

**Title:** Differences in the early stages of social information processing for adolescents involved in bullying

**Authors and affiliations:**

Alexa Guy<sup>a</sup>, M.Res;

Kirsty Lee<sup>a</sup>, Ph.D;

Dieter Wolke<sup>ab</sup>, Ph.D.; Dr rer nat. h.c.

<sup>a</sup> Department of Psychology, University of Warwick, Coventry, CV4 7AL, United Kingdom.

<sup>b</sup> Warwick Medical School, University of Warwick, Coventry, CV4 7AL, United Kingdom.

**Corresponding author:**

Dieter Wolke,

Department of Psychology, University of Warwick, Coventry, CV4 7AL, UK

**Work phone:** 024 7652 3537

**Email:** D.Wolke@warwick.ac.uk

**Conflict of interest:** The authors declare that they have no conflict of interest.

**Funding:** Alexa Guy and Kirsty Lee were supported to undertake this research by a fellowship from the Department of Psychology, University of Warwick.

**Contributions:** Alexa Guy and Dieter Wolke conceived the study and all authors contributed to the study design. Alexa Guy produced the first draft of the manuscript and all authors revised the manuscript and approved the final version.

## Abstract

Bullying victimization has commonly been associated with deficiencies in social information processing (SIP). In contrast, findings regarding bullying perpetration are mixed, with some researchers claiming that bullies may have superior SIP abilities than victimized or uninvolved youth. This study investigated the effects of bullying and victimization on early SIP; specifically the recognition and interpretation of social information. In stage 1, 2782 adolescents (11-16 years) were screened for bullying involvement, and in stage 2, 723 of these participants (mean age=13.95) were assessed on measures of emotion recognition, hostile attribution bias, and characterological self-blame (CSB). No associations between bullying and early SIP were found. In contrast, victimization was associated with more hostile attribution bias and CSB attributions. Girls performed better than boys on the emotion recognition task while boys showed greater hostile attribution biases. No interaction effects of bullying or victimization with gender were found. Follow-up categorical analyses that considered pure victims versus victims who also bullied (bully-victims) on SIP, found a similar pattern of findings. These findings suggest that those who purely bully others are neither superior nor deficient in the early stages of SIP. Victimized adolescents, however, show biases in their interpretations of social situations and the intentions of others. These biases may lead to maladaptive responses and may increase risk for further victimization by peers.

Adolescence is a critical period for social development, when relationships with peers become increasingly dominant and influential (Knoll, Magis-Weinberg, Speekenbrink, & Blakemore, 2015). Negative social relationships and experiences can lead to adverse and potentially long-lasting effects on health and well-being (Wolke & Lereya, 2015). One prominent example is bullying. Defined as unwanted and repeated aggression involving an imbalance of power (Gladden, Vivolo-Kantor, Hamburger, & Lumpkin, 2014), bullying is a highly prevalent problem for children and adolescents. The typical school bully has been stereotyped as impulsive and socially incompetent. However many have questioned this stereotype, as well as inconsistencies in how social competence has been defined (Arsenio & Lemerise, 2001; Sutton, Smith, & Swettenham, 1999a, 1999b).

There are distinct social attributes and outcomes associated with bullying and victimization (Haynie et al., 2001; Veenstra et al., 2005). Despite being disliked by many of their peers, bullies often hold a high social status, are perceived as popular, and have relatively positive long term social outcomes (Garandeau, Lee, & Salmivalli, 2014a, 2014b; Wolke, Copeland, Angold, & Costello, 2013). Conversely, victims report more loneliness, have few friendships, and are often seen as unpopular by their peers (Pouwels, Lansu, & Cillessen, 2016; Veenstra et al., 2005). Differences in social competence, and in particular the way that social information is processed, may account for some of the difference in attributes and outcomes associated with bullying and victimization. It remains a matter of debate whether those who bully are deficient or potentially superior in their social information processing (Crick & Dodge, 1996, 1999; Sutton et al., 1999a, 1999b).

The Social Information Processing (SIP) Model (Crick & Dodge, 1994; Dodge, 1986), has been widely used to describe how cognitive and behavioral responses are generated from the

way that social information is managed (Lemerise & Arsenio, 2000). The early stages of SIP involve the encoding and interpretation of cues obtained from social situations, from which our desired goals are clarified. Possible responses are then generated and evaluated, and in the final stage the chosen response is enacted. According to the SIP Model, accurate processing within these initial stages is critical for implementing appropriate behavior in response to social cues. Bullying perpetration is considered to be maladaptive behavior and is thought to arise from deficiencies, or persistent biases, in the early stages of SIP (Crick & Dodge, 1999; Hazler, 1996; Randall, 1997). However those who are victimized may also show deficits in the recognition and interpretation of social events (Woods, Wolke, Nowicki, & Hall, 2009; Ziv, Leibovich, & Shechtman, 2013). There have been inconsistent reports regarding the abilities and/or deficiencies in SIP of those who bully and those who are victimized.

The first stage of SIP relies on the ability to acknowledge and correctly identify the thoughts, feelings, and behavior of others. Emotion recognition is a basic yet fundamental skill which is important for our social and cognitive development (Nowicki & Duke, 1994). Deficiencies at this initial stage of processing have been associated with aggression (Fine, Trentacosta, Izard, Mostow, & Campbell, 2004; Schultz, Izard, & Ackerman, 2000; Schultz, Izard, & Bear, 2004) and conduct problems (Blair & Coles, 2000; Sharp, 2008). Few studies have investigated emotion recognition with regards to bullying/victimization (Ciucci, Baroncelli, & Nowicki, 2014) and findings are mixed. In general, no differences have been found between the emotion perception ability of bullies and their peers in childhood (Camodeca & Goossens, 2005; Woods et al., 2009) or adolescence (Ciucci et al., 2014). Victimization has been associated with poor social-cognition (Gini, 2006); however it is unclear if this is due specifically to deficits in the initial encoding of emotional and social cues. Woods et al. (2009) found that children

identified as relational or overlap victims (i.e., those victimized by multiple means) performed poorer than uninvolved children at recognizing angry and afraid faces. In adolescence, however, this association was reported only for boys who were victims of cyber-bullying (Ciucci et al., 2014).

The second stage of SIP is the interpretation of social cues, i.e. how we interpret situations or the behavior of others, and research has often focussed on attribution biases relating to aggressive behavior (Sutton et al., 1999a). Hostile attribution bias describes a tendency for interpreting situations or the intentions and behavior of others as hostile, even when there is conflicting, missing or ambiguous information. Both bullies and victims have been reported to make more hostile attributions in response to ambiguous social information than uninvolved children or adolescents (Camodeca & Goossens, 2005; Ziv et al., 2013); however these findings have not always been supported (Camodeca, Goossens, Schuengel, & Terwogt, 2003; Pouwels, Scholte, van Noorden, & Cillessen, 2015)

The attribution style of bullies and victims may also differ. Attribution style is largely reflected in the type of causal attributions that are endorsed about why a situation has occurred, or how we explain our own and others' behavior (Georgiou & Stavrinides, 2008). Characterological self-blame (CSB) attributions are those in which the occurrence of, predominantly negative, events are attributed to uncontrollable and unchangeable aspects of ourselves, i.e., "it is just something about me" (Graham & Juvonen, 2001). CSB is considered to be closely related to self-esteem (Janoff-Bulman, 1979), and the uncontrollability aspect of these attributions in particular has shown strong associations to depression and loneliness (Anderson & Arnoult, 1985; Anderson & Riger, 1991). Victims of bullying have been reported to endorse more CSB attributions than non-victims (Georgiou & Stavrinides, 2008; Graham & Juvonen,

1998, 2001), whereas children who bully may favour more external attributions for situations of peer violence (Georgiou & Stavrinides, 2008). Overall, the attributional styles of adolescent victims and perpetrators of bullying has received little empirical attention from researchers, and the extent to which these roles may differ in this aspect of SIP is unclear.

