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The Personality Trait of Environmental Sensitivity Predicts Children's Positive Response to School-Based Antibullying Intervention

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Abstract
Meta-analyses on the effectiveness of antibullying interventions show that average effects tend to be significant but small. Informed by the vantage sensitivity framework, the current study aimed to test in a large randomized controlled trial whether individual differences in environmental sensitivity predict treatment response to an antibullying intervention. A total of 2,042 pupils (Grades 4 and 6) were randomly assigned to a treatment or control condition. Significant intervention effects on victimization and internalizing symptoms were moderated by both environmental sensitivity and gender: Boys who scored high on sensitivity benefited significantly more than did less sensitive boys from the effects of the intervention regarding reduced victimization and internalizing symptoms. The findings are consistent with the notion of vantage sensitivity, suggesting that some individuals are disproportionately likely to respond to treatment and others are more resistant as a function of individual differences in environmental sensitivity.

Keywords
differential susceptibility, vantage sensitivity, internalizing symptoms, antibullying intervention, environmental sensitivity, Highly Sensitive Child scale

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Bullying among school children is recognized as a significant and serious issue in the educational sector (Srabstein & Leventhal, 2010). Many intervention programs have been developed to prevent and reduce bullying at schools, including the KiVa antibullying program (Salmivalli, Kärnä, & Poskiparta, 2010). Meta-analyses on the efficacy of antibullying interventions show that they are generally effective, but average treatment effects tend to be modest (Ttofi, Eisner, & Bradshaw, 2014). What has not yet been investigated is whether children vary in how much they benefit from such interventions as a result of individual differences in their *environmental sensitivity*, defined as the inherent ability to perceive and process environmental stimuli (Pluess, 2015). This hypothesis builds on the developmental frameworks of *differential susceptibility* (Belsky & Pluess, 2009) and *vantage sensitivity* (Pluess, 2015; Pluess & Belsky, 2013), according to which children vary in their sensitivity to environmental quality, with some children being generally more responsive to supportive experiences than others. Hence, the present study investigates the role of self-reported environmental sensitivity in children, measured with the recently developed Highly Sensitive Child (HSC) scale (Pluess et al., 2018) regarding the response to KiVa, an established and effective universal school-based antibullying program (Kärnä, Voeten, Little, Poskiparta, Alanen, et al.,

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2011; Kärnä, Voeten, Little, Poskiparta, Kaljonen, et al., 2011).

Bullying affects a large proportion of children all over the globe. According to a recent international survey (Inchley et al., 2016), 13% of 11-year-old children around the world reported having been bullied at least twice in the past 2 months, and 8% admitted to having bullied others. Bullying has been associated with various mental health problems, for both bullies and victims alike. For example, active bullying behavior has been found to predict externalizing disorders (Klomek, Sourander, & Elonheimo, 2015), criminal offenses (Ttofi, Farrington, Lösel, & Loeber, 2011), and antisocial personality disorder (Copeland, Wolke, Angold, & Costello, 2013). Victims of bullying, on the other hand, tend to report significantly higher levels of internalizing problems, such as anxiety and depression, as well as heightened risk of suicidal ideations and suicide attempts and higher levels of self-harming behaviors, psychosomatic symptoms, and substance abuse (Fisher et al., 2012; Nansel et al., 2001). Importantly, associations between bullying behaviors and mental health problems are not restricted to childhood but extend well into adulthood, even when accounting for other important childhood risks and preexisting psychiatric problems (Copeland et al., 2013).

Over the past 30 years, several school-based intervention programs have been developed to prevent and counteract the negative effects of bullying in schools. The more effective programs feature multiple components and are based on universal actions such as improving whole-school and classroom climate, introducing schoolwide rules related to bullying, and providing specific training for teachers and parents (Farrington & Ttofi, 2009). Some programs combine these universal actions with additional more selective and indicated actions (Bradshaw, 2015). KiVa, for example, is a systematic universal school-based multicomponent antibullying program (Salmivalli et al., 2010) that targets the whole school and classrooms (i.e., universal actions) as well as individual children (i.e., indicated actions). The universal prevention component involves a 10-session teacher-taught curriculum that is targeted to all students and delivered throughout the school year. KiVa has been shown to be effective in reducing bullying-related behaviors in Finland, where it was developed (Kärnä, Voeten, Little, Poskiparta, Alanen, et al., 2011; Kärnä, Voeten, Little, Poskiparta, Kaljonen, et al., 2011), and, more recently, also in Italy, in a study featuring the same sample as the current one (Nocentini & Menesini, 2016).

