The Association of Children's Locus of Control Orientation and Emotion Recognition Abilities at 8 Years of Age and Teachers' Ratings of their Personal and Social Difficulties at 10 Years

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Abstract

The purpose of the present study was to see if emotion recognition skill and locus of control in 8-year-old children predicted teacher rated Goodman Strengths and Difficulties (SDQ, Goodman 2001) two years later. Children participating in the Avon Longitudinal Study of Parents and Children (ALSPAC; Golding 2004) completed emotion recognition tests of child facial expressions and voices and a child locus of control scale when they were 8 years of age. Later at age 10, as part of ALSPAC's on-going-assessment of children's personal and social lives, teachers completed the SDQ. Based on past research and developmental theory (e. g., Nowicki & Duke 1994: Thomas, DeBellis, Graham, & LaBar, 2007) it was predicted and found that children who made more recognition errors, were more external, and male at age 8 had a greater number of teacher-rated psychological/behavioral difficulties at age 10 than those who made fewer errors, were internal, and female. Implications of the findings for children's personal and social adjustment were discussed.

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The ability to identify emotional states of others is a major interpersonal skill that affects our everyday interactions (Hall & Bernieri, 2001; Nowicki, Duke, & Van Buren, 2008). Emotion recognition is included as a fundamental ability within the constructs of emotional intelligence (Mayer, Roberts & Barasade, 2008; Mayer & Salovey, 1997), emotional/affective competence (Halberstadt, Denham, & Dunsmore, 2001; Saarni, 1999), and social competence (Crick & Dodge, 1994).

Elfenbein et al. (2010), concluded: "even for individuals of normal or exceptional functioning emotion skill testing can be worthwhile as a signal of the ability to engage in effective interpersonal relationships, academic achievement, and workplace performance" (p. 199). Halberstadt, Denham, and Dunsmore (2001) suggest that receptive emotion identification skill is "crucial" because it "provides immediate feedback about the effects of our own behavior along with information about others' intentions and the advisability of interacting with them" (p. 18).

Consistent with its theorized importance, deficits in identifying emotion in the nonverbal expressions of others have been found to be associated with negative personal and social outcomes. For example, for children between the ages of 8 and 10, the target population in the present study, poorer emotion recognition ability has been found to be related to lower popularity (Collins & Nowicki, 2001; Glanville & Nowicki, 2002; Monfries & Kanfer, 1988; Nowicki & Duke, 1992, 1994; Nowicki & Maxim, 2004) and social competence as rated by teachers (Feldman, Phillipot, & Custrini, 1991), and a higher incidence of bipolar disorder (Seymour, Pescosolido, Reidy et. al., 2013), attention deficit disorder, nonverbal and verbal learning disabilities (C. Hall, Peterson, Webster, Bolen, & Brown, 1999; Sprouse, Hall, Webster, & Bolen, 1998), high functioning autism (Thomeer, Lopata, Volker et al., 2012), traumatic brain injury (Tlustos, Chiu, Tayler et. al., 2011), externalizing problems and conduct disorder (Cadesky, Mota, & Schachar, 2000; Lancelot & Nowicki, 1997; Stevens, Charman, & Blair, 2001), emotional problems (Nowicki & DiGirolamo, 1989; Zabel, 1979) depression (Lenti, Giacobbe, & Pegna, 2000; Nowicki & E. Carton, 1997) social anxiety (McClure & Nowicki, 2001; Melfsen & Florin, 2002; Walker, Nowicki, Jones, & Heiman, 2011), schizotypal personality disorder (Wickline, Nowicki, Bollini, & Walker, 2012), speech and language impairment (Creusere, Alt, & Plante, 2004), and aggression (Cooley & Triemer, 2002).

While there are correlations between emotion recognition and personal and social outcomes, the magnitude of these associations is small. Apparently, other determinants contribute to children's behavioral difficulties besides emotion recognition skill. One likely candidate is locus of control (LOC). LOC reflects the degree to which individuals perceive connections between their behavior and their outcomes. Rotter (1966) defined the LOC construct as follows:

> Internal vs. external control refers to the degree to which persons expect that a reinforcement or an outcome of their behavior is contingent on their own behavior or personal characteristics vs. the degree to which persons expect that the reinforcement or outcome is a function of chance, luck, or fate, is under the control of powerful others, or is simply unpredictable. Such expectancies may generalize along a gradient based on the degree of semantic similarity of the situational cues. (p. 1)

Locus of control orientations vary between complete internality or externality. Individuals typically move from greater externality toward more internality during childhood and into adulthood eventually leveling off in later adulthood (Duke, Shaheen, & Nowicki, 1974; Nowicki, 2017a; Nowicki & Duke, 1974; Nowicki & Strickland, 1973).