To summarize, there is considerable uncertainty whether victimization and/or perpetration of bullying in adolescence is associated with deficiencies in the initial recognition and interpretation stages of SIP, or whether neither group are different from those uninvolved in bullying. While hostile biases in interpretations have been found for aggressive youth, we are still uncertain whether this extends specifically to those who bully. Furthermore it remains unclear whether victims and perpetrators differ in their ability to recognize the emotions of others, or whether a greater distinction between these roles can be found in their attributions of blame.

This study aimed to investigate the early SIP abilities associated with bullying and victimization. Adolescents were assessed on emotion recognition, attributions of intent, and attributions of blame. We predicted that those who bully would accurately identify the emotions of others, but show hostile biases in their interpretations of social situations and behavior of others. Victims would show similar biases for making hostile interpretations but also select more attributions of characterological self-blame. We repeated the analyses using categorical groups to investigate whether those who both bully and are victimized (i.e., bully-victims), are more similar to those who are pure victims or pure bullies. Bully-victims have been reported to show the worst social, psychological, and behavioral difficulties and outcomes of those involved in bullying (Haynie et al., 2001; Lereya, Copeland, Zammit, & Wolke, 2015; Schwartz, 2000), and warrant separate consideration regarding SIP compared to victims and bullies.

## **Method**

### **Design**

The current study (The Bullying, Appearance, Social information processing and Emotions Study; BASE) involved a two stage sampling design involving adolescents from five UK secondary schools. Stage 1 used both self-report and peer-nomination measures to screen adolescents for involvement in bullying. The responses on these bullying measures first identified participants who perpetrated or were victims of bullying, and for the secondary analyses, participants were also assigned to a 'bullying' role (i.e. bullies, victims, bully-victims, and uninvolved). For stage 2, selected participants were assessed for emotion recognition, hostile attribution bias, and attributions of self-blame.

### **Sample**

During stage 1, 3883 11-16 years-olds were invited to participate in a study about peer relationships, of which 2782 (71.6%) were screened for bullying involvement using self-reports and peer-nominations. These pupils were obtained from five predominantly mixed-sex secondary schools within the UK (Wolke, Lee, & Guy, 2017). Based upon the data for self-reported and peer-nominated bullying involvement, a total of 1088 pupils were selected for stage 2 and for each school, those who participated in both stages were entered into a prize draw to win a £50 voucher.

Of the 1088 pupils selected for stage 2, 276 (25.4%) were absent or could not take part due to organizational difficulties within schools (i.e. timetabling, access to computers, exams). Twelve pupils were unable to participate due either to their school's concerns about vulnerability ( $n=5$ ) or parent and/or child refusals ( $n=7$ ), and a further seven were excluded (incorrect pupil

attended,  $n=1$ ; participant used for a pilot study,  $n=6$ ). The final sample comprised 754 pupils with complete data for the bullying/victimization measure, of which 53.6% were female. The majority of participants were white British (85.3%) and the mean age of the sample was 13.95 years ( $SD=1.34$ ).

## **Measures**

**Peer bullying.** Self-reported bullying involvement was assessed using the Bullying and Friendship Interview schedule (Wolke, Woods, Bloomfield, & Karstadt, 2000). For this measure, pupils were provided with behavioral descriptions of bullying/victimization. The first 13 items assessed experience of different types of victimization; direct (e.g., “been hit or beaten up”), relational (e.g. “had lies/nasty things said about you”), and cyber (e.g. “had rumors spread about you online”), and pupils were asked how frequently each behavior had happened to them in the last six months. For each item, participants could respond with “never”, “sometimes”, “quite a lot” (several times a month), or “a lot” (at least once a week). Only responses of “quite a lot” or “a lot” were considered indications of victimization (Wolke, Woods, Bloomfield, & Karstadt, 2001; Woods & Wolke, 2004). The same 13 items were then adapted to assess bullying perpetration.

For the peer-nomination measure of bullying involvement, pupils were given a numbered list of the names of the other students in their tutor/form group (broadly equivalent to the ‘homeroom’ in US schools). Each participant could nominate up to three of these students (and not themselves) who were either the victims or the perpetrators of the behavior described. These descriptions corresponded to those used for the self-report measure of direct and relational bullying (e.g. Some people repeatedly leave people out of get-togethers, parties, trips or groups,



get others to ignore people, or spread nasty lies, rumors, or stories about people on purpose. Which people in your form/tutor do this?"). This study used nominations limited to three pupils, similar to procedures reported previously (de Bruyn, Cillessen, & Wissink, 2010; Juvonen, Graham, & Schuster, 2003; Schwartz, 2000). It is argued that by limiting nominations, participants are required to think about who best fits the description, rather than simply nominating several classmates.

For this measure, bullying and victimized pupils were identified if their z-score (using the number of nominations received at the tutor group level) was one standard deviation above the mean ( $>1SD$ ) of their tutor group for bullying or victimization (Wolke et al., 2017).

**Emotion Recognition.** To assess emotion recognition, items were used from the Child's version of the "Reading the Mind in the Eyes Test" (Baron-Cohen, Wheelwright, Spong, Scahill, & Lawson, 2001). The original child measure consists of 28 photographs showing only the eye region of people's faces and participants are asked to select which of four words best describes what that person is thinking or feeling. In this study, eight items were selected, representing an equal number of males and females and a wide range of ages. Only one word for each photo was deemed correct and the order of responses was randomized. Across the eight items, the number of correct responses was calculated to give a total score for the Eyes Test. Good test-retest reliability has been reported for the adult version: intraclass correlation coefficient (ICC) = .63 ( $p < .01$ ) (Fernández-Abascal, Cabello, Fernández-Berrocal, & Baron-Cohen, 2013), and child version: limits of agreement (Bland Altman) =  $\pm 4.3$  (Hallerbäck, Lugnegård, Hjärthag, & Gillberg, 2009).

**Attributions of Intent: Hostile Attribution Bias.** Hostile attribution biases have been assessed using a range of stimuli including stories, pictures, or films to depict ambiguous social scenes, situations, and behavior (Crick & Dodge, 1996; Dodge & Coie, 1987). For this study, a new measure was constructed in which pupils were shown photographs of social situations (see supplementary material 1 for an example item). Each photograph showed an ambiguous scene in which the behavior or situation shown could be interpreted as harmless or hostile. Eight photographs were selected based upon data from a pilot study which was conducted online with 27 adolescents (mean age=15.56 years, female=70.4%) who were members of an educational social network for young people aged 13-18 years (i.e., IGGY; [www.iggy.net](http://www.iggy.net)). The photographs selected were those which received the most variation in responses, but also depicted different types of potential bullying (i.e. physical, relational, cyber or sibling) and varied in the gender of perpetrator(s)/victims(s). In this pilot sample of participants, Cronbach's alpha for the eight selected photographs was .69 and thus all items were retained.

