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Exploring Links between Neuroticism and Psychoticism Personality Traits, Attentional Biases to Threat and Friendship Quality in 9-11-year-olds

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Abstract

The current study used an eye-movement Remote Distractor Paradigm (RDP) to explore attention to threat and considered associations with personality traits (neuroticism and psychoticism) and self-reported friendship quality in children aged 9-11 years. The RDP asked children to look at and identify a target presented on a computer display in the presence or absence of a central, parafoveal or peripheral visual distractor (an angry, happy or neutral face). The results showed that symptoms of neuroticism were associated with hypervigilance for threat (i.e., slower latencies to initiate eye movements to the target in the presence of angry versus happy or neutral faces). In addition, when distractors were presented centrally, this relationship was most evident in children who reported lower levels of attentional control. Psychoticism traits were associated with increased selective attention to all distractors (as measured by directional errors to face stimuli) and to child reported lower friendship quality. Moreover, the negative relationship between psychoticism and friendship characteristics associated with companionship was mediated via attentional capture of threat (i.e., a greater proportion of directional errors to angry distractors). The findings have potential to inform the development of translational research, to reduce symptoms of psychopathology and address attentional biases to threat with an aim to improve peer relationships in late childhood.

Keywords: anxiety; personality; attention biases; friendship quality

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Introduction

Neuroticism is a personality dimension associated with individuals who experience increased levels of negative emotion and sensitivity to environmental stress. In Eysenck's (1982) formulation of personality neuroticism sits alongside psychoticism (which describes individuals with low levels of empathy and altruism and increased aggression) and extraversion (associated with traits reflecting friendliness and warmth). Neuroticism is associated with an early emerging behaviourally inhibited temperament that similarly reflects characteristics associated with increased negative arousal and fearfulness in the context of novelty and uncertainty (Kagan & Fox, 2006; Rettew, 2008), in addition to low levels of effortful control (a reduced ability to focus attention to complete tasks and increased distractibility; Rothbart, 2011). Behavioural Inhibition (BI) and neuroticism are both recognised to be risk factors for the development of anxiety in childhood and adolescence (Lonigan, Phillips, Wilson & Allan, 2011). In support, measures of these constructs were elevated in children and adolescents diagnosed with an anxiety disorder, compared to non-anxious children (Vreeke & Muris, 2012) and increased neuroticism was found to predict the development of anxiety over time in adolescents (O'Leary-Barrett et al., 2015). While increased neuroticism traits have been found to place individuals at risk for the development of anxiety (Lonigan et al., 2011, Paulus, Vanwoerden, Norton & Sharp, 2016), psychoticism traits have been associated with the emergence of externalizing behaviours (e.g., elevated symptoms of aggression, arguing, school absence; Center, Jackson & Kemp, 2005).

Several indices of social competence have been linked to children who show increased negative affect (i.e., neuroticism and associated internalising traits), including fewer reciprocal friendships and reports of reduced opportunities to receive help and guidance from friends (Erath, Flanagan, & Bierman, 2007; Fanti, Brookmeyer, Henrich & Kuperrminc, 2009). Negative affect has also been related to elevated levels of social wariness (Schneider, 1999) and hypersensitivity to peer rejection (Kujawa, Arfer, Klein & Proudfit, 2014) as well as to increased social inhibition across development (Asendorpf, van Aken, 2003). Consistently, extreme levels of inhibited behaviour early in childhood were found to predict a distinct developmental pathway leading to delays in forming romantic relationships and partnerships in emerging adulthood (Asendorpf, Denissen & van Aken 2008). Similarly, increased aggression associated with psychoticism traits and externalising behaviors have been related to social adjustment difficulties in development, such as increased levels of bullying (Farmer et al., 2015), peer rejection, isolation and loneliness, and later in life, with violence and adult crime (review by Liu, 2004). The association between vulnerable personality traits and developmental psychopathology with social adjustment in childhood and adolescence is likely to be reciprocal. Cascade models have shown, for example, that young children who fail to develop social skills are at risk for the development of internalising and externalising behaviour later in development (Bornstein, Hahn & Haynes, 2010).