The tendency to view outcomes as externally rather than internally determined has been found to be related to a variety of negative child outcomes. As compared to internality, childhood externality has been related to a greater likelihood of being sexually abused (Beach & Ford, 2006), depressed (Benassi, Sweeney, & Dufour, 1988; Luthar, & Blatt, 1993), anxious (Li & Chung, 2009), bullied (Kokknos & Panayiotou, 2007), enuretic (Butler, 2001), as well as having psychotic symptoms (Thompson, Sullivan, Lewis et al., 2011), learning disabilities (Dueley-Marling, Snider, & Traver, 1982), attention deficit disorders (Ialongo, Horn, Pascoe et al., 1993), suicidal behavior (Liu, Tein, Zhao, & Sandler, 2005), a lack of persistence (McLeod, 1985), and adjustment difficulties in adulthood (Gale, Batty, & Deary, 2008).

Unfortunately, except for a few large-scale prospective studies of adolescent and adult outcomes associated with child locus of control (e. g., Cobb-Clark & Schurer, 2013; Gale, Batty, & Deary, 2008), support for the child locus of control, and emotion recognition ability relations with negative outcomes has been obtained from cross-sectional studies with small numbers of participants from largely homogeneous populations. In contrast, the present study uses a large representative population of children to assess the locus of control, social adjustment association.

Based on empirical results from cross-sectional studies, it was predicted that externality and inaccuracy in emotion recognition at 8 years of age would be associated with a greater number of teacher-rated difficulties on the Goodman Strengths and Difficulties scale (Goodman,

2001) at 10 years of age. Predictions were made in regards to total SDQ difficulties because of a lack of persuasive evidence to predict associations between specific emotions and outcomes.

The final prediction involves gender. Because past research suggests boys generally have more school and behavior-related difficulties than girls (Birch & Ladd, 1993; Koepke & Harkins, 2008; Prior Smart, & Sanson, 1993), they were predicted to have more teacher rated difficulties than girls.

To summarize, it is predicted that children at age 8 who are (1) less rather than more accurate in emotion recognition of faces and voices, (2) more external than internal and (3) male rather than female, will have a greater number of teacher-rated difficulties at age 10. Although, the predicted outcomes are main effects, tests were done to assess the possibility of moderated effects for emotion recognition ability, locus of control and gender with SDQ scores.

Method

Sample

The Avon Longitudinal Study of Parents and Children (ALSPAC) is a prospective population-based birth cohort study designed to investigate the interaction of environment and genotype on the health and development of children. The study investigators invited all pregnant women in the geographically defined area of Avon, southwest England, with an expected date of delivery between April 1, 1991, and December 31, 1992, to take part. The study contains data on 14,062 live births, of which 13,988 were still alive at 12 months of age; active contact currently is maintained with nearly10,000 children. Mothers of infants in the ALSPAC were broadly representative of the rest of the United Kingdom at the 1991 census.

Data were collected on a variety of developmental traits by using face-to-face assessments at special clinics, parental self-completion questionnaires, and linked education and health records. Participating parents provided informed consent for testing sessions, and assent was gained from the children. Ethical approval for the study was obtained from the ALSPAC Law and Ethics Committee and the local research ethics committees.

Measures

Facial emotion recognition. Previous information on facial expression recognition was available in the cohort. This was collected using the Diagnostic Analysis of Nonverbal Accuracy 2 (DANVA2) child faces and voices subtests at the age of 8 (Rothman & Nowicki 2004; Nowicki 2017b; Nowicki & J. Carton, 1993; Nowicki & Duke, 1994). The faces subtest comprises 24 photos of child faces, with each face showing one of four emotions: fear, happiness, sadness, and anger. The faces are color photos of both male and female children of primary school age. The photos are presented to the child for 2 seconds. The child then responds by indicating which emotion is displayed in the photo. The pictures include 3 high and 3 low-intensity stimuli for each emotion. The construct validity of the child faces test is supported by the results of over 500 studies (Nowicki, 2017b).