For each item, participants were asked to select one of four statements that best described what was happening in the picture. The responses varied in the harmful intent of the 'perpetrator(s)' in the photographs from 0) the most innocent (e.g. 'The two boys are telling jokes and laughing') to 3) the most hostile (e.g. 'The boys are telling a nasty joke about the other boy and laughing about him'). The order of the responses was reversed for half of the items. Across the eight items, the number of 'most hostile intent' attributions were totalled to give a hostile attribution score, in which higher scores indicated more bias. In the current study, Cronbach's alpha for this measure was .56.

**Attribution Style: Characterological Self-Blame (CSB).** This measure of attribution style consisted of six short vignettes which described hypothetical ambiguous social situations.

Five of these vignettes were based upon those already used in the assessment of attributions (Crain, Finch, & Foster, 2005; Crick, 1995), with slight word adaptations to ensure they were age appropriate and relevant. A sixth vignette was newly added as shown below:

‘You have texted your friend Jade and did not get a reply, however then you see Jade has written a Facebook status from her phone since receiving your message and therefore must have been on her phone and seen your text. How would you explain this behavior?’

1. Jade always replies to everyone else’s texts but never yours. She obviously prefers her other friends to you and therefore treats them better (Characterological self-blame)
2. Jade may have seen your text and then been distracted and forgot to reply; your friends do this a lot. (External blame)
3. You must have upset Jade in some way because she would never normally ignore you like this. (Behavioral self-blame)
4. It’s possible that Jade’s phone is not working properly and she may not have received your text. (External blame)’

These vignettes were piloted on a sample of 140 UK students (mean age=19.76 years, males=50.7%) to check for ambiguity. Based upon previous research highlighting the distinction between characterological self, behavioral self, and external blame attributions (Graham & Juvonen, 1998; Janoff-Bulman, 1979), responses were coded into these attribution styles. In the example, responses are labelled accordingly. For each item, two responses reflected external blame in order for a characterological self-blame bias to be more stringently identified. The number of each type of attribution made was calculated across the six vignettes. The focus of the analysis was on the number of CSB attributions made as they are considered to be the most

maladaptive (Graham & Juvonen, 1998), and therefore a good reflection of deficiencies in this aspect of interpretation. Past measures for assessing the controllability dimension of attributional style have yielded modest Cronbach's alpha levels of .51 to .60 (Anderson, Jennings, & Arnoult, 1988; Anderson & Riger, 1991). Similarly, relatively low reliability was found for the vignettes used in this study (Cronbach's  $\alpha=.48$ ).

**Demographic Data.** During stage 1, pupils self-reported their gender, their parent's highest level of education, and their date of birth; from which an age in years variable was calculated. Parent's education was dichotomized into 1-11 years (no education to basic schooling) and >11 years (further education; i.e., college or university), and ethnicity was dichotomized into 'White British' and 'Minority'. Schools provided data on attendance rate (%) and pupil premium status (yes/no). In the UK, pupil premium refers to extra funding that schools receive to promote attainment in disadvantaged pupils. This includes pupils who have been (in the past six years) eligible for free school meals. Pupil premium status for each pupil was obtained as an indicator of deprivation and/or financial assistance.

## **Procedure**

This study was reviewed and received full ethical approval by the university's ethics committee. Schools were contacted and, following confirmation of their participation, written details of the study were provided alongside consent forms for pupils and parents. Written informed consent was obtained from all pupils prior to assessment and passive consent (via an opt-out procedure) was obtained from parents. The measures were completed online in groups of 20-30 pupils during one lesson (approximately 50-60 minutes) throughout the school day. At the start of each session, pupils were reminded about the purpose and nature of the study via a

written overview, and were given standardized instructions for completing the survey. The survey was accessed via individual passwords and all measures were counterbalanced. For ethical and data quality purposes, questionnaires could only be completed whilst a researcher and a member of teaching staff were present. Data collection took place between October 2014 and July 2015, with approximately 1-2 months between stage 1 and 2.

## **Analysis**

Participants with more than one missing item on any measure were excluded from the analyses ( $n=31$ ). Bivariate analyses (chi-square comparisons, one-way ANOVAs) were conducted on the demographic data to identify differences between the bullying and victimization roles, and any of the demographic variables that significantly differed between these bullying roles were included in the subsequent analyses as covariates, to control for any confounding effects. In the primary analysis, for each SIP measure, three-way ANCOVAs were conducted to investigate the effects of bullying (bully/not a bully), victimization (victim/not a victim), and gender, and any interaction effects from these variables. Gender was included in the model due to reported differences between boys and girls in regards to involvement in bullying (Cook, Williams, Guerra, Kim, & Sadek, 2010; Scheithauer, Hayer, Petermann, & Jugert, 2006). Secondly, to explore how bully-victims may differ to other roles (i.e., bullies, victims, and uninvolved), individual ANCOVAs and Bonferroni adjusted post-hoc comparisons were conducted for each measure. A significance level of  $p<.05$  was set for all analyses and values for partial eta squared will be reported as a measure of effect sizes. These values will be interpreted using the previously reported guidelines of .0099, .0588, and .1379 as indicators of small, moderate, and large effect sizes, respectively (Cohen, 1977; Richardson, 2011). All analyses were computed using SPSS version 22.

## Results

### Descriptive Statistics

The exclusion of missing data resulted in a final sample of 723 pupils with complete data for all measures. These participants were allocated to bullying groups; 'bully yes' ( $n = 397$ ) and 'bully no' ( $n = 326$ ), and also victimization groups; 'victim yes' ( $n = 421$ ) and 'victim no' ( $n = 302$ ) (table 1). Of the demographic data obtained, age showed significant differences between the bully yes ( $M = 14.09$ ,  $SD = 1.30$ ) and bully no ( $M = 13.78$ ,  $SD = 1.38$ ) groups ( $F(1,721) = 9.680$ ,  $p = .002$ ). The percentage of pupils with pupil premium status differed between the bully yes (27.5%) and no (17.2%) groups ( $\chi^2(1,723) = 10.736$ ,  $p = .001$ ), and also between the victim yes (26.8%) and no (17.2%) groups ( $\chi^2(1,723) = 9.244$ ,  $p = .002$ ). These variables were therefore included as covariates in all models. The number of participants within each tutor group ranged from 15-36 ( $M = 26.76$ ,  $SD = 4.30$ ).

**Table 1.** Descriptive data for participants (split by bullying and victimization). All numbers are percentages, unless otherwise stated

		Total	Bully		Victim	
			Yes	No	Yes	No
		<i>N</i> 723	397	326	421	302
		(%)	(54.9)	(45.1)	(58.2)	(41.8)
Gender	<i>Girls %</i>	53.9	51.4	57.1	54.6	53.0
	<i>Boys %</i>	46.1	48.6	42.9	45.4	47.0
Age (in years)	<i>Mean</i>	13.95	14.09	13.78	13.93	13.98
	<i>(SD)</i>	(1.35)	(1.30)	(1.38)	(1.30)	(1.40)
Ethnicity	<i>White British %</i>	85.5	84.1	87.1	86.9	83.4
	<i>Minority %</i>	14.5	15.9	12.9	13.1	16.6
Attendance	<i>Mean</i>	95.42	95.39	95.46	95.22	95.70
	<i>(SD)</i>	(4.67)	(4.48)	(4.90)	(4.85)	(4.40)
Parent Education	<i>≤11 years %</i>	14.7	15.1	14.1	15.2	13.9
	<i>&gt;11 years %</i>	85.3	84.9	85.9	84.8	86.1
Pupil Premium	<i>Yes %</i>	22.8	27.5	17.2	26.8	17.2
	<i>No %</i>	77.2	72.5	82.8	73.2	82.8

**Primary Analysis: The effects of bullying, victimization and gender on early SIP**

**Emotion Recognition.** There was no significant main effect of bullying ( $F(1,713)=.003$ ,  $p=.955$ ,  $\eta^2=.000$ ), or victimization ( $F(1,713)=1.779$ ,  $p=.291$ ,  $\eta^2=.002$ ) on scores for emotion

recognition. Gender had a small but significant main effect ( $F(1,713)=4.258, p=.039, \eta^2=.006$ ), whereby girls ( $M=5.15, 95\% \text{ CI}=5.02, 5.28$ ) gave more correct responses on this measure than boys ( $M=4.95, 95\% \text{ CI}=4.81, 5.09$ ). There were no significant interactions between bullying and victimization, or between bullying, victimization, and gender. Neither age nor pupil premium covariates had a significant main effect on emotion recognition.