Generally, meta-analyses of antibullying programs provide evidence for their efficacy in reducing direct behavioral outcomes related to bullying behavior and victimization (Ttofi et al., 2014), although effects tend to be small with Cohen's $d = 0.14$ to 0.17 (Evans, Fraser, & Cotter, 2014; Ferguson, Miguel, Kilburn, & Sanchez, 2007; Jimenez-Barbero, Ruiz-Hernandez, Llor-Zaragoza, Perez-Garcia, & Llor-Esteban, 2016; Lee, Kim, & Kim, 2015; Ttofi & Farrington, 2011; Yeager, Fong, Lee, & Espelage, 2015). Effects of antibullying programs on internalizing and externalizing behaviors have also been studied. In particular, the evidence-based KiVa antibullying program showed efficacy in reducing students' levels of internalizing problems (Cohen's $d = 0.13$) related to the effect of being victims and living in a social environment perceived as unsafe (Williford, Noland, Little, Kärnä, & Salmivalli, 2012). Focusing on externalizing symptoms, the evidence-based Olweus Bullying Prevention Program showed a significant reduction in self-reported delinquency, vandalism, and alcohol use (Limber, Nation, Tracy, Melton, & Flerx, 2004; Olweus, 1993; Olweus & Limber, 2010). Effects are stronger in European and/or ethnically homogeneous samples (Evans et al., 2014) and, not surprising, when programs are longer, more intensive, and implemented with higher fidelity (Ttofi & Farrington, 2011).

Furthermore, individual child characteristics also emerged as important moderators of treatment efficacy. For example, children with more severe symptoms and problematic behaviors at baseline (Ferguson et al., 2007; Yanagida, Strohmeier, & Spiel, 2016) and of younger age (Yeager et al., 2015) tend to benefit more from antibullying interventions. And at least one study provided evidence that treatment effects are stronger in boys than in girls (Kärnä et al., 2013). What has not been investigated yet, however, is whether children may also differ in their response to an antibullying intervention as a function of individual differences in sensitivity or susceptibility to environmental influences (i.e., environmental sensitivity), as suggested by the differential susceptibility (Belsky & Pluess, 2009) and vantage sensitivity concepts (Pluess & Belsky, 2013). The vantage sensitivity framework (Pluess & Belsky, 2013) specifically proposes individual differences in response to positive experiences and provides the theoretical basis for the hypothesis that some children are more likely than others to benefit from intervention (e.g., antibullying programs) because of their heightened sensitivity to positive aspects of the environment. The hypothesized mechanism underlying such differences is that some children register contextual changes that result from schoolwide antibullying programs more easily and more deeply than other children because of heightened environmental sensitivity (Pluess, 2015; Pluess et al., 2018), a stable and heritable personality trait (Assary, Zavos, Krapohl, Keers, & Pluess, 2018) characterized by heightened behavior inhibition, emotional reactivity,

sensitivity to subtle stimuli, and deeper cognitive processing of environmental stimuli (as proposed by sensory sensitivity processing theory; Aron, Aron, & Jagiellowicz, 2012). According to the neurosensitivity hypothesis (Aron & Aron, 1997; Pluess & Belsky, 2013), individual differences in environmental sensitivity may reflect a more sensitive central nervous system. Applied to the school context and bullying programs, highly sensitive children, who tend to make up a minority of about 20% to 30% (Pluess et al., 2018), may benefit more from treatment effects of an antibullying intervention compared with the majority of less sensitive children because they are more likely to register program-induced improvements in the social school environment.

Environmental sensitivity can be measured in children and adolescents with the 12-item HSC scale (Pluess et al., 2018), adapted from the Highly Sensitive Person scale for adults (Aron, 1996). The HSC scale has been developed, validated, and tested across four independent samples of British children with a total sample size of more than 3,500 and found to be reliable, psychometrically robust, and largely distinct from other established temperament and personality traits (Pluess et al., 2018). In children, heightened sensitivity has been associated with more internalizing and less externalizing problems, specifically fights and bullying behaviors (Boterberg & Warreyn, 2016). The first empirical evidence for the moderating effect of the Highly Sensitive Person scale emerged in an experimental study on the emotional reactivity to doing well or not well on a test, providing findings that undergraduate students scoring high on the Highly Sensitive Person scale reported increased sensitivity to both negative and positive conditions (Aron, Aron, & Davies, 2005). More recently, it has been shown that the HSC score moderates the effects of a school-based depression prevention program (Pluess & Boniwell, 2015; Pluess, Boniwell, Hefferon, & Tunariu, 2017). In a study employing a two-cohort treatment/control design in a sample of 11-year-old girls ($N = 363$), it was found that the intervention was successful in reducing depression in girls scoring high on the HSC scale while not being effective at all in girls scoring low on the same measure. The validity of the measure of child environmental sensitivity has been further supported in a recent longitudinal study aimed at testing whether parent-reported HSC moderated the effects of parenting quality on child outcomes (Slagt, Dubas, van Aken, Ellis, & Dekovic, 2018). Children who were rated as more sensitive were more strongly affected (i.e., teacher-rated externalizing behavior problems) by changes in both negative and positive parenting practices compared with less sensitive children, consistent with the differential susceptibility (Belsky & Pluess, 2009) and vantage sensitivity concepts (Pluess & Belsky, 2013). The current study overcame methodological limitations of the previous studies, such as lack of a randomized design and relatively small samples, to test whether highly sensitive children indeed benefit more from school-based interventions than do less sensitive ones, featuring a randomized controlled design and a large sample of more than 2,000 boys and girls.