The child voices subset is composed of 24 trials of children saying the sentence, “I am going out of the room, but I’ll be back later.” to reflect 3 high and 3 low-intensity examples of happy, sad, angry, and fearful statements. The test was performed as part of the assessment clinic at age 8 and was computerized to aid completion, with the tester providing only minimal prompts to the child throughout the testing procedure. As with the child faces test, the child voices test has accrued considerable construct validity evidence (Nowicki, 2017b; Rothman & Nowicki, 2004).

The child faces and voices tests provide a total error score out of 24 for emotion recognition, a score for emotion misattribution, and individual summary scores for the four emotions and low and high-intensity emotions. Because the DANVA2 was originally constructed to identify individuals who were not as accurate in identifying emotions in faces and voices the test scores reflect the *number of errors* made in identifying emotions. In addition, to assess the possibility of *response bias*, misattribution scores reflect which emotions were perceived instead of the correct ones. For example, two individuals could both make 6 errors in recognizing emotion in facial expressions or voices, but the first's erroneous responses are evenly spread among the three other emotion possibilities while all six of the second's response errors are focused on one emotion. Both the error and the misattribution scores were analyzed. The total DANVA score and the scores for each of these individual summary scores were used as continuous variables. Coefficient alpha for the total scores for the Face test was .73 and for voices, .64. The alpha for faces is consistent with past studies while the alpha for voices is in the low range of past studies (Nowicki, 2017b)

Locus of control. Children completed the 12-item anglicized form of the children's Nowicki Strickland Internal External control scale (CNSIE, Nowicki, 2017a; Nowicki & Strickland, 1973) as part of the face-to-face testing that took during their 8^{th} year. (completion = 8.7; inter-quartile range=8.6-8.10). Preliminary testing showed a correlation of .78 between the 12 items in the abbreviated scale and the 40-item original scale with 178 English children with a mean age of 8 years. A person with a higher" internal" score perceives that more outcomes of events are under their own control in contrast to an "external" person who perceives that more outcomes of events are controlled by factors outside their control. A total score was derived by summing scores answered in an external manner, with higher scores indicating a more external

LOC. The questionnaire has shown satisfactory construct validity as shown in the results from over two-thousand studies in both English and non-English speaking countries (Golding, Iles-Caven, Ellis, Gregory, & Nowicki, 2018; Nowicki, 2017a). Coefficient alpha in the present study was .78, consistent with measures in previous studies (Nowicki, 2017a).

Measure of Cognition: The WISC-III (UK). The WISC-III was used to assess cognitive function at age 8. At the time, it was the most up-to-date version of the Wechsler Intelligence Scale for Children. A short form of the measure was employed where alternate items (always beginning with item number 1) in the standard form were used from all subtests, except for the coding subtest, which was administered in its full form. The verbal IQ score was used for the present study.

Goodman Strengths and Difficulties Scale. Teachers completed the Strengths and Difficulties Questionnaire (SDQ, Goodman, 2001) a widely used measure of child and adolescent mental health. The questionnaire measures four mental health constructs under investigation in this study: attention difficulty/ hyperactivity, conduct problems, emotional symptoms, and prosocial behavior. Each construct is measured with 5 items rated on a three-point Likert scale (0 - *not true*; 1 - *somewhat true*; or 2 - *certainly true*). Total scores for each construct range from 0-10, with higher scores indicating more severe conduct problems, more severe emotional symptoms and lower levels of prosocial behavior. Internal consistency across the different constructs of the SDQ and across different informants (self-report, teacher, parent) has been found to be satisfactory (Cronbach's alpha mean of .73). Test–retest stability after 4–6 months was found to be .62 (Goodman, 2001).

Ethical approval

Ethical approval for the study was obtained from the ALSPAC Law and Ethics Committee and the Local Research Ethics Committees. Informed consent was obtained from the parents of the children after explanation of the nature of the study.

Results

Statistical Approach

Multiple regression with ordinary least squares estimation was used to evaluate whether gender, emotional recognition skills, and locus of control measured at eight years of age predict child emotional and behavioral outcomes at age 10. Child verbal IQ was statistically controlled in all analyses. Examination of distributions of DANVA errors, locus of control, and teacher ratings of emotional/behavioral problems revealed that many study variables were skewed with ceiling effects (see Tables 1 and 2) and that emotion recognition errors were correlated across faces and voices (range: .12 - .30). As a result, heteroscedasticity-consistent methods that are robust to violations of assumptions required for hypothesis-testing using ordinary least squares regression (Hayes & Cai, 2007) were applied to derive standard errors. The benefit of using heteroscedasticity-consistent methods is that more precise standard errors for hypothesis tests can be calculated without the need to transform skewed data or dichotomize variables (Hayes, Glynn, & Huge, 2012). Recognition errors for both faces and voices were entered into analyses as main effects to allow the unique effects of each type of error to be examined. In order to rule out statistical moderation (Hayes, 2013), full models that included both main and interaction effects were estimated. No statistically significant interactions were found for any analysis[1]. Therefore, only the results of tests of main effects are presented in tables.