Stemming from cognitive models of anxiety (e.g., Eysenck et al., 2007; Eysenck & Derakshan, 2011), researchers working with child and adult populations have found associations between self-reported negative affect (i.e., linked to neuroticism or anxiety) with attentional control, including increased selective attention to environmental threat (Paelecke1, Paelecke-Habermann & and Borkenau, 2012; see review by Dudeney, Sharpe, & Hunt, 2015). Extending this research Rueda, Checa and Rothbart (2010) proposed a theoretical framework which suggests that temperamental traits characterised by negative affect and poor regulation of attentional networks impact social adjustment across development. In support, Simonds and colleagues found that children aged 7 - 10 years of age who showed increased attentional control to inhibit irrelevant information in order to complete a computer task were also able to more effectively mask feelings of disappointment when they were given a gift they had previously rated as one they would like least from the choice available (Simonds, Kieras, Rueda & Rothbart, 2007). Checa, Rodriguez-Bailon and Reuda (2008) also found that effortful control mediated a positive association between social status in school (i.e., positive responses from peers to questions about whether they were a nice classmate and paid attention/ listened to others) with achievement. With respect to attention to threat, Pérez-Edgar et al., (2010, 2011) found that the presence of BI early in development was related to later social withdrawal at 5 years of age and with parent reported social isolation in adolescence (these associations were most evident for individuals who showed an attentional bias towards threatening stimuli). Related research suggests that increased attentional control in childhood and adolescence (Lonigan & Vasey, 2009; Susa, Pitica, Benga, and Miclea, 2012), as well as in adulthood (Derryberry and Reed, 2002), works to minimise the interference of threat stimuli on achieving task goals.

Dodge (2006) similarly developed a psychological model that aimed to understand the emergence of aggression in children and adolescents via the development of selective attention biases to environmental threat. This model builds on early research which has shown that a predisposition to interpret ambiguous or benign social situations as hostile is associated with increased aggression early in development (Gouze, 1987) and predicts aggressive behaviours over time (e.g., Dodge, Pettit & Valente, 1995). Dodge (2006) suggested that the emergence of biases are underpinned by personality traits, and develop via socialisation processes (see Piekarska, 2012 for support).

A recent theoretical framework utilized eye movement methodology to build on early models of anxiety (e.g., Eysenck, 1987) that differentiate selective attention processes towards threat (i.e., the notion of attentional capture), from hypervigilance (i.e., a broadening of attention that facilitates its detection (Richards, Benson, Donnelly & Hadwin, 2014). Richards, Benson and Hadwin (2012) used the remote distractor paradigm (RDP) to explore selective attention and hypervigilance for threat with self-reported trait anxiety in adults. The task allows some consideration of the impact of irrelevant distractors presented in central, parafoveal or peripheral vision, on the task goal to identify the shape of a target stimulus (i.e., the remote distractor effect; see e.g., Benson, 2008). On some experimental trials targets were presented alongside a threatening (angry face) or non-threatening (neutral or happy face) distractor stimulus presented centrally or in the contralateral hemifield opposite to the target. The results showed that symptoms of anxiety were linked to increased latencies to initiate a first saccade towards a target in the presence of angry (but not happy or neutral) distractor faces located in all regions of the visual field. They also highlighted that anxiety was not associated with erroneous eye movements towards threat distractors. The authors concluded that elevated anxious affect interferes with task goals via the covert processing of parafoveal and peripheral information, and with difficulties disengaging attention from centrally presented threat stimuli.