In summary, the aim of the present study was to evaluate whether the personality trait of environmental sensitivity, measured with the recently developed HSC scale, moderates treatment effects of the KiVa antibullying program in a large randomized controlled trial. The current study used data from a recent general evaluation of KiVa (Nocentini & Menesini, 2016) but extended previous findings by testing moderation effects of self-reported sensitivity on bullying and victimization outcomes as well as internalizing and externalizing symptoms. Informed by the vantage sensitivity framework (Pluess, 2015; Pluess & Belsky, 2013), we hypothesized that highly sensitive children, who tend to be more perceptive and aware of their surroundings, will register treatment-induced changes in peer behavior and classroom atmosphere more easily and more strongly and therefore report less bullying, less victimization, and fewer internalizing and externalizing symptoms compared with less sensitive children. Furthermore, given previous findings of gender differences in bullying-related behaviors, we expected that these moderating effects may be more pronounced in sensitive boys compared with girls.

Method

Participants

Children were recruited from 13 comprehensive schools located in three cities of Tuscany, Italy, for inclusion in a randomized controlled trial aimed at testing the effectiveness of the KiVa antibullying program (for a detailed description of the trial design and recruitment and retention of participants, see Nocentini & Menesini, 2016). In short, the regional school board of Tuscany randomly assigned seven schools to the intervention and six schools to the control condition with a total of 97 classrooms and 2,184 pupils in Grades 4 and 6. For recruitment, all parents were sent information letters with a consent form. A total of 2,050 pupils (94% of the target sample) provided active consent for study participation. Data were collected in two waves: September through October 2013 (T1: pretreatment) and May through June 2014 (T2: posttreatment). Overall, 2,042 pupils filled out the questionnaires at T1 and 1,910 at T2 (for a flow chart, see Fig. 1). Descriptive data about the included children are reported in Table 1.

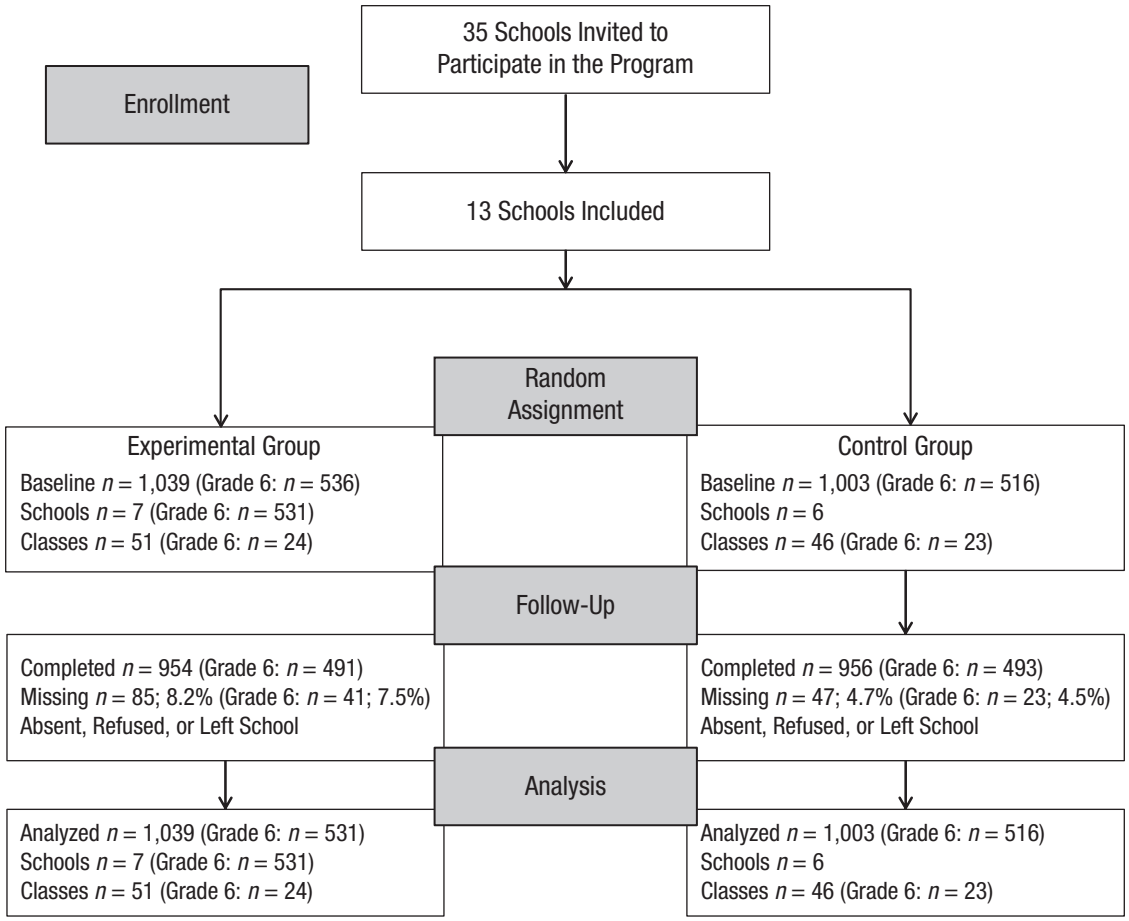

Fig. 1. Flowchart of the recruitment and retention of participants in the evaluation.

For the present study, we included the complete sample for all analyses focused on bullying and victimization outcomes. For internalizing and externalizing symptoms, however, we could consider only the older children given that the Youth Self Report (Achenbach, 1991) was not administered to children in Grade 4.