Gender

Previous research suggests that while nonverbal processing skills are important for both boys' and girls' well-being, there are gender differences in both processing skills and the types of emotional and behavioral problems experienced (J. Hall & Gunnery, 2013; McClure, 2000) that may affect the size of observed associations. Consistent with this literature, we found gender differences in the total number of emotional/behavior symptoms ($t(2578) = 12.18$, $p < .001$) with teachers reporting more problems for boys ($M = 6.00$, $SD = 5.83$) than girls ($M = 3.55$, $SD = 4.30$), as well as more external locus of control ($t(257) = -2.42$, p<05) among girls ($M = 6.12$, $SD = 2.0$) than boys ($M = 5.92$; $SD = 2.09$). Multivariate analysis of variance revealed an overall pattern of gender differences in recognition of emotions (Wilks lambda = 0.96, $F(8, 2555) = 12.49$, $p < .001$), as well as specific misattribution errors (Wilks lambda = 0.97, $F(8, 2512) = 9.47$, $p < .001$). Follow-up tests revealed that boys had more recognition errors to happy faces ($F(1, 2562) = 16.55$, $p < .001$), sad voices ($F(1, 2562) = 22.84$, $p < .001$), angry faces ($F(1, 2562) = 30.23$, $p < .001$), and fearful voices ($F(1, 2562) = 6.18$, $p < .01$) and misattribution errors for sad faces ($F(1, 2519) = 47.30$, $p < .001$) and happy voices ($F(1, 2519) = 21.92$, $p < .001$) when compared to girls. Girls had more recognition errors to happy voices ($F(1, 2562) = 14.35$, $p < .001$).

Number of Emotion Recognition Errors – Faces

Our first set of hypothesis tests focused on children's total emotional/behavioral problems observed by teachers at age 10 and emotion recognition errors to faces and voices expressing happy, sad, angry and fearful emotions measured at age 8, gender, and locus of control at age 8, while controlling for verbal IQ assessed at age 8 (see Table 3). Verbal IQ, gender, the number of emotion recognition errors for sad, angry, and fearful faces, and locus of control emerged from analyses as statistically significant predictors of total emotional/behavior difficulties (see Table 3 for all estimates). Errors in nonverbal processing of emotion expressed in voices failed to predict emotional/behavioral difficulties over and above variance explained by recognition errors to faces. Analysis of total emotion recognition errors showed a similar pattern with main effects (*b* represents the unstandardized regression coefficient) for verbal IQ ($b = -0.06$, t = -9.20, $p < .001$), total emotion recognition errors to faces ($b = 0.22$, $t = 5.50$, $p < .001$), gender ($b = -2.49$, $t = -12.714$, $p < .001$), and locus of control ($b = 0.23$, $t = 4.63$, $p < .001$), but no main effect for total emotion recognition errors to voices ($b = 0.01$, $t = 0.09$, $p > .05$). Effect sizes across all analyses were small with percent variance explained in emotional/behavioral problems ranging from 13.0% to 14.0%.

Misattributions of Facial Expression of Emotions

To assess whether errors in identifying emotions in faces and voices reflected a specific bias or were more randomly distributed, analyses were repeated with a focus on specific pattern of errors (see Table 4). Total number of children's emotional/behavioral difficulties as rated by teachers at age 10 was regressed on scores indicating the number of times at age 8 that a facial emotion was incorrectly identified as happy, sad, angry or fearful. The corresponding index of misattributions to voices and both locus of control and gender were entered in analyses as main effects and verbal IQ was entered as a covariate.

Analyses revealed statistically significant main effects for incorrectly classifying emotions as happy, sad, or fearful, with more misattributions at age 8 associated with teacher ratings of emotional/behavioral difficulties at age 10 (see Table 4 for estimates). Misattributions to angry faces was not significantly associated with teacher ratings of age 10 emotional/behavioral difficulties. Similar to the results of analyses of emotion recognition errors, no main effects for misattributions of emotions expressed in voices were observed. Verbal IQ, gender, and external locus of control were significant predictors of emotional/behavioral difficulties in all analyses. Effect sizes were consistently small and ranged from 13.0% to 13.5% variance explained in teacher ratings of emotional/behavioral problems at age 10.