The current study utilised the RDP to consider attentional control and threat processing in children aged 9-11 years with individual difference measures recognised to place children at risk for anxiety (Lonigan et al., 2011); i.e. neuroticism and psychoticism personality traits. In late childhood there is an increase in the onset of anxiety disorders (review by Beesdo, Knappe & Pine, 2009), therefore, the identification of vulnerability factors for anxiety onset is critical for this age group. Following Richards et al., (2012), we anticipated that hypervigilance for threat (as reflected in delayed saccade latencies towards the target in the presence of angry faces) would be associated with childhood neuroticism. In line with previous research, we further expected that increased psychoticism traits would be linked to a selective attention bias for threat i.e., directional errors towards angry faces (review by Dodge, 2006). The study extended current research to explore the potential of a moderating role of attentional control in understanding the emergence of cognitive biases in development, linked to neuroticism (see e.g., Susa et al., 2012). In addition, we considered the relationship between personality traits and friendship quality (Fanti et al., 2009) and investigated the proposition that attentional processes are important in understanding any such associations (e.g., Pérez-Edgar et al., 2010; 2011).

Method

Participants

We invited 55 children to take part in the study and obtained parental consent for *N* = 42 (75%; mean age = 10.40 years, SD = .54, age range = 9-11 years; 25 male). Children provided their written assent to take part in the study on the day of testing. Participants were given a £5 voucher for their participation on the completion of the study. Ethical permission for the study was obtained from the Psychology Ethics' Committee and University Research Governance.

Stimuli and apparatus

Participants completed three experimental blocks each with 144 trials; one for each facial expression (angry, happy, neutral)[1]. Each block included 48 single target trials (used as a measure of baseline performance) and 96 emotion face distractor trials with distractors presented in central parafoveal or peripheral locations. On each experimental trial we asked participants to identify a target stimulus, a white diamond or square. The size of the target stimuli was 59 x 59 pixels (1.5° x 1.5° of visual angle) at a viewing distance of 70 cm. In the single-target trials, the target appeared in a parafoveal (4° eccentricity) or peripheral (8° eccentricity) location on the right or left of central fixation with equal frequency. In trials containing parafoveal or peripheral distractors the targets appeared in the mirror position of the distractor. If a distractor was presented in the center, then the target appeared either in a parafoveal or peripheral position.

Sixteen models (8 males and 8 females) from the NimStim face set (Tottenham et al., 2009) were used as distractor stimuli and these included emotional (angry and happy) and non-emotional (neutral) faces. Four additional models were used for practice trials. Faces were 165 x 256 pixels in size or 4.2° horizontally and 6.5° vertically at 70 cm viewing distance. Response buttons and experimental blocks were counterbalanced. Stimuli were presented on a black background. We used the Eyelink 1000 (1000 samples per second) Desk Mounted eye-tracking system (SR Research Ltd.) to record participants' right-eye vertical and horizontal eye-movements.

Materials[2]

Neuroticism and Psychoticism.

These two personality traits were measured with the Junior Eysenck Personality Inventory (Eysenck, & Eysenck, 1975) which consists of 81 items. For each item children are asked to respond yes or no depending on whether they think the item describes them. In the current study we used the neuroticism (n = 20 items, total score 0-20, e.g., "Do you worry about awful things that might happen?", "Do you find it hard to sleep at night because you are worrying about things?") and psychoticism (n = 14 items, score range = 0-14, e.g., "Do you seem to get into a lot of fights?", "Are you in more trouble at school than most children?") subscales. Twenty four percent of the sample reported levels of neuroticism and psychoticism that were above published norms (Eysenck, & Eysenck, 1975). Previous research has found that the scale has good reliability and validity (e.g., Scholte & De Bruyn, 2001). In the current study α = .80 and α = .60 for the neuroticism and psychoticism scales respectively[3].

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[1] A fourth experimental block used white circles as distractor stimuli; this data is not reported in the current paper.

[2] Participants also completed measures of state and trait anxiety; these data are not reported in the current paper.