Procedure

Data were collected in classrooms during school hours with paper-and-pencil questionnaires under the supervision of trained psychologists, researchers, and master's students. The intervention took place at schools after baseline data collection.

Measures

Bullying and victimization. Bullying behaviors were measured with the Florence Bullying-Victimization scales (Palladino, Nocentini, & Menesini, 2016). Each of the two scales consists of 14 items asking how often respondents have experienced particular behaviors as perpetrator or victim (e.g., "I threatened someone" for bullying, and "I was threatened" for victimization) during the past couple of months. Each item is rated on a 5-point scale ranging from 1 (*never*) to 5 (*several times a week*). Children completed these scales after the different constructs were explained to them. Internal reliability for both scales at T1 and T2 was reflected by alphas ranging from .82 to .86.

Environmental sensitivity. Environmental sensitivity was measured at T1 with the HSC scale (Pluess et al., 2018). The 12 items (e.g., "I notice when small things have changed in my environment," "Loud noises make me feel uncomfortable") were rated by children on a 5-point scale ranging from 1 (*not at all*) to 5 (*extremely*). The HSC scale is a relatively new tool, but its robust psychometric properties and construct validity have recently been confirmed across four different samples with a total sample size of more than 3,500 children and adolescents (Pluess et al., 2018). Internal consistency in the current sample was satisfactory with an alpha of .79.

Internalizing and externalizing symptoms. We used the Youth Self-Report (Achenbach, 1991) to measure both internalizing and externalizing symptoms at T1

Table 1. Descriptive Statistics for the Total Sample and Differentiated by Gender

	Experimental group			Control group		
Variable	Boys	Girls	Total	Boys	Girls	Total
Bullying						
T1 (n = 2,019)	n = 517	n = 500	n = 1,017	n = 511	n = 491	n = 1,002
	0.055 (0.089)	0.034 (0.055)	0.045 (0.075)	0.059 (0.099)	0.034 (0.046)	0.047 (0.074)
T2 (n = 1,890)	n = 473	n = 462	n = 935	n = 490	n = 465	n = 955
	0.046 (0.077)	0.028 (0.046)	0.037 (0.064)	0.063 (0.085)	0.042 (0.054)	0.053 (0.072)
Victimization						
T1 (n = 2,024)	n = 520	n = 501	n = 1,021	n = 512	n = 491	n = 1,003
	0.108 (0.125)	0.085 (0.104)	0.097 (0.115)	0.106 (0.118)	0.086 (0.102)	0.096 (0.110)
T2 (n = 1,892)	n = 474	n = 463	n = 937	n = 490	n = 465	n = 955
	0.082 (0.097)	0.071 (0.082)	0.077 (0.090)	0.110 (0.109)	0.103 (0.109)	0.107 (0.109)
Internalizing symptoms						
T1 (n = 1,047)	n = 263	n = 269	n = 532	n = 268	n = 247	n = 515
	8.10 (7.29)	10.58 (7.81)	9.35 (7.65)	9.30 (7.51)	10.07 (8.27)	9.66 (7.88)
T2 (n = 948)	n = 233	n = 247	n = 480	n = 249	n = 219	n = 468
	6.65 (6.95)	10.33 (8.59)	8.51 (8.04)	9.10 (7.38)	9.79 (7.38)	9.52 (8.10)
Externalizing symptoms						
T1 (n = 1,047)	n = 263	n = 269	n = 532	n = 268	n = 247	n = 515
	5.87 (5.54)	5.38 (4.82)	5.60 (5.18)	6.17 (5.06)	4.41 (4.16)	5.329 (4.72)
T2 (n = 948)	n = 233	n = 247	n = 480	n = 249	n = 219	n = 468
	5.02 (4.94)	4.82 (5.08)	4.93 (5.05)	6.42 (5.42)	4.46 (4.76)	5.606 (5.21)
HSC						
T1 (n = 2,020)	n = 520	n = 501	n = 1,021	n = 508	n = 491	n = 1,004
	3.294 (0.752)	3.527 (0.676)	3.397 (0.725)	3.257 (0.728)	3.543 (0.692)	3.406 (0.725)
Age						
T1 (n = 2,028)			n = 1,024			n = 1,004
			9.92 (1.16)			9.93 (1.13)

Note: Values in the table are means, with standard deviations in parentheses. Experimental group: 82% Italian, 18% other ethnicities; control group: 83% Italian, 17% other ethnicities. HSC = Highly Sensitive Child score.

and T2 in Grade 6. The 103 items were rated by children on a 3-point scale ranging from 0 (*not true*) to 2 (*very true or often true*). The two subscales of internalizing symptoms and externalizing symptoms showed good reliability with alphas ranging from .85 to .87.