Discussion

Children at age 8 who were less adept at emotion recognition, higher in externality, and male had more teacher rated difficulties at age 10 than their peers who were better at identifying emotions, were lower in externality, and female. We did not predict, nor did we find, interactions among the three predictors and outcomes. The effects were additive and not conditional.

Identification of Emotion in Faces and Voices

As predicted and consistent with the assumptions of a variety of theories (e. g., Halberstadt, Denham, & Dunsmore, 2001), children who were less accurate in identifying emotion had more teacher-rated difficulties. The results suggest that children need to know how their peers are feeling and facial expressions are a dependable source of emotion information. As peers become a more important part of their social lives and making friends is a major goal, children who are handicapped by mistakes in processing nonverbal information may have more problems establishing important relationships as they move from early into later childhood.

Boys made more recognition errors to angry faces than girls, but they did not show a misattribution bias to anger. In addition, errors to angry faces were associated with teacher-observed emotional difficulties and social behavior among both boys and girls. Misattribution of anger in faces was not associated with negative outcomes. In other words, failing to see anger was a problem; seeing it when it was not there was not. If children fail to identify anger in their peers (an emotional signal that most likely communicates to stay away) and instead read anger as another emotion (i. e., happiness, sadness, or fear), it likely increases their chances of social difficulties. While anger messages warn others to stay away, other emotions invite others to approach; perhaps to join with them if they are happy, to console them if they are sad, or to support them if they are afraid. Negative consequences result when helpful behaviors are met with unexpected annoyance or irritation by the misidentified angry peer.

Teacher-rated difficulties were predicted better by face than by voice accuracy scores. When both variables were included in analyses, the number of errors to voices failed to contribute to variance in teacher-rated emotional difficulties above that explained by face recognition of emotion. Eight-year-old children may depend more on what they see than on what they hear nonverbally. Future research should see if the greater importance of recognizing emotion in faces rather than voices pattern extends into adolescence. However, perhaps a more obvious reason for voices more doing more poorly than faces is that English children were listening to American voices. Though English children share a verbal language with their American peers, there are significant differences in the meanings and pronunciations of words and phrases. Significant differences may also exist in the vocalics of emotion in the two verbal languages even though English children have listened to American voices on television, in movies, and in music that may not be sufficient for them to decode emotional meanings from voices. The DANVA voices were included in the testing because pilot testing showed English children scored similarly to American peers. However, until other studies validate the use of DANVA voices with non-American populations more extensively or tests are constructed to measure emotion in voices of English children (Chonaki, 2012), voice error results from the present study should be taken cautiously.

Locus of Control Expectancy

Just as children who made more mistakes in identifying emotions in facial expressions at age 8 had more teacher-rated difficulties at age 10, so did children who were more external. Perceiving a lack of connection between behavior and outcomes interferes with children learning from their errant behaviors. It also makes them less likely to persist in attaining a goal, accept responsibility for their actions, or gather information, since viewing outcomes as due to luck, fate, or chance would reduce the importance of such efforts (Nowicki, 2016). Past negative outcomes observed in cross-sectional studies showed externality to be associated with negative personality, social and academic outcomes.

Although locus of control did not interact with errors in recognizing emotion in faces at this age, it does not preclude this possibly occurring at a later age. For example, Culpin and her colleagues (Culpin, Stapinski, Miles, Araya, & Joinson, 2015) have found locus of control to moderate the relationship between childhood poverty and adolescent depression. Prospective and longitudinal research designs could be used to examine this possibility for a variety of personal, social, and academic outcomes.

Gender

As predicted, boys had more teacher-rated difficulties than girls. Although results of previous studies found boys have a greater number of behavior problems in school (e. g., Birch & Ladd, 1993), the present findings, as well as those in the past, should be taken cautiously because most of the teachers doing the ratings were women. Rater gender could make a difference in what is categorized as a difficulty or not. Women teachers may be more likely to see typical boys' behavior as misbehavior than men would. It also may be that boys' more observable “acting out” classroom behaviors may be more disruptive than girls who tend to turn their problems inwardly and not affect classroom climate as much. Although there were some male teachers in the school system surveyed in ALSPAC, specific teacher gender information was unavailable for analysis. Because of the potential bias of women rating behaviors of boys and girls, we suggest caution in interpreting and applying findings.