**Hostile Attribution Bias.** There was a significant main effect of victimization ( $F(1,713)=5.006, p=.026, \eta^2=.007$ ) on hostile attribution bias, whereby those who were victimized ('victim yes';  $M=2.38, 95\% \text{ CI}=2.22, 2.54$ ) attributed more hostile intent to the ambiguous photographs than non-victimized participants ('victim no';  $M=2.11, 95\% \text{ CI}=1.93, 2.29$ ) (figure 1). A main effect was also found for gender ( $F(1,713)=11.499, p=.001, \eta^2=.016$ ), in which boys ( $M=2.45, 95\% \text{ CI}=2.27, 2.62$ ), showed a greater hostile attribution bias than girls ( $M=2.04, 95\% \text{ CI}=1.88, 2.20$ ). There was no significant main effect of bullying ( $F(1,713)=2.032, p=.154, \eta^2=.003$ ), nor any significant interactions between bullying and victimization, or between bullying, victimization, and gender.

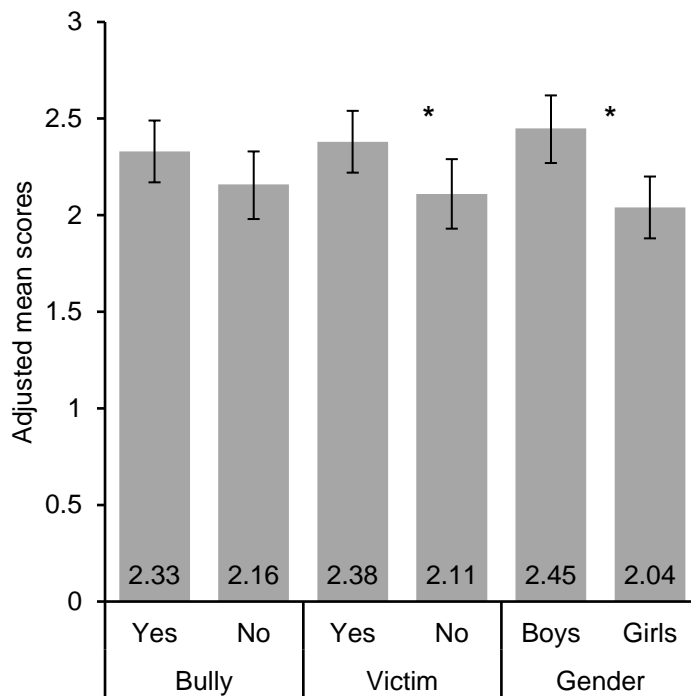
Of the covariates included in the model, there was a significant main effect of age ( $F(1,713)=67.904, p<.001, \eta^2=.087$ ); the number of hostile intent attributions decreased with increasing age ( $r(723)= -.292, p<.001$ ). There was no main effect of pupil premium status on hostile attribution bias.

**Characterological Self-Blame (CSB).** Only victimization was found to have a significant main effect on the number of CSB attributions made for the social vignettes ( $F(1,713)=20.434, p<.001, \eta^2=.028$ ); although the effect size was small (figure 2). CSB responses were selected more often by victimized ('victim yes';  $M=1.51, 95\% \text{ CI}=1.39, 1.63$ )



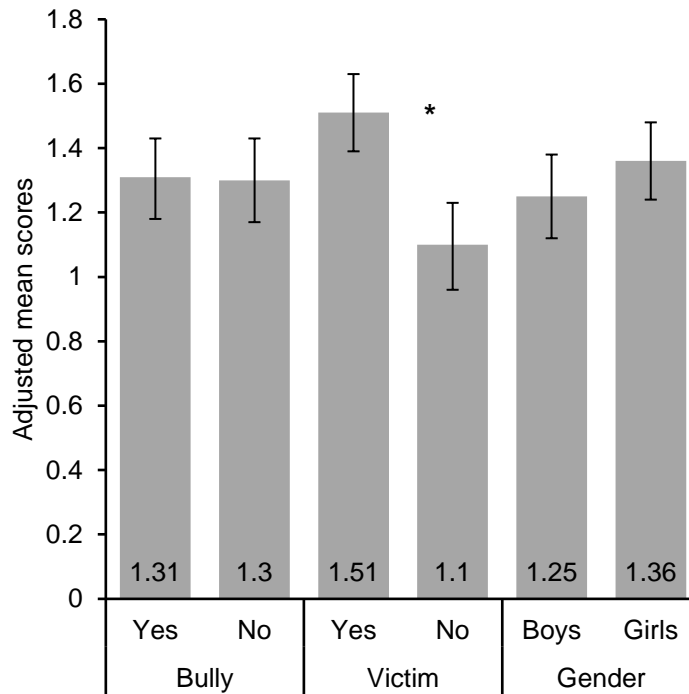
than non-victimized youth ('victim no';  $M=1.10$ , 95% CI=.962, 1.23). There were no main effects of bullying ( $F(1,713)=.003$ ,  $p=.959$ ,  $\eta p^2=.000$ ) or gender ( $F(1,713)=1.454$ ,  $p=.228$ ,  $\eta p^2=.002$ ), and no significant interactions between bullying and victimization, or between bullying, victimization, and gender.

Finally, no covariates included in the model, i.e., age and pupil premium, had a significant main effect on the number of CSB attributions made.



**Figure 1.** Hostile Attribution Bias: Adjusted group means (including 95% confidence intervals).

\* = significant main effect of victimization ( $F(1,713)=5.006$ ,  $p=.026$ ), and gender ( $F(1,713)=11.499$ ,  $p=.001$ ).



**Figure 2.** Characterological self-blame: Adjusted group means (including 95% confidence intervals).

\* = significant main effect of victimization ( $F(1,713)=20.434, p<.001$ ).

### **Secondary analysis: comparisons between the bully, victim, bully-victim and uninvolved roles**

Participants were assigned to a role (i.e., bully, victim, bully-victim or uninvolved) via classification rules (Wolke et al., 2017) (see supplementary material 2; table S1). Descriptive data and the results of the one-way ANCOVAs and Bonferroni comparisons for each SIP measure are reported in supplementary material 2 (tables S2 to S4). A small but significant main effect of role was found for hostile attribution bias ( $F(3,716)=3.044, p=.028, \eta^2=.013$ ) and characterological

self-blame ( $F(3,716)=7.840, p<.001, \eta p^2=.032$ ), but not for emotion recognition ( $F(3,716)=.397, p<=.755, \eta p^2=.002$ ). Of the covariates included in the ANCOVA models, i.e., age and pupil premium, there was a main effect of age on hostile attribution bias ( $F(1,716)=68.016, p<.001, \eta p^2=.087$ ), whereby the number of hostile intent attributions decreased with increasing age ( $r(723)= -.292, p<.001$ ).