Statistical analysis

We applied linear mixed-effects models with full-information maximum likelihood estimation (West, 2009) to test our hypotheses. Analyses were conducted in three stages using a three-level (time within individuals within schools) random-intercept model to account for within-subjects, within-school correlations: First, the main treatment effect was tested across the whole KiVa sample. Second, we tested whether environmental sensitivity, as a continuous variable, moderated the efficacy of the KiVa program. To this end, a multiplicative interaction term was added to the previous regression model (Time × Group × HSC). We also evaluated possible four-way interactions with gender or grade (Time × Group × HSC × Gender; Time × Group × HSC × Grade). Third and finally, significant interactions were followed up with simple slopes by investigating change across time for three distinct groups—*high* HSC score (*top 25*% of the HSC scores), *medium* HSC score (between the top and bottom 25% of HSC scores), and *low* HSC score (*bottom 25*% of HSC scores)—to illustrate detected moderation effects for ease of interpretation. In more detail, using the same approach (linear mixed-effects models), we estimated the change between T1 and T2 for each group (i.e., low-, medium-, and high-sensitivity children) separately for children in KiVa schools versus those in control schools. Effect size of pre/post change in the treatment group was calculated as the standardized effect size in a mixed/multilevel model, in which standard deviations were derived from the standard errors of the estimated marginal means (Hedges, 2007). All analyses were conducted within SPSS with the significance level set at .05 and with values between .05 and .10 considered marginal.

Results

Preliminary analyses

Means and standard deviations for all study variables are presented in Table 1.

Consistent with previously reported findings (Nocentini & Menesini, 2016), a significant Group × Time interaction emerged for bullying (β = −0.012, *SE* = 0.005, *p* = .040) and victimization (β = −0.026, *SE* = 0.008, *p* = .004), with children in the KiVa group displaying a significant decrease between T1 and T2 in bullying (β = 0.007, *SE* = 0.003, *p* = .019, *d* = 0.07) and victimization (β = 0.020, *SE* = 0.004, *p* < .001, *d* = 0.10). The same result emerged for externalizing symptoms (β = −0.915, *SE* = 0.269, *p* = .001), with a significant decrease from T1 to T2 in the KiVa group (β = 0.701, *SE* = 0.198, *p* = .000, *d* = 0.09). For internalizing symptoms, however, the Group × Time interaction was only marginally significant (β = −0.797, *SE* = 0.423, *p* = .060), with a marginally significant decrease from T1 to T2 in the KiVa group (β = 0.832, *SE* = 0.489, *p* = .080, *d* = 0.11).

Moderation effects

Findings of the linear mixed models aimed at evaluating the moderation effect of environmental sensitivity are presented in Table 2. No significant three-way interactions were found for bullying, victimization, and internalizing symptoms. Significant four-way interactions (Group × Time × HSC × Gender) emerged for bullying, victimization, and internalizing symptoms, suggesting that the change of bullying, victimization, and internalizing symptoms between T1 and T2 in the two groups (treatment and control) was moderated by both HSC and gender. No significant three-way (Group × Time × HSC; β = 0.132, *SE* = 0.424, *p* = .755) or four-way (Group × Time × Gender × HSC; β = 0.245, *SE* = 0.859, *p* = .775) interaction emerged for externalizing behaviors.

Follow-up analyses for bullying

Results for bullying are shown in Table 3. Boys in the KiVa condition did not show any significant decrease across time, excepting for a marginal effect in the medium-HSC-score group. Similarly, there was no significant change in any of the girls' groups in the KiVa condition. However, for girls, the level of bullying increased significantly in the control group—but not the KiVa group—for girls in both the high- and low-HSC-score groups.

Follow-up analyses for victimization

Results for victimization are shown in Figure 2 and Table 3. Boys with high and medium HSC scores in the KiVa condition showed a significant reduction in victimization, and the effect size for the boys with high HSC scores was double that of those with medium HSC scores. Boys with low HSC scores in the KiVa condition, on the other hand, did not show any significant change. In the control group, no significant change over time was found, whether for boys with high, medium, or low HSC scores. For girls in the KiVa group, victimization did not change among those with low HSC scores, but it decreased significantly for those with medium HSC scores and marginally for those with high HSC scores, with a similar effect size. Conversely, in the control group, victimization increased among girls with high HSC scores but not among girls with medium or low HSC scores.

Follow-up analyses for internalizing symptoms

Results for internalizing symptoms are shown in Figure 2 and Table 3. Boys with high HSC scores in the KiVa condition showed a significant reduction in internalizing symptoms, and the effect size was double that for boys with medium and low HSC scores. In the control group, there was no significant change over time for any of the boys. Similarly, internalizing symptoms did not change in girls, regardless of treatment condition and HSC score.

Discussion

The current study aimed at testing whether individual differences in the personality trait of environmental sensitivity predicted children's treatment response to an established antibullying intervention. Informed by the concepts of differential susceptibility (Belsky & Pluess, 2009) and vantage sensitivity (Pluess, 2015; Pluess & Belsky, 2013), we expected that children who scored higher on the HSC scale (Pluess et al., 2018) would benefit more from the intervention in relation to both behavioral and mental health outcomes compared with those scoring lower on the same measure.