Girls had fewer emotion recognition errors and fewer teacher-rated difficulties but higher external expectancies than boys. Researchers, like J. Hall (1984; J. Hall & Gunnery, 2013) have pointed out that being adept at nonverbal communication skills may be more socially important for females in navigating a possibly more male-dominated society, although the findings were less impressive for children than adults. McClure (2000) meta-analyzed emotion recognition in faces across the life span and concluded that females were better than males in identifying emotion in facial expressions and this effect increased from childhood into adulthood. Our finding that girls had fewer emotion recognition errors than boys is consistent with this literature. As mentioned earlier, conditional effects with constructs like locus of control may be more likely to develop in adolescence and adulthood when individuals are engaged in multiple social roles where greater emotion recognition skills would provide an advantage across a range of interpersonal settings.

Practical Implications of the Findings

As noted in the introduction, both emotion recognition skill and locus of control are learned and show systematic changes with age; children improve their emotion recognition accuracy (Nowicki 2017b) and become more internal (Nowicki 2017a, Nowicki & Strickland 1973) over time. Both are learned first in the home through interactions with parents and family members and then refined through situational experiences outside the home, as in school. Children whose emotion recognition skill does not improve as rapidly as their peers or who do not continue to learn the appropriate connections between their behavior and resultant outcomes are likely to experience more personal and interpersonal difficulties than their peers.

Interventions to improve emotion recognition skills and guide children's learning of an appropriate locus of control orientation may help reduce the number of future difficulties in school. Grinspan, Hemphill, and Nowicki (2003) found that focused small group exercises in reading emotion in facial expressions over a six-week time improved children's ability to identify emotion in adult and child faces. Uhls, Michikyan, Morris et. al. (2014) administered the DANVA2 to measure the ability to identify emotion in faces and then had one group of children who had taken the test attend camp with their smart phones while another group attended the same week-long camping experience without their smart phones. She found that children who gave up their cell phones for a week-long camping experience improved their post-camp ability compared to those who took their phones with them for camp. Similar to interventions to improve abilities to identify emotion in facial expressions through learning experiences, others have shown that children can learn to become more appropriately internal through camp (Nowicki & Barnes, 1973; Daley, 1995) and school-based experiences (Nowicki, Duke, Sisney, Strickler & Tyler, 2004). More research is needed to evaluate the capability of interventions to improve nonverbal receptive skill and learn appropriate internality and then to see if changes are related to personal, social, and academic outcomes.

In conclusion, the results of the present study suggest that gender, emotion recognition skill, and locus of control at age 8 are significantly associated with teacher-rated difficulties two years later. However, the relatively small effect sizes suggest other factors may play a role in emotional functioning and social behavior during this developmental period. Further, because we did not control for concurrent assessments of the predictors, findings must be considered preliminary. However, if the results of the present study can be replicated and expanded to other age groups it calls for intervention programs to improve emotion recognition skill and promote appropriate internality to see if such changes help children adjust to their social world.

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Footnote

[1] Statistical results of all tests of interaction effects are available from the corresponding author upon request.

Table 1

DANVA Emotion Recognition Errors (Age8), Locus of Control (Age8), and Teacher Reported Problem Behaviors (Age10): Correlations and Descriptive Statistics (N = 2564)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Gender	_													
2. WISCV	-0.05*	--												
3. SDQ10	-0.23**	-0.24**	--											
4. LOC8	0.05*	-0.33**	0.16**	--										
5. HappyFE	-0.08**	-0.10**	0.10**	0.03	--									
6. HappyVE	0.08**	-0.20**	0.04*	0.12**	0.12**	--								
7. SadFE	-0.01	-0.13**	0.12**	0.09**	0.18**	0.15**	--							
8. SadVE	-0.09**	-0.08**	0.09**	0.03	0.13**	0.25**	0.20**	--						
9. AngryFE	-0.11**	-0.08**	0.14**	0.07**	0.15**	0.09**	0.22**	0.15**	--					
10. AngryVE	-0.01	-0.04	0.04*	0.06**	0.08**	0.45**	0.14**	0.36**	0.21**	--				
11. FearFE	0.00	-0.16**	0.11**	0.10**	0.08*	0.05*	0.19**	0.11**	0.26**	0.11**	--			
12. FearVE	-0.05*	-0.14**	0.07**	0.07**	0.04*	0.29**	0.10**	0.27**	0.19**	0.31**	0.20**	--		
13. TotalFE	-0.07**	-0.18**	0.18**	0.12**	0.40**	0.15**	0.58**	0.23**	0.73**	0.23**	0.71**	0.24**	--	
14. TotalVE	-0.03	-0.17**	0.09**	0.10**	0.14**	0.72**	0.22**	0.71**	0.22**	0.71**	0.16**	0.64**	0.30**	--