[3] Note that reliability for the Psychoticism scale is low, but for this age range the score is comparable with the internal consistency as reported in the original reports of its psychometric properties (αs = .65, .73 and .65 for 9-, 10-, and 11-year-olds; see Eysenck & Eysenck, 1975.)

Attentional control.

We assessed attentional control with the child version of the Attentional Control Scale (ACS; Derryberry & Reed, 2002). The scale consists of 20 items to assess children's ability to focus and switch attention. For each item participants are asked to judge whether they "almost never" (score 1), "sometimes", "often" or "always" (score 4) show a particular behaviour, making a possible score range from 20 to 80, where higher scores indicate poorer attentional control. Previous research has found that the ACS-C is reliable and valid (e.g., e.g., Muris, 2006; and α = .85 in the current study).

Friendship quality.

We assessed quality of friendships with the Friendship Quality Scale (FQS, Bukowski, Hoza & Boivin, 1991. This scale consists of 23 items and for each children are asked to indicate "strongly agree" (score = 1), "agree", "neither agree nor disagree", "disagree" or strongly disagree (score = 5). The original scale is made up five subscales reflecting companionship (4 items), help (5 items), closeness (5 items), security (5 items) and conflict (4 items). The total score range on this questionnaire is 23 to 115 and higher scores indicate poorer quality friendships. While the current study focused on the total score, exploratory analysis also considered associations between the subscale scores with key variables. Previous research has reported good psychometric properties for the FQS (Bukowski et al., 1991; and α = .79 in the current paper).

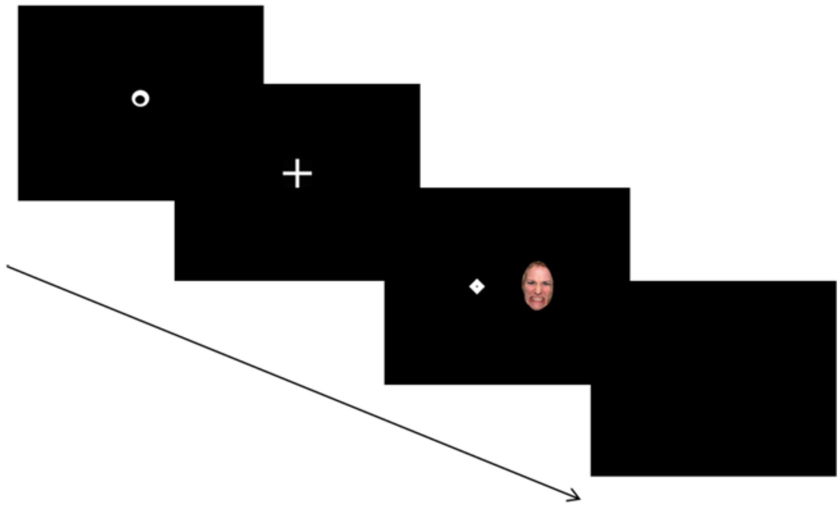

Figure 1: An example of trial sequence in the Remote Distractor Paradigm (RDP) showing an angry distractor face and where the target and distractor is presented in the parafovea.

Procedure

The aim of the study was explained to each child prior to completing the eye movement task, and children were given the opportunity to ask questions before signing an assent form. The task response and equipment use was explained to each child before starting the eye movement recording. A nine-point-calibration routine was performed prior to each experimental block to measure the position of the eye at different locations on the display screen, and a small one-point-calibration was used between trials within each block to correct for drifts before each trial. Each trial began with a centrally-located fixation cross, presented on a black background, which participants had to fixate. The fixation cross was presented for a minimum duration of 1000 milliseconds (ms) and participants had to look within 1.5 degrees of the centre of the fixation cross for at least 200ms. The fixation cross was then replaced with a trial display that contained either a single target or a target and a distractor. The trial display was presented for 1500 ms or until a key-press response was made (see Figure 1). Participants were instructed to direct their eyes towards and identify a target (a square or a diamond) as quickly and accurately as possible. The questionnaire measures were completed in groups of four children within a week following completion of the eye-tracking task.