As reported in a previous study (Nocentini & Menesini, 2016), the KiVa antibullying program proved effective in reducing bullying and victimization. In addition, it also significantly reduced externalizing and, at a marginal level, internalizing problems. Consistent with our hypothesis, several of these main effects were moderated by environmental sensitivity and gender, with effects most pronounced in boys scoring high in sensitivity. Although the intervention significantly reduced bullying behaviors and mental health outcomes across the whole sample, highly sensitive boys seemed particularly responsive to the beneficial effects of the intervention on victimization and internalizing symptoms (i.e., the effect size of the

Table 2. Mixed Model Predicting Bullying, Victimization, and Internalizing Symptoms: The Moderating Role of HSC

	Bullying		Victimization		Internalizing symptoms		Externalizing symptoms	
Estimated effect	β (*SE*)	*p*	β (*SE*)	*p*	β (*SE*)	*p*	β (*SE*)	*p*
Intercept	0.0001 (0.016)	.966	0.001 (0.024)	.982	0.810 (20.15)	.706	0.929 (0.138)	.502
Time	0.004 (0.022)	.857	−0.002 (0.032)	.954	−2.95 (2.95)	.318	1.51 (1.18)	.202
Group	0.038 (0.023)	.097	0.028 (0.034)	.407	−1.02 (3.02)	.735	2.26 (1.94)	.245
Gender	−0.005 (0.021)	.816	0.028 (0.030)	.359	−0.23 (3.28)	.944	−0.514 (0.210)	.807
Grade	0.036 (0.021)	.091	**0.095 (0.030)**	**.002**				
HSC	**0.011 (0.005)**	**.026**	**0.017 (0.007)**	**.017**	**1.91 (0.680)**	**.005**	**1.33 (0.439)**	**.002**
Time × Group	−0.018 (0.031)	.555	−0.003 (0.045)	.953	2.46 (4.15)	.553	−2.71 (1.66)	.103
Time × Gender	0.028 (0.028)	.330	0.036 (0.041)	.384	5.12 (4.50)	.256	0.045 (2.95)	.988
Time × Grade	−0.030 (0.029)	.308	−0.052 (0.042)	.219				
Group × Gender	−0.038 (0.029)	.198	**−0.100 (0.043)**	**.018**	− 4.31 (4.68)	.357		.357
Group × Grade	−0.014 (0.030)	.631	−0.029 (0.043)	.486				
Time × HSC	0.000 (0.006)	.974	0.004 (0.010)	.720	1.44 (0.940)	.125	−0.215 (0.377)	.569
Group × HSC	−0.008 (0.007)	.256	0.948 (0.94)	.310	1.09 (0.95)	.251		.251
HSC × Gender	−0.004 (0.006)	.529	1.05 (0.98)	.284	0.980 (0.998)	.326		.326
HSC × Grade	−0.006 (0.006)	.335	−0.016 (0.009)	.072				
Time × HSC × Gender	**−0.013 (0.006)**	**.023**	**−0.025 (0.008)**	**.002**	−1.02 (0.942)	.277	−0.147 (0.616)	.811
Time × HSC × Grade	0.010 (0.008)	.218	0.021 (0.012)	.085				
Time × HSC × Group	−0.006 (0.006)	.361	−0.008 (0.009)	.371	−0.146 (0.904)	.871	0.225 (0.591)	.704
Time × Gender × Group	−0.033 (0.040)	.408	0.008 (0.058)	.896	−7.32 (6.39)	.253	−2.01 (2.91)	.491
Time × Grade × Group	0.068 (0.041)	.095	0.044 (0.059)	.458				
Group × Time × HSC × Gender	**0.020 (0.008)**	**.013**	**0.027 (0.011)**	**.022**	**2.97 (1.32)**	**.024**	0.264 (0.862)	.760
Group × Time × HSC × Grade	−0.013 (0.008)	.100	−0.001 (0.011)	.926				
Residual variance	**0.002 (0.000)**	**.000**	**0.005 (0.000)**	**.000**	**21.64 (1.00)**	**.000**	**0.869 (0.40)**	**.000**
Subjects: Random intercept	**0.002 (0.000)**	**.000**	**0.004 (0.000)**	**.000**	**34.99 (2.14)**	**.000**	**15.18 (0.90)**	**.000**
Schools: Random intercept	0.000 (0.000)	.085	**0.000 (0.000)**	**.029**	0.150 (0.284)	.598	0.139 (0.166)	.400

Note: Boldface type indicates statistically significant results ($p < .05$) from the deviance tests for fixed effects and from the Wald tests for random effects. HSC = Highly Sensitive Child scale.

Table 3. Follow-Up Analyses on HSC Groups

	Boys			Girls		
Group	β (*SE*)	*p*	*d*	β (*SE*)	*p*	*d*
			Victimization			
KiVa						
High HSC	0.048 (0.016)	.004	0.23	0.018 (0.009)	.055	0.13
Medium HSC	0.019 (0.008)	.020	0.13	0.017 (0.006)	.009	0.12
Low HSC	0.014 (0.010)	.180	0.14	−0.007 (0.016)	.637	0.01
Control						
High HSC	0.003 (0.018)	.850	0.02	−0.032 (0.012)	.011	0.23
Medium HSC	−0.009 (0.006)	.108	0.06	−0.009 (0.006)	.108	0.07
Low HSC	−0.005 (0.012)	.668	0.03	−0.020 (0.015)	.176	0.19
			Internalization			
KiVa						
High HSC	4.156 (2.046)	.038	0.37	0.502 (0.927)	.590	0.02
Medium HSC	0.798 (0.624)	.204	0.12	0.117 (0.526)	.824	0.03
Low HSC	1.239 (0.833)	.139	0.17	0.789 (1.48)	.597	0.10
Control						
High HSC	0.924 (1.15)	.669	0.10	2.49 (2.06)	.229	0.23
Medium HSC	0.413 (0.597)	.490	0.05	−0.453 (0.592)	.446	0.06
Low HSC	−0.495 (0.82)	.547	0.06	−0.352 (0.953)	.712	0.07
			Bullying			
KiVa						
High HSC	0.006 (0.014)	.644	0.04	0.004 (0.013)	.770	0.04
Medium HSC	0.014 (0.007)	.060	0.11	0.006 (0.004)	.192	0.12
Low HSC	0.001 (0.008)	.845	0.02	0.000 (0.009)	.979	0.19
Control						
High HSC	0.004 (0.013)	.770	0.06	−0.011 (0.005)	.017	0.16
Medium HSC	−0.0107 (0.007)	.153	0.13	−0.005 (0.004)	.203	0.11
Low HSC	0.000 (0.009)	.979	0.01	−0.014 (0.006)	.014	0.24