Bonferroni adjusted comparisons revealed that bully-victims gave significantly more hostile attributions of intent than uninvolved pupils ( $2.35 \pm 1.60$  vs  $1.97 \pm 1.65, p=.032$ ), and significantly more characterological self-blame attributions for the social vignettes ( $1.43 \pm 1.24$  vs  $.99 \pm 1.10, p=.003$ ). Similarly victims gave significantly more characterological self-blame attributions than uninvolved peers ( $1.60 \pm 1.21$  vs  $.99 \pm 1.10, p<.001$ ) or bullies ( $1.60 \pm 1.21$  vs  $1.20 \pm 1.14, p=.021$ ). Bully-victims showed no significant differences to either bullies or victims on any of the SIP measures.

## **Discussion**

For the first stage of social information processing, neither bullying nor victimization was associated with emotion recognition ability. Consistent with previous findings, no differences in emotion recognition were found between the bullying roles (Camodeca & Goossens, 2005; Ciucci et al., 2014). These findings suggest that involvement in bullying may not be associated with deficits at this stage of SIP. For the next stage of processing, victimized adolescents showed biases in their interpretation of social information. Victimization was associated with a bias for endorsing characterological self-blame attributions, whereas a greater hostile attribution bias was found among bully-victims specifically. Overall the effect sizes were small.

In contrast to the findings for general aggression and conduct disorder, bullying perpetration was not associated with notable deficiencies in early social information processing. These findings do not support the view that bullies are socially incompetent as historically portrayed (Crick & Dodge, 1996, 1999; Randall, 1997). However, we can neither conclude that bullies are superior in their social information processing skills. Thus rather than bullying behavior being explained by inaccuracies in the recognition or interpretation of social information, it may be more likely explained by the way this information is used (Arsenio & Lemerise, 2001; Sutton, Smith, & Swettenham, 2001; Ziv et al., 2013). Arsenio and Lemerise (2001) proposed that emotions play an important role in how social information is processed and used, and indeed the nature of bullies has been described as cold, Machiavellian, callous, and unempathic (Ciucci & Baroncelli, 2014; Sutton & Keogh, 2001; Zych, Ttofi, & Farrington, 2017). These emotional and personality attributes may therefore influence the use of bullying behaviour for potential material or social gains (Sutton et al., 1999b; Volk, Camilleri, Dane, & Marini, 2012; Volk, Dane, Marini, & Vaillancourt, 2015).

On the other hand, these results suggest that those who are victimized show the most interpretation biases in the early stages of social information processing. Consistent with previous findings (Georgiou & Stavrinides, 2008; Graham & Juvonen, 1998), victimization was associated with a greater use of characterological self-blame attributions, and this tendency was shown by both victims and bully-victims. These biases may be manifestations of the low self-esteem and self-worth that have been reported for those who are victimized (Haynie et al., 2001; Lee, Guy, Dale, & Wolke, 2017), and are reinforced by experiencing further negative outcomes, i.e., bullying (Rosen, Milich, & Harris, 2009). Thus a repeated cycle of negative expectations and negative outcomes may increase feelings of hopelessness, which has been associated with

internalizing disorders, i.e., depression (Pinto & Francis, 1993), and more recently victimization (Radliff, Wang, & Swearer, 2016). Hopelessness as a result of persistent self-blame may account in part for the poor outcomes in psychological health and well-being often reported for victimized youth (Takizawa, Maughan, & Arseneault, 2014; Wolke et al., 2013; Wolke & Lereya, 2015).

Victimization was associated with greater interpretations of hostility within ambiguous social situations, and this bias was exhibited the most by bully-victims. The reason for this is unclear. Both bullies and victims experience hostile interactions from their involvement in bullying; however these roles do not show the same level of attribution bias. Because of their dual involvement as both a bully and a victim, bully-victims may be more frequently exposed to hostile situations (Dodge, 2006), and this exposure could add further strength to these biases (Pouwels et al., 2015). Bully-victims are most like the aggressive child described in the SIP model; exhibiting high levels of reactive aggression and retaliatory behavioral responses. However this aggression is often unsuccessful in gaining dominance and may lead to further ostracism, hostility, and victimization by peers. Bully-victims may therefore experience chronic stress in the form of social defeat (Björkqvist, 2001), which is associated with low self-esteem, depression, and other clinical disorders (Hamilton, Newman, Delville, & Delville, 2008; Lee et al., 2017). This may explain why bully-victim status is associated with the worst behavioral problems and poorest outcomes (Haynie et al., 2001; Schwartz, 2000; Wolke et al., 2013). However, overall, associations between victimization and both self-blame and hostile attribution biases were small, suggesting that there are other major factors involved in victimization beyond deficits in early SIP.

Attribution biases may be reasonable responses to the aggression that victimized adolescents frequently face, and may therefore reflect accurate interpretations based on their own social experiences. Why bully-victims engage in aggression while victims do not, is likely due to a combination of individual and familial characteristics (Hanish & Guerra, 2004; Lereya, Samara, & Wolke, 2013; Veenstra et al., 2005), however the greater bias shown by bully-victims for making hostile attributions may explain their commonly aggressive and reactive behavior within social contexts. In contrast, bullies do not need to be alert to the same potential threats, as they are often highly ranked and dominant in the social peer structure (Garandean et al., 2014a, 2014b) and have low levels of stress as indicated by inflammatory markers (Copeland et al., 2014).

It is somewhat surprising that no interaction effects were found, especially considering the reported differences between boys and girls in relation to bullying (Cook et al., 2010). However some gender differences in SIP were found. Boys displayed a stronger hostile attribution bias than girls, which is in contrast to many previous studies that have reported no effect of gender on attribution bias (Camodeca et al., 2003; Perren, Etekal, & Ladd, 2013). However, as De Castro, Veerman, Koops, Bosch, and Monshouwer (2002) noted in their meta-analysis, girls have been highly underrepresented within the attribution literature, and further investigation is therefore warranted. Girls have been reported to show better emotion recognition skills than boys, however gender differences have not been consistently shown (Leppänen & Hietanen, 2001; Thomas, De Bellis, Graham, & LaBar, 2007). In this study, girls performed slightly better than boys on the Eyes Test, and similar findings have been reported for adult populations (Kirkland, Peterson, Baker, Miller, & Pulos, 2013). However effect sizes are small and warrant caution in drawing strong conclusions.

This study has several strengths. To our knowledge no other study has simultaneously addressed these early stages of SIP in regards to bullying involvement in adolescence and the different roles adopted (Pouwels et al., 2015; Ziv et al., 2013). The two stage sampling approach allowed for sufficient statistical power for group comparisons. Our assessment of adolescents also addressed a gap in previous literature, which has predominantly focussed on social information processing during childhood, despite adolescence being a period of continued and critical social development (Knoll et al., 2015).

There are also limitations. Firstly, the nature of the study is correlational and associations need to be cautiously interpreted regarding the direction of causality. Secondly, the sample may not be representative of the UK as a whole. Thirdly, new measures were used to investigate the recognition and interpretation of social information, and the reliability coefficients for these measures were modest. The Child's Eyes Test was selected due to its relative difficulty compared with other child emotion recognition tests and was deemed more suitable for our sample. However, further research is needed to determine the suitability of the Eyes Test as a measure of emotion recognition within adolescent populations. Similarly the ambiguous photographs as a measure of hostile attribution bias were created for this study and further development and validation of this measure is needed.