Data Analysis

The eye movement measures of interest were the percentage of directional errors (i.e. first saccades towards the distractor of any type or eccentricity with an amplitude greater than 2°) and the latency of accurate first saccades (i.e. first saccades directed towards the target with an amplitude greater than 2°). Data Viewer software was used to inspect and organise the behavioural and eye movement data. Trials were excluded from the eye movement analysis if (1) the fixation point at the beginning of the trial was greater than 1° away from the center of the screen (3%) (2) a blink occurred (4%) (3) an anticipatory eye movement was executed (i.e. first saccades with latencies less than 80 ms; Wenban-Smith & Findlay, 1991) (1%) (4) the latency of the first saccade was greater or lower than 3 standard deviations away from the participant's mean first saccade latency (2%) (4) an incorrect button press response was made (18%). First saccades with amplitude less than 1º were replaced with second saccades (5%). For the RT analysis trials were excluded from the analysis if (1) RTs were greater or lower than 3 standard deviations away from the participant's mean total RT (3%) or (2) an incorrect button press response was made (13%)

Data analysis considered the basic effects related to the RDP (i.e., time taken to make an eye movement to the target in distractor versus single target trials). Repeated measures ANOVAs were conducted to assess the effects of distractor condition (i.e. present or absent), distractor type (i.e. angry, happy and neutral faces) and distractor eccentricity (central, parafoveal, peripheral) on behavioural reaction time (RT) and eye movement measures across participants. Correlations and regression analysis considered links between individual difference measures (i.e. neuroticism, psychoticism, and attentional control) with eye movement measures and friendship quality. The eye movement measures were initially collapsed across eccentricities for each distractor condition separately and any significant findings were followed up with further analyses to see whether effects were evident across the different eccentricities. Models were tested to explore whether any positive association between neuroticism and task performance was moderated by attentional control. In addition, mediation analysis aimed to test the proposition that temperamental risk was related to poor quality friendships and indices of attentional processing of threat. Moderating and mediating effects were tested using a process that applies bootstrapping techniques (Hayes, 2013).

Results

Eye movement measures

Saccade latencies and the remote distractor effect (RDE).

For each distractor condition and eccentricity the latencies of first saccades to the target in the distractor trials were compared with the saccade latencies towards the target in the single-target trials from the same experimental block (e.g. angry central distractor trials were compared with single target trials embedded within the angry block etc.). First saccade latencies were found to be shorter in the single-target trials compared with the distractor trials (i.e. a remote distractor effect occurred; see Walker, Kentridge, & Findlay, 1995), and this was evident across all distractor conditions and eccentricities (all *t*s > 8, all *p*s < .001). Thus, first saccade latencies to the target were delayed by the presence of distractors regardless as to whether the distractor was located in the central, parafoveal or peripheral vision[4].

Saccade latencies to the target.

A repeated measures ANOVA for 3 distractor expression (angry, happy, neutral) x 3 distractor eccentricity (central, parafoveal, peripheral) was conducted on the latency of accurate first saccades to the target (means for each emotion

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[4] A one-way ANOVA (with single target trials only) was also conducted to assess whether any distractor effects were carried over in the single-target trials embedded within each experimental block. The results revealed that first saccade latencies to the target did not differ significantly between the single-target trials in each experimental block (Angry M = 161.17 ms, SD = 24.84 ; Happy M = 166.75 ms, SD = 29.88 ; Neutral M = 168.51, SD = 32.10).

and eccentricity are shown in Table 1). The results revealed a significant main effect of eccentricity (F (2, 66) = 18.92, η_p^2 = .36, p < .001). Pairwise comparisons showed that first saccade latencies to the target were significantly longer in central distractor trials (M = 232.14 ms*,* SD = 32.36) compared with parafoveal distractor trials (M = 220.91 ms*,* SD = 31.02) and peripheral distractor trials (M = 214.93 *ms,* SD = 28.92), suggesting that distractors located in foveal vision interfered more with performance, compared with distractors located in peripheral regions of the visual field. In addition, saccade latencies to the target were significantly longer in parafoveal trials compared to peripheral distractor trials. The main effect of emotion and the interaction between emotion and eccentricity was not significant (*F*s < 2 and *p*s > .1).

