intelligence was not associated with aggression in boys who used ineffective attentional strategies. However, an unexpected finding in Study 2 was that among boys who used ineffective attentional strategies, those with higher verbal intelligence tended to be more aggressive than those with lower verbal intelligence. Thus in Study 2, in the total sample combining both high and low self-regulation groups, verbal aggression had only a small and statistically insignificant effect on aggression (unlike in Study 1 in which the main effect of verbal intelligence was significant). This, however, does not necessarily indicate that verbal intelligence failed to have protective functions; rather this may indicate that verbal intelligence has multiple functions in the generation of aggressive behavior. More specifically, some functions may be protective while others increase the risk for externalizing problems. For example, in the population studied and the highly controlled clinical setting of Study 2, being bright might characterize a “smart enough to make big trouble” pattern, and if so could be a formula for more serious forms of aggression. This process may co-exist with

and counteract the protective effect of intelligence particularly among those with less effective self-regulatory abilities. That is, in the clinical population of Study 2, high verbal intelligence may be a double-edged sword: it can be used in the service of generating antisocial, aggressive behavioral scripts, and at the same time serve as a protective factor, with the strength of the latter depending on one's regulatory competencies and motivations.

The distinction between reactive, hostile aggression versus aggression that is instrumental and goal-directed (Dodge & Coie, 1987) might also be relevant to our understanding of the differences in the type of aggression displayed by the high and low verbal intelligence groups. Although our aggression measures conceptually tap more into reactive aggression, not allowing us to make this distinction empirically, it is possible that impulsive boys with low intelligence engage more in reactive whereas impulsive boys with high intelligence engage in more proactive forms of aggression. In fact, Frick and colleagues find that antisocial children who show a callous-unemotional interpersonal style (e.g., lack of guilt, empathy, and emotional expression) engage in more severe and proactive forms of aggression despite being verbally more intelligent than antisocial children who do not show this interpersonal style (Christian, Frick, Hill, Tyler, & Frazer, 1997; Loney, Frick, Ellis, & McCoy, 1998). Nevertheless, further research is needed to more unequivocally establish (i) whether verbal intelligence increases risk for aggression among impulsive boys and (ii) whether this aggression can be characterized as proactive.

4.1. Implications

The results indicate that in efforts to understand, prevent, and treat externalizing behavior in boys at risk, both the individual's verbal intelligence and self-regulatory competencies need to be targeted in tandem so that their interactive effects can be taken into account. Indeed, a focus either on increasing verbal knowledge or executive control without taking careful account of the other is likely to be sub-optimal—and in some conditions even counter-productive. The results also show that the cognitive-attentional strategies that enable impulse regulation in the laboratory-based delay of gratification situation have empirical utility and predictive validity in analyzing at-risk boys' social behavior in their everyday social interactions.

There is growing consensus in the literature that individuals differ in the social situations and the interactional contexts that they encounter (e.g., Buss, 1987; Zayas, Shoda, & Ayduk, 2002). For the present research this notion suggests that self-regulation and verbal intelligence may jointly affect how frequently children evoke or encounter situations in which aggression is more likely (e.g., being picked on vs. being approached positively), and these situations in turn, explain at least in part, children's aggressive behavior. Any preventive and treatment efforts for reducing externalizing behavior thus, also need to be mindful of how verbal intelligence and self-regulation may impact aggressive behavior indirectly via the social situations children find themselves in.

4.2. Caveats and conclusions

Although the replication of main findings in two studies supports their robustness, several caveats need to be acknowledged. Partly because of the practical constraints imposed by the research settings, we used the PPVT-R, which is a measure of receptive vocabulary, not a comprehensive test of verbal intelligence. However, this caveat needs to be weighted

against the advantage of using the PPVT-R in at-risk, clinical, or ethnically diverse populations because of its relative culture free content (Argulewicz & Abel, 1984; Giddan, Milling, & Campbell, 1996). Furthermore, receptive and expressive verbal intelligence are interrelated showing similar developmental trajectories (Reznick, Corley, & Robinson, 1997) and deficits on measures of receptive language have also been related to delinquency (Dishion, Loeber, Stouthamer-Loeber, & Patterson, 1984). Nonetheless, it remains to be seen whether the findings obtained in the current research replicate with more traditional and comprehensive verbal intelligence tests.

It should also be noted that both studies presented here were cross-sectional, leaving many questions about causal relations for further research. Finally, we do not know whether the joint effect of verbal intelligence and delay ability also explain girls' aggression. It will be important to examine in future research the effect of these processes especially for relational and indirect forms of aggression that are more typical of girls (Crick & Grotpeter, 1995).

These constraints notwithstanding, the present studies help identify the psychological conditions necessary for understanding and potentially reducing aggression in at risk youth with greater precision and specificity. They indicate that to effectively reduce the probability of an aggressive, externalizing behavior pattern for at risk boys, the potential benefits of having verbal skills depend on also having the attention control competencies that enable the individual to self-regulate impulsive behaviors in the service of long-term consequences. Indeed when self-regulatory competencies and impulse control are lacking, verbal skills and intelligence may be used in the service of even greater problem-producing aggression—a possibility not inconsistent with everyday observation of world events and human history. Together, these findings serve as a critical qualifier on the notion that intelligence by itself is sufficient as a protective factor to inhibit maladaptive social behaviors such as aggression. It is also consistent with accumulating evidence for the value of taking account of the interaction of multiple determinants, both intrapersonal and interpersonal, in the analysis and prediction of complex social behaviors, of which aggression is a prototype (e.g., Freitas & Downey, 1998; Luthar et al., 1993; Wright, Zakriski, & Drinkwater, 1999).

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