In conclusion, our findings suggest that adolescents that bully others are neither deficient nor superior in the recognition and interpretation of social information, and are indistinguishable in the early stages of SIP from those uninvolved in bullying. In contrast, those who are victimized show biases in their interpretations of social situations, and bully-victims in particular show the strongest biases for attributing hostile intent within social situations. For victimized adolescents, these interpretations can often become reality, and their biases are thus further

strengthened. Therefore interventions may target the maladaptive responses that arise from such biases and place these adolescents at increased risk of repeated victimization.



## References

- Anderson, C. A., & Arnoult, L. H. (1985). Attributional style and everyday problems in living: Depression, loneliness, and shyness. *Social Cognition, 3*(1), 16-35.
- Anderson, C. A., Jennings, D. L., & Arnoult, L. H. (1988). Validity and utility of the attributional style construct at a moderate level of specificity. *Journal of Personality and Social Psychology, 55*(6), 979.
- Anderson, C. A., & Riger, A. L. (1991). A controllability attributional model of problems in living: Dimensional and situational interactions in the prediction of depression and loneliness. *Social Cognition, 9*(2), 149-181.
- Arsenio, W. F., & Lemerise, E. A. (2001). Varieties of childhood bullying: Values, emotion processes, and social competence. *Social Development, 10*(1), 59-73.
- Baron-Cohen, S., Wheelwright, S., Spong, A., Scahill, V., & Lawson, J. (2001). Are intuitive physics and intuitive psychology independent? A test with children with Asperger Syndrome. *Journal of Developmental and Learning Disorders, 5*(1), 47-78.
- Björkqvist, K. (2001). Social defeat as a stressor in humans. *Physiology & Behavior, 73*(3), 435-442.
- Blair, R. J. R., & Coles, M. (2000). Expression recognition and behavioural problems in early adolescence. *Cognitive Development, 15*(4), 421-434.
- Camodeca, M., & Goossens, F. A. (2005). Aggression, social cognitions, anger and sadness in bullies and victims. *Journal of Child Psychology and Psychiatry, 46*(2), 186-197.
- Camodeca, M., Goossens, F. A., Schuengel, C., & Terwogt, M. M. (2003). Links between social information processing in middle childhood and involvement in bullying. *Aggressive Behavior, 29*(2), 116-127.
- Ciucci, E., & Baroncelli, A. (2014). The emotional core of bullying: Further evidences of the role of callous-unemotional traits and empathy. *Personality and Individual Differences, 67*, 69-74.
- Ciucci, E., Baroncelli, A., & Nowicki, S. (2014). Emotion perception accuracy and bias in face-to-face versus cyberbullying. *The Journal of Genetic Psychology, 175*(5), 382-400.
- Cohen, J. (1977). Statistical power analysis for the behavioural sciences (Rev. ed.). *New York: Academic.*
- Cook, C. R., Williams, K. R., Guerra, N. G., Kim, T. E., & Sadek, S. (2010). Predictors of bullying and victimization in childhood and adolescence: A meta-analytic investigation. *School Psychology Quarterly, 25*(2), 65.
- Copeland, W. E., Wolke, D., Lereya, S. T., Shanahan, L., Worthman, C., & Costello, E. J. (2014). Childhood bullying involvement predicts low-grade systemic inflammation into adulthood. *Proceedings of the National Academy of Sciences, 111*(21), 7570-7575.
- Crain, M. M., Finch, C. L., & Foster, S. L. (2005). The relevance of the social information processing model for understanding relational aggression in girls. *Merrill-Palmer Quarterly, 51*(2), 213-249.
- Crick, N. R. (1995). Relational aggression: The role of intent attributions, feelings of distress, and provocation type. *Development and Psychopathology, 7*(02), 313-322.
- Crick, N. R., & Dodge, K. A. (1994). A review and reformulation of social information-processing mechanisms in children's social adjustment. *Psychological Bulletin, 115*(1), 74.
- Crick, N. R., & Dodge, K. A. (1996). Social information-processing mechanisms in reactive and proactive aggression. *Child Development, 67*(3), 993-1002.
- Crick, N. R., & Dodge, K. A. (1999). 'Superiority' is in the eye of the beholder: A comment on Sutton, Smith, and Swettenham. *Social Development, 8*(1), 128-131.
- de Bruyn, E. H., Cillessen, A. H., & Wissink, I. B. (2010). Associations of peer acceptance and perceived popularity with bullying and victimization in early adolescence. *The Journal of Early Adolescence, 30*, 543-566.

- De Castro, B. O., Veerman, J. W., Koops, W., Bosch, J. D., & Monshouwer, H. J. (2002). Hostile attribution of intent and aggressive behavior: A meta-analysis. *Child Development, 73*(3), 916-934.
- Dodge, K. A. (1986). A social information processing model of social competence in children. *Minnesota symposium on child psychology, 18*, 77-125.
- Dodge, K. A. (2006). Translational science in action: Hostile attributional style and the development of aggressive behavior problems. *Development and Psychopathology, 18*(03), 791-814.
- Dodge, K. A., & Coie, J. D. (1987). Social-information-processing factors in reactive and proactive aggression in children's peer groups. *Journal of Personality and Social Psychology, 53*(6), 1146.
- Fernández-Abascal, E. G., Cabello, R., Fernández-Berrocal, P., & Baron-Cohen, S. (2013). Test-retest reliability of the 'Reading the Mind in the Eyes' test: a one-year follow-up study. *Molecular autism, 4*(1), 33.
- Fine, S. E., Trentacosta, C. J., Izard, C. E., Mostow, A. J., & Campbell, J. L. (2004). Anger perception, caregivers' use of physical discipline, and aggression in children at risk. *Social Development, 13*(2), 213-228.
- Garandeau, C. F., Lee, I. A., & Salmivalli, C. (2014a). Differential effects of the KiVa anti-bullying program on popular and unpopular bullies. *Journal of Applied Developmental Psychology, 35*(1), 44-50.
- Garandeau, C. F., Lee, I. A., & Salmivalli, C. (2014b). Inequality matters: Classroom status hierarchy and adolescents' bullying. *Journal of Youth and Adolescence, 43*(7), 1123-1133.
- Georgiou, S. N., & Stavrinides, P. (2008). Bullies, victims and bully-victims psychosocial profiles and attribution styles. *School Psychology International, 29*(5), 574-589.
- Gini, G. (2006). Social cognition and moral cognition in bullying: What's wrong? *Aggressive Behavior, 32*(6), 528-539.
- Gladden, R. M., Vivolo-Kantor, A. M., Hamburger, M. E., & Lumpkin, C. D. (2014). Bullying Surveillance Among Youths: Uniform Definitions for Public Health and Recommended Data Elements, Version 1.0. Atlanta, GA: National Center for Injury Prevention and Control, Centers for Disease Control and Prevention and U.S. Department of Education.
- Graham, S., & Juvonen, J. (1998). Self-blame and peer victimization in middle school: an attributional analysis. *Developmental Psychology, 34*(3), 587.
- Graham, S., & Juvonen, J. (2001). An attributional approach to peer victimization. In J. Juvonen & S. Graham (Eds.), *Peer harassment in school: The plight of the vulnerable and victimized* (pp. 49-72). New York: Guilford.
- Hallerbäck, M. U., Lugnegård, T., Hjärthag, F., & Gillberg, C. (2009). The Reading the Mind in the Eyes Test: test-retest reliability of a Swedish version. *Cognitive Neuropsychiatry, 14*(2), 127-143.
- Hamilton, L. D., Newman, M. L., Delville, C. L., & Delville, Y. (2008). Physiological stress response of young adults exposed to bullying during adolescence. *Physiology & Behavior, 95*(5), 617-624.
- Hanish, L. D., & Guerra, N. (2004). Aggressive victims, passive victims, and bullies: Developmental continuity or developmental change? *Merrill-Palmer Quarterly, 50*(1), 17-38.
- Haynie, D. L., Nansel, T., Eitel, P., Crump, A. D., Saylor, K., Yu, K., & Simons-Morton, B. (2001). Bullies, victims, and bully/victims: Distinct groups of at-risk youth. *The Journal of Early Adolescence, 21*(1), 29-49.
- Hazler, R. J. (1996). *Breaking the cycle of violence: Interventions for bullying and victimization*. Washington, DC: Taylor & Francis.
- Janoff-Bulman, R. (1979). Characterological versus behavioral self-blame: inquiries into depression and rape. *Journal of Personality and Social Psychology, 37*(10), 1798.
- Juvonen, J., Graham, S., & Schuster, M. A. (2003). Bullying among young adolescents: The strong, the weak, and the troubled. *Pediatrics, 112*(6), 1231-1237.