Table 1: Mean reaction times (RTs) (SD) and saccade onset latencies (milliseconds) to identify target stimuli and proportion of directional errors to distractor stimuli to the target stimuli with angry, happy and neutral face distractors and where the target was presented centrally (0o), or in the parafovea, (4o) or periphery (8o).

Dependent variables	**Angry**			**Happy**			**Neutral**		
	0°	**4°**	**8°**	**0°**	**4°**	**8°**	**0°**	**4°**	**8°**
Saccade onset	239.19	221.36	214.72	233.65	223.31	217.84	226.57	218.33	212.77
(N = 34)	(34.19)	(33.82)	(29.14)	(42.31)	(36.78)	(37.01)	(32.74)	(31.37)	(29.77)
Errors	N/A	30.65	39.54	N/A	25.37	34.46	N/A	21.80	32.36
(N = 37)		(21.55)	(23.20)		(20.58)	(21.46)		(19.88)	(22.03)
	878.04	880.21	915.64	855.88	833.66	866.07	841.27	825.76	846.49
RTs	(192.07)	(205.32)	(184.13)	(180.59)	(176.07)	(191.37)	(173.27)	(159.55)	(154.58)
(N = 40)									

Note. Directional errors to faces are not relevant to experimental conditions where the distractor is presented centrally.

Directional errors.

The mean proportion of directional errors made to the distractor stimuli for each emotion and in each eccentricity (parafoveal and peripheral) is shown in Table 1. Consideration of the data distribution revealed that that error rates were negatively skewed in all distractor conditions, therefore non-parametric tests were used to assess whether distractor type and eccentricity influenced directional error rates. The Wilcoxon signed ranks test showed significant error rate differences between the parafoveal and the peripheral distractor trials in all distractor conditions (in parafoveal angry, happy and neutral trials Mdns were 27.59%, 19.35% and 17.24% respectively; and in peripheral angry, happy and neutral Mdns were 40%, 31.25% and 32.26%). A Friedman's ANOVA was used to assess whether the emotion of the face distractor (angry, happy or neutral face) influenced directional error rates (for parafoveal and peripheral trials separately).

The results revealed that error rates differed significantly between distractor conditions in parafoveal distractor trials (χ^2 (2) = 33.24, p < .001) and peripheral distractor trials (χ^2 (2) = 20.30, p < .001). In parafoveal trials, non-parametric post-hoc tests showed that the error rate was significantly greater in angry distractor trials compared with neutral distractor trials (χ^2 (2) = 4.57, p = .03). Differences in error rates for angry versus happy and happy versus neutral distractor trials were not significant (χ^2 (2) < 3, *ps* > .05). In peripheral trials, the error rate was marginally significantly higher in the angry distractor condition compared with the happy distractor condition (χ^2 (2) = 3.67, p = .05) and the neutral distractor condition (χ^2 (2) = 4.00, p = .05). The difference between the error rate for the happy versus the neutral distractor condition was not significant (χ^2 (2) = .26, p = .61).

Reaction time data.

A repeated measures ANOVA was conducted to explore whether distractor emotion or eccentricity influenced the total time taken to identify the target, and the results showed a main effect of eccentricity (F (2, 80) = 9.98, p < .001). Pairwise comparisons showed that RTs were significantly longer in peripheral distractor trials (M = 876.18 ms, SD = 159.95) compared with parafoveal distractor trials (M = 848.26 ms, SD = 162.16). In addition, RTs were marginally significantly longer in central distractor trials (M = 859.21 ms, SD = 162.16) compared with parafoveal distractor trials.