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
M	0.50	107.15	4.77	6.02	0.30	1.44	0.72	1.82	2.09	1.49	1.54	1.47	4.66	6.22
SD	0.50	16.66	5.267	2.05	0.63	1.15	0.94	1.23	1.36	0.82	1.37	0.93	2.77	2.89
Range	0 – 1	46-155	0 - 33	0 - 11	0 - 6	0 - 4	0 – 5	0 - 5	0 - 6	0 - 4	0 - 6	0 - 3	0 - 20	0 - 15

Note. Gender 0=male, 1=female; WISCV: WISC Verbal IQ, SDQ10: Age10 Teacher Ratings of Total Problems; LOC8: Age8 Locus of Control Summary Score (High = External); Age8 DANVA Variables: HappyFE (Faces) -- # Errors; HappyVE (Voices) -- # Errors; SadFE (Faces) -- # Errors; SadVE (Voices) -- # Errors; AngryFE (Faces) -- # Errors; AngryVE (Voices) -- # Errors; FearFE (Faces) -- # Errors; FearVE (Voices) -- # Errors; TotalFE (Faces) -- # Errors; TotalVE (Voices) -- # Errors

*p < .01. **p < .001.

Table 2

DANVA Misattributions of Emotions (Age8), Locus of Control (Age8), and Teacher Reported Problem Behaviors (Age10): Correlations and Descriptive Statistics (N = 2521)

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. Gender	--											
2. WISCV	-0.05*	--										
3. SDQ10	-0.23**	-0.24**	--									
4. LOC8	0.05*	-0.33**	0.16**	--								
5. HappyFM	0.004	-0.04*	0.09**	0.04*	--							
6. HappyVM	-0.09**	-0.08**	0.07**	0.05*	0.19**	--						
7. SadFM	-0.14**	-0.11**	0.14**	0.06*	0.14**	0.17**	--					
8. SadVM	0.01	-0.17**	0.08**	0.11**	0.04	0.02	0.16**	--				
9. AngryFM	0.01	-0.17**	0.08**	0.10**	0.07**	0.11**	0.19**	0.12**	--			
10. AngryVM	0.03	-0.08**	0.02	0.03	0.05*	0.18**	0.09**	0.19**	0.13**	--		
11. FearFM	-0.03	-0.14**	0.11**	0.10**	-0.04	0.02	0.05*	0.05*	0.23**	0.06*	--	
12. FearVM	0.00	0.05*	0.05*	0.05*	-0.00	0.01	0.03	0.03	0.10**	0.14**	0.24**	--
M	0.50	107.18	4.77	6.02	2.16	1.33	1.27	1.76	0.51	1.69	0.79	1.46
SD	0.50	16.67	5.27	2.05	1.36	1.29	1.34	1.22	0.94	1.37	1.08	1.20
Range	0 - 1	46-153	0 - 33	0 - 11	0 - 11	0 - 12	0 - 11	0 - 7	0 - 7	0 - 8	0 - 8	0 - 12

Note. Gender 0=male, 1=female; SDQ10: Age10 Teacher Ratings of Total Problems; LOC8: Age8 Locus of Control Summary Score (High = External); Age8 DANVA Variables: HappyFM (Faces) -- # Misattributions; HappyVM (Voices) -- # Misattributions; SadFM (Faces) -- # Misattributions; SadVM (Voices) -- # Misattributions; AngryFM (Faces) -- # Misattributions; AngryVM (Voices) -- # Misattributions; FearFM (Faces) -- # Misattributions; FearVM (Voices) -- # Misattributions

*p < .01. **p < .001.