- Kirkland, R. A., Peterson, E., Baker, C. A., Miller, S., & Pulos, S. (2013). Meta-analysis Reveals Adult Female Superiority in "Reading the Mind in the Eyes Test". *North American Journal of Psychology, 15*(1), 121-146.
- Knoll, L. J., Magis-Weinberg, L., Speekenbrink, M., & Blakemore, S.-J. (2015). Social influence on risk perception during adolescence. *Psychological Science, 26*, 583-592.
- Lee, K., Guy, A., Dale, J., & Wolke, D. (2017). Does psychological functioning mediate the relationship between bullying involvement and weight loss preoccupation in adolescents? A two-stage cross-sectional study. *International Journal of Behavioral Nutrition and Physical Activity, 14*(1), 38.
- Lemerise, E. A., & Arsenio, W. F. (2000). An integrated model of emotion processes and cognition in social information processing. *Child Development, 71*(1), 107-118.
- Leppänen, J. M., & Hietanen, J. K. (2001). Emotion recognition and social adjustment in school-aged girls and boys. *Scandinavian Journal of Psychology, 42*(5), 429-435.
- Lereya, S. T., Copeland, W. E., Zammit, S., & Wolke, D. (2015). Bully/victims: a longitudinal, population-based cohort study of their mental health. *European Child & Adolescent Psychiatry, 24*(12), 1461-1471.
- Lereya, S. T., Samara, M., & Wolke, D. (2013). Parenting behavior and the risk of becoming a victim and a bully/victim: A meta-analysis study. *Child Abuse & Neglect, 37*(12), 1091-1108.
- Nowicki, S., & Duke, M. P. (1994). Individual differences in the nonverbal communication of affect: The Diagnostic Analysis of Nonverbal Accuracy Scale. *Journal of Nonverbal Behavior, 18*(1), 9-35.
- Perren, S., Ettekal, I., & Ladd, G. (2013). The impact of peer victimization on later maladjustment: mediating and moderating effects of hostile and self-blaming attributions. *Journal of Child Psychology and Psychiatry, 54*(1), 46-55.
- Pinto, A., & Francis, G. (1993). Cognitive correlates of depressive symptoms in hospitalized adolescents. *Adolescence, 28*(111), 661.
- Pouwels, J., Lansu, T., & Cillessen, A. (2016). Participant roles of bullying in adolescence: Status characteristics, social behavior, and assignment criteria. *Aggressive Behavior, 42*, 239-253.
- Pouwels, J., Scholte, R., van Noorden, T., & Cillessen, A. (2015). Interpretations of bullying by bullies, victims, and bully-victims in interactions at different levels of abstraction. *Aggressive Behavior, 42*(1), 54-65.
- Radliff, K. M., Wang, C., & Swearer, S. M. (2016). Bullying and peer victimization an examination of cognitive and psychosocial constructs. *Journal of Interpersonal Violence, 31*(11), 1983-2005.
- Randall, P. (1997). *Adult bullying: Perpetrators and victims*. London: Routledge.
- Richardson, J. T. (2011). Eta squared and partial eta squared as measures of effect size in educational research. *Educational Research Review, 6*(2), 135-147.
- Rosen, P. J., Milich, R., & Harris, M. J. (2009). Why's everybody always picking on me? Social cognition, emotion regulation, and chronic peer victimization in children. In M. J. Harris (Ed.), *Bullying rejection & peer victimization: A social cognitive neuroscience perspective* (pp. 79-100). New York, NY: Springer.
- Scheithauer, H., Hayer, T., Petermann, F., & Jugert, G. (2006). Physical, verbal, and relational forms of bullying among German students: Age trends, gender differences, and correlates. *Aggressive Behavior, 32*(3), 261-275.
- Schultz, D., Izard, C. E., & Ackerman, B. P. (2000). Children's anger attribution bias: Relations to family environment and social adjustment. *Social Development, 9*(3), 284-301.
- Schultz, D., Izard, C. E., & Bear, G. (2004). Children's emotion processing: Relations to emotionality and aggression. *Development and Psychopathology, 16*(02), 371-387.
- Schwartz, D. (2000). Subtypes of victims and aggressors in children's peer groups. *Journal of Abnormal Child Psychology, 28*(2), 181-192.