Note: Positive β values indicate a decrease across time, and negative β values indicate an increase across time. HSC = Highly Sensitive Child scale.

intervention in highly sensitive boys was more than 2 times the average effect size across the whole sample). Low-sensitivity boys, on the other hand, did not benefit from the intervention in relation to victimization and internalizing symptoms. We found that medium-sensitive and high-sensitive girls were significantly and marginally significantly more likely, respectively, to report reduced levels of victimization when in the treatment group, with no moderation effects emerging for the other outcomes. A possible explanation for the victimization findings is that highly sensitive children are more likely to be (or perceived as being) victimized, as shown in the bivariate correlations, and therefore also more positively affected by a treatment-induced reduction of bullying behavior in the school context. The significant main effect on externalizing symptoms, however, was moderated by neither sensitivity nor gender, which may be explained by the observation that sensitive children were generally less likely to manifest externalizing behaviors. In the same direction are findings related to bullying: The stronger decrease was for the group of KiVa boys with a medium level of sensitivity but not for the high-sensitivity group, possibly because they are less likely to manifest bullying. In summary, low-sensitivity children—boys and girls—seem to be relatively resistant to the program's effects in relation to reducing victimization, and low-sensitivity boys in relation to reducing internalizing behaviors. On the other side, children with medium or high HSC scores were more sensitive to the antibullying program for victimization, but only boys with high HSC scores were more sensitive to the treatment for internalizing behaviors.

Overall, the average effect sizes for a reduction in bullying (d = 0.07), victimization (d = 0.10), externalizing behaviors (d = 0.09), and internalizing symptoms (d = 0.11) were relatively low, which is consistent with the existing literature (Evans et al., 2014; Ferguson et al., 2007; Jimenez-Barbero et al., 2016; Lee et al., 2015; Ttofi