Table 3

Predictors of Teacher Ratings of Total Difficulties at Age 10 - Emotion Recognition Errors

		DANVA Subsample (*n* = 2564)			
Model	R^2	b^a	*SE(HC)*	B^b	t^c
Happy	0.130				
Constant		11.649	0.967	_--	12.045***
WISC Verbal IQ		-0.068	0.007	-0.215	-9.559***
Gender		-2.552	0.199	-0.242	-12.849***
# DANVA Recognition Errors (Faces)		0.474	0.179	0.057	2.652**
# DANVA Recognition Errors (Voices)		-0.013	0.092	-0.003	-0.137
LOC Total Score		0.260	0.052	0.101	5.047***
Sad	0.134				
Constant		11.068	0.926	_--	11.594***
WISC Verbal IQ		-0.066	0.007	-0.209	-9.579***
Gender		-2.552	0.197	-0.242	-12.973
# DANVA Recognition Errors (Faces)		0.397	0.116	0.071	3.416***
# DANVA Recognition Errors (Voices)		0.160	0.084	0.037	1.910
LOC Total Score		0.249	0.051	0.097	4.874***
Angry	0.134				
Constant		11.019	0.928	_--	11.871***
WISC Verbal IQ		-0.068	0.007	-0.214	-9.812***
Gender		-2.499	0.197	-0.237	-12.691***
# DANVA Recognition Errors (Faces)		0.340	0.075	0.088	4.526***
# DANVA Recognition Errors (Voices)		0.034	0.127	0.005	0.266
LOC Total Score		0.248	0.052	0.096	4.818***
Fearful	0.131				
Constant		11.188	0.952	--	11.751***
WISC Verbal IQ		-0.066	0.007	-0.210	-9.530***
Gender		-2.592	0.196	-0.246	-13.204***
# DANVA Recognition Errors (Faces)		0.234	0.078	0.061	2.995*
# DANVA Recognition Errors (Voices)		0.079	0.104	0.014	0.759
LOC Total Score		0.250	0.051	0.097	4.867***
Total	0.140				
Constant		10.266	0.955	--	10.748***
WISC Verbal IQ		-0.063	0.007	-0.200	-9.200***
Gender		-2.498	0.196	-0.237	-12.714***
# DANVA Recognition Errors (Faces)		0.220	0.040	0.116	5.504***
# DANVA Recognition Errors (Voices)		0.014	0.036	0.008	0.381
LOC Total Score		0.237	0.051	0.092	4.633***

*$p < .05$. **$p < .01$. *** $p < .001$.

[a] unstandardized regression coefficient; [b] standardized regression coefficient; [c] *df* = 2558

Note: Predictors are measured at age 8. All analyses used heteroscedasticity consistent standard errors

Table 4

Predictors of Teacher Ratings of Total Difficulties at Age 10 - Misattribution Errors

		DANVA Subsample (*n* = 2521)			
Model	R^2	b^a	*SE(HC)*	B^b	t^c
Happy	0.134				
Constant		11.414	0.944	--	12.095***
WISC Verbal IQ		-0.070	0.007	-0.222	-10.032***
Gender		-2.596	0.198	-0.247	-13.093***
# DANVA Misattribution Errors (Faces)		0.286	0.075	0.074	3.839***
# DANVA Misattribution Errors (Voices)		0.040	0.083	0.010	0.484
LOC Total Score		0.251	0.052	0.097	4.845***
Sad	0.135				
Constant		11.251	0.954	--	11.795***
WISC Verbal IQ		-0.068	0.007	-0.214	-9.662***
Gender		-2.488	0.199	-0.236	-12.516***
# DANVA Misattribution Errors (Faces)		0.306	0.083	0.078	6.714***
# DANVA Misattribution Errors (Voices)		0.080	0.084	0.019	0.952
LOC Total Score		0.248	0.052	0.096	4.770***
Angry	0.130				
Constant		11.884	0.962	--	12.358***
WISC Verbal IQ		-0.069	0.007	-0.219	-9.768***
Gender		-2.604	0.197	-0.247	-13.196***
# DANVA Misattribution Errors (Faces)		0.212	0.122	-0.038	1.734
# DANVA Misattribution Errors (Voices)		-0.004	0.074	-0.001	-0.058
LOC Total Score		0.252	0.052	0.098	4.876***
Fearful	0.132				
Constant		11.608	0.953	--	12.182***
WISC Verbal IQ		-0.069	0.007	-0.217	-9.712***
Gender		-2.581	0.198	-0.245	-13.067***
# DANVA Misattribution Errors (Faces)		0.276	0.103	0.057	2.675**
# DANVA Misattribution Errors (Voices)		0.092	0.095	0.021	0.974
LOC Total Score		0.245	0.051	0.095	4.770***

**p* < .05. ***p* < .01. ****p* < .001.

[a] unstandardized regression coefficient; [b] standardized regression coefficient; [c] *df* = 2515

Note: Predictors are measured at age 8. All analyses used heteroscedasticity consistent standard errors