- Sharp, C. (2008). Theory of mind and conduct problems in children: Deficits in reading the “emotions of the eyes”. *Cognition and Emotion*, 22(6), 1149-1158.
- Sutton, J., & Keogh, E. (2001). Components of Machiavellian beliefs in children: Relationships with personality. *Personality and Individual Differences*, 30(1), 137-148.
- Sutton, J., Smith, P. K., & Swettenham, J. (1999a). Bullying and ‘theory of mind’: A critique of the ‘social skills deficit’ view of anti-social behaviour. *Social Development*, 8(1), 117-127.
- Sutton, J., Smith, P. K., & Swettenham, J. (1999b). Social cognition and bullying: Social inadequacy or skilled manipulation? *British Journal of Developmental Psychology*, 17(3), 435-450.
- Sutton, J., Smith, P. K., & Swettenham, J. (2001). ‘It’s easy, it works, and it makes me feel good’—A Response to Arsenio and Lemerise. *Social Development*, 10(1), 74-78.
- Takizawa, R., Maughan, B., & Arseneault, L. (2014). Adult health outcomes of childhood bullying victimization: evidence from a five-decade longitudinal British birth cohort. *American Journal of Psychiatry*, 171(7), 777-784.
- Thomas, L. A., De Bellis, M. D., Graham, R., & LaBar, K. S. (2007). Development of emotional facial recognition in late childhood and adolescence. *Developmental Science*, 10(5), 547-558.
- Veenstra, R., Lindenberg, S., Oldehinkel, A. J., De Winter, A. F., Verhulst, F. C., & Ormel, J. (2005). Bullying and victimization in elementary schools: a comparison of bullies, victims, bully/victims, and uninvolved preadolescents. *Developmental Psychology*, 41(4), 672.
- Volk, A. A., Camilleri, J. A., Dane, A. V., & Marini, Z. A. (2012). Is adolescent bullying an evolutionary adaptation? *Aggressive Behavior*, 38(3), 222-238.
- Volk, A. A., Dane, A. V., Marini, Z. A., & Vaillancourt, T. (2015). Adolescent Bullying, Dating, and Mating Testing an Evolutionary Hypothesis. *Evolutionary Psychology*, 13(4), 1-11.
- Wolke, D., Copeland, W. E., Angold, A., & Costello, E. J. (2013). Impact of bullying in childhood on adult health, wealth, crime, and social outcomes. *Psychological Science*, 24(10), 1958-1970.
- Wolke, D., Lee, K., & Guy, A. (2017). Cyberbullying: a storm in a teacup? *European Child & Adolescent Psychiatry*, 1-10.
- Wolke, D., & Lereya, S. T. (2015). Long-term effects of bullying. *Archives of Disease in Childhood*, 100, 879-885.
- Wolke, D., Woods, S., Bloomfield, L., & Karstadt, L. (2000). The association between direct and relational bullying and behaviour problems among primary school children. *Journal of Child Psychology and Psychiatry*, 41(08), 989-1002.
- Wolke, D., Woods, S., Bloomfield, L., & Karstadt, L. (2001). Bullying involvement in primary school and common health problems. *Archives of Disease in Childhood*, 85(3), 197-201.
- Woods, S., & Wolke, D. (2004). Direct and relational bullying among primary school children and academic achievement. *Journal of School Psychology*, 42(2), 135-155.
- Woods, S., Wolke, D., Nowicki, S., & Hall, L. (2009). Emotion recognition abilities and empathy of victims of bullying *Child Abuse & Neglect*, 33(5), 307-311.
- Ziv, Y., Leibovich, I., & Shechtman, Z. (2013). Bullying and victimization in early adolescence: Relations to social information processing patterns. *Aggressive Behavior*, 39(6), 482-492.
- Zych, I., Ttofi, M. M., & Farrington, D. P. (2017). Empathy and Callous–Unemotional Traits in Different Bullying Roles: A Systematic Review and Meta-Analysis. *Trauma, Violence, & Abuse (in press)*.

## Supplementary Material 1

Ambiguous photographs measure: example item



**What is happening in this picture?**

	<b>Response/Score</b>
The two boys ('1' in picture) are telling jokes and laughing	1
The boys ('1') are telling jokes and laughing and look at the other boy	2
The boys ('1') are telling a joke about the other boy	3
The boys ('1') are telling a nasty joke about the other boy and laughing about him ( <i>Most hostile intent</i> )	4

## Supplementary Material 2

**Table S1.** Assignment rules to roles for the secondary analyses.

Role	Rule
Uninvolved	Not a self-reported victim or bully AND no peer nominations as victim or bully
Victim	Self-reported victim (several times a month or more) AND not a self-reported or peer nominated bully
Bully	Self-reported bully OR peer nominated bully AND not a self-reported or peer-nominated victim
Bully-victim	Bully and victim on one measure OR any combination of bully and victim on either self-reported or peer-nominated bullying measure

SOCIAL INFORMATION PROCESSING AND BULLYING

**Table S2.** Descriptive data for participants (split by bullying role). All numbers are percentages, unless otherwise stated.

		Total	Not Involved	Bully	Victim	Bully-Victim
<i>N</i>		723	160	142	166	255
Gender %	<i>Girls %</i>	53.9	51.9	54.2	62.0	49.8
	<i>Boys %</i>	46.1	48.1	45.8	38.0	50.2
Age (in years)	<i>Mean</i>	13.95	13.82	14.15	13.74	14.05
	<i>(SD)</i>	(1.35)	(1.39)	(1.39)	(1.37)	(1.25)
Ethnicity	<i>White British %</i>	85.5	86.9	79.6	87.3	86.7
	<i>Minority %</i>	14.5	13.1	20.4	12.7	13.3
Attendance	<i>Mean %</i>	95.42	96.00	95.36	94.93	95.41
	<i>(SD)</i>	(4.67)	(4.13)	(4.68)	(5.51)	(4.38)
Parent Education %	<i>≤11 years %</i>	14.7	13.1	14.8	15.1	15.3
	<i>&gt;11 years %</i>	85.3	86.9	85.2	84.9	84.7
Pupil Premium %	<i>Yes %</i>	22.8	12.5	22.5	21.7	30.2
	<i>No %</i>	77.2	87.5	77.5	78.3	69.8

SOCIAL INFORMATION PROCESSING AND BULLYING

**Table S3.** Raw and adjusted role means (and standard deviations) and the effects of role and gender on the early SIP measures.

Role	Emotion Recognition				Hostile Attribution Bias <sup>a</sup>			Characterological Self-Blame		
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>M_adj</i>	<i>M</i>	<i>SD</i>	<i>M_adj</i>	<i>M</i>	<i>SD</i>	<i>M_adj</i>
Uninvolved	160	5.13	1.36	5.09	1.97	1.65	1.94	.99	1.10	1.00
Bully	142	5.03	1.17	5.11	2.19	1.68	2.28	1.20	1.14	1.19
Victim	166	4.98	1.28	5.01	2.40	1.69	2.37	1.60	1.21	1.59
Bully-victim	255	5.05	1.26	4.99	2.35	1.60	2.38	1.43	1.24	1.43
Total	723	5.10	1.24		2.25	1.65		1.33	1.20	
	<i>df</i>	<i>F</i>	<i>p</i>	<i>np<sup>2</sup></i>	<i>F</i>	<i>p</i>	<i>np<sup>2</sup></i>	<i>F</i>	<i>p</i>	<i>np<sup>2</sup></i>
Role	3	.397	.755	.002	3.044	.028	.013	7.840	.000	.032
Gender	1	4.401	.036	.006	11.757	.001	.016	2.309	.129	.003

NOTE: *M\_adj* = adjusted mean.

Covariates included in all ANCOVA models were age (in years) and pupil premium status (yes/no).

Significance at *p*<.05 level.

<sup>a</sup>The covariate of age had a significant main effect on hostile attribution bias ( $F(1,716)=68.016, p<.001, \eta^2=.087$ ), whereby the number of hostile intent attributions decreased with increasing age ( $r(723)= -.292, p<.001$ ).



SOCIAL INFORMATION PROCESSING AND BULLYING

**Table S4.** Post hoc comparisons (Bonferroni adjusted) between roles.

	Hostile Attribution Bias			Characterological Self-Blame		
	Mean Difference (95% CI)	SE	<i>p</i>	Mean Difference (95% CI)	SE	<i>p</i>
Uninvolved vs Bully	-.346 (-.825 , .133)	.181	.339	-.189 (-.552 , .175)	.138	1.000
Uninvolved vs Victim	-.436 (-.896 , .024)	.174	.075	-.588 (-.937 , -.239)	.132	.000
Uninvolved vs Bully-victim	-.446 (-.868 , -.023)	.160	.032	-.424 (-.744 , -.103)	.121	.003
Bully vs Victim	-.090 (-.565 , .385)	.180	1.000	-.400 (-.760 , -.039)	.136	.021
Bully vs Bully-victim	-.100 (-.533 , .334)	.164	1.000	-.235 (-.564 , .094)	.124	.357
Victim vs Bully-victim	-.010 (-.426 , .406)	.157	1.000	.165 (-.152 , .481)	.119	1.000

NOTE: 95% CI = 95% confidence intervals. Significance at  $p < .05$  level.