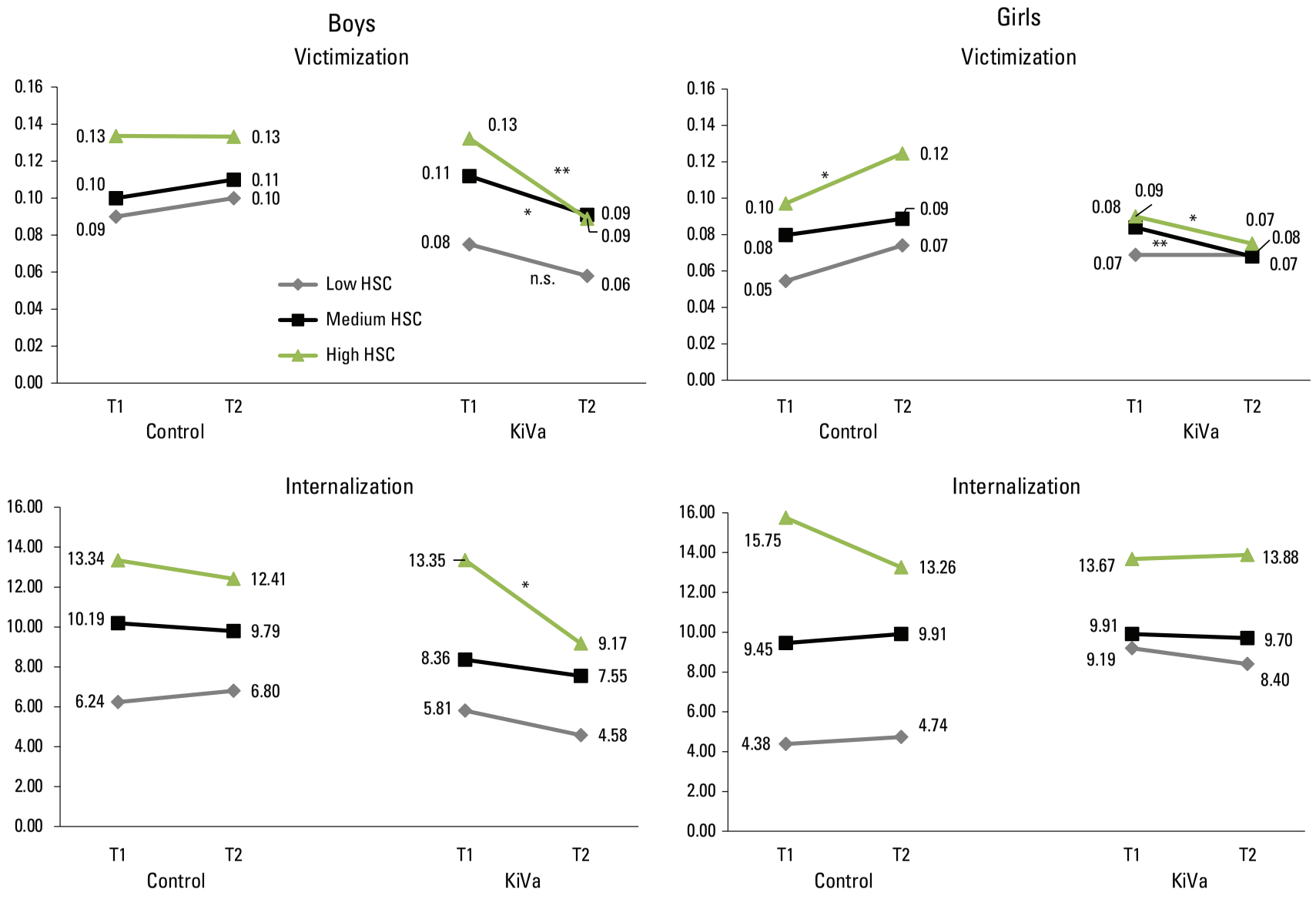

Fig. 2. Victimization and internalizing symptoms across time, distinguishing between boys and girls, control and KiVa groups, and children with high, medium, and low scores on the Highly Sensitive Child (HSC) scale.
*$p < .05$. **$p < .01$.

& Farrington, 2011; Yeager et al., 2015). However, for sensitive boys, effect-size estimates were more than twice the average estimate, particularly for victimization (0.23) and for internalizing symptoms (0.37).

Why do sensitive children benefit more from antibullying interventions? KiVa is a program that targets the social structure of the context in which bullying occurs. Program activities are aimed at improving children's ability to recognize and deconstruct the typical bullying context. As a result, children learn to empathize with the suffering of the victim, to process the features of the bullying situation, and to find the most appropriate coping solution. According to the predominant theories of environmental sensitivity, more sensitive individuals may have a more responsive central nervous system on which experiences register more easily and more deeply (Belsky & Pluess, 2009; Pluess & Belsky, 2013). Hence, highly sensitive children may be better at acquiring empathy and also more perceptive of treatment-induced improvements of the school and classroom context.

In line with our hypothesis, the moderating effects of environmental sensitivity were more pronounced in boys than in girls. Boys are generally more likely to get involved in bullying-related behaviors, both actively as bullies or passively as victims (Cook, Williams, Guerra, Kim, & Sadek, 2010). Hence, sensitive boys may (a) benefit directly from a treatment-induced reduction in being bullied and (b) be generally more perceptive of positive changes in the school and classroom context. This explains both the reduction in reported victimization as well as the significantly reduced internalizing problems in highly sensitive boys.

The strengths of this study include the randomized controlled trial design, the large sample, and the focus on multiple bullying-related outcomes. However, findings must be considered in light of several methodological limitations. First, all the measures were based on self-report. Second, the sample was not representative of the Italian population. The reported findings are generalizable only to Italian schools that are willing to implement an antibullying program with a medium level of risk (Nocentini & Menesini, 2016). Third, mental health symptoms were assessed only among older children. Finally, the study did not focus on investigating the specific processes underlying the heightened treatment response of children with high HSC scores. A better understanding of the specific mechanisms associated with environmental sensitivity will be crucial for the development of specific intervention components aimed at low-sensitivity children who seem less likely to benefit from an antibullying intervention.

Despite these limitations, the present study makes a significant contribution to the literature by demonstrating that the personality trait of environmental sensitivity represents an important predictor of the response to a school-based antibullying intervention (for similar findings regarding a depression prevention intervention, see Pluess & Boniwell, 2015). There is a growing recognition that universal prevention programs fail to equally benefit all individuals and that it is important to better understand differences in treatment response (Bradshaw, 2015). The current study provided evidence that individual differences in environmental sensitivity should be considered as an important moderator of treatment response to school-based intervention programs. Not only can it be measured easily with a questionnaire, but the resulting data could be useful for the identification of children most and least likely to benefit from universal school-based interventions, such as antibullying programs. Not accounting for individual differences in environmental sensitivity may lead to misestimation of the often small to moderate average treatment effects: Highly sensitive children may be considerably more responsive to treatment than the average effect size suggests, whereas less sensitive individuals may not respond at all. This important information is lost when individual differences in environmental sensitivity are not considered and data from more and less responsive individuals are combined.

In conclusion, the current study provided first evidence that self-reported environmental sensitivity, measured with a short questionnaire, moderates the positive effects of an established antibullying intervention. These moderating effects were particularly strong in boys, with highly sensitive boys benefiting significantly more from the intervention than did low-sensitivity boys regarding victimization and internalizing symptoms.

Author Contributions

All the authors listed have contributed sufficiently to the project to be included as authors, and all those who are qualified to be authors are listed in the author byline. All the authors approved the final manuscript for submission.

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All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors. Informed consent was obtained from all individual participants included in the study.

Declaration of Conflicting Interests

The authors declared that there were no conflicts of interest with respect to the authorship or the publication of this article.

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