The main effect of emotion and the interaction between emotion and eccentricity were not significant ($F < 1.5$, *ns*. See Table 1).

Table 2: Descriptive statistics (mean, standard deviation, range) for neuroticism and psychoticism personality traits, attentional control and friendship quality and correlations between these mesures with global eye movement measurements (directional errors to distractor faces and saccade onset latencies to targets) collapsed across distractor condition.

	Descriptive statistics			Directional errors			Saccade onset latency		
Questionnaire measures	**Mean (SD)**		**Range**	**Angry**	**Happy**	**Neutral**	**Angry**	**Happy**	**Neutral**
Neuroticism	9.57	(5.12)	1-20	.11	.06	.00.	.62**	.27	.36*
Psychoticism	3.15	(2.26)	0-8	.34*	.39*	.40*	-.03	-.01	.11
Attentional Control	50.76	(4.22)	42-59	.37*	.18	.22	.018	.052	.012
Friendship Quality	45.37	(9.36)	28-97	.39*	.24	.23	-.09	-.01	.09

Note. Directional errors are collapsed across parafoveal and peripheral distractor conditions and saccade onset latency is collapsed across centrally presented, parafoveal and peripheral distractor conditions.

Task performance and individual differences[5]

Saccade onset latencies. The mean score (and SD) for each questionnaire measure is shown in Table 2. Table 2 also shows correlations between each questionnaire with both of the key eye movement measures (directional errors and saccade onset latencies for angry, happy and neutral distractors). It highlights that self-reported symptoms of neuroticism were positively associated with saccade onset latencies for angry and neutral faces and this association was significant at all distractor eccentricities. We further considered whether the relationship between neuroticism and saccade onset to angry faces (for four models collapsed across distractor location and for each location separately) was moderated via attentional control (complete data was available for N = 33 participants).

The models that explored the moderating effect of attentional control on the relationship between neuroticism traits and increased saccade onset latencies to the target showed non-significant interaction effects for parafoveal and peripheral distractor locations, as well as for all locations combined (in all cases $p > .1$). The interaction effect between neuroticism and attentional control for centrally presented angry faces was marginally significant ($b = .65$, 95% CI [-.012 – 1.31], t = 2.00, $p = .054$). Because of this borderline effect and the theoretical significance of this result we examined simple slopes. This analysis highlighted that at lower levels of attentional control, there was a significant positive association between saccade onset latencies with neuroticism ($b = 3.28$, 95% CI [0.734 – 5.82], t = 2.63, $p = .013$ and $b = 6.09$, 95% CI [1.91 – 10.28], t = 2.97, $p = .006$). In contrast the model for this relationship when attentional control was high was not significant ($t < 1$ and $p > .1$); see Figure 2. This analysis provides preliminary evidence for a moderating role of attentional control in understanding associations between anxiety related personality traits and difficulties disengaging from threat stimuli to meet task goals.

Directional errors. With respect to directional errors, Table 2 shows that the personality trait psychoticism was positively associated with directional errors to all face distractor stimuli. In addition, the table highlights that directional errors to angry faces was associated with reports of lower quality friendships. Further analysis showed that psychoticism was also significantly associated with lower quality friendships ($r = .47$, $p < .01$). Moreover, the

[5] Reaction time data was not significantly associated with any individual difference measure (in all cases p >.1) and is therefore not reported further in this section.

relationship between psychoticism traits and friendship was evident for the help, security and conflict subscales (*r*s > .35, *p*s < .05) and was marginally linked to companionship (*r* = .28, p = .08) (closeness ns). Similarly, directional errors to angry faces was linked to the companionship and security subscales (*r*s > .3 and *p*s <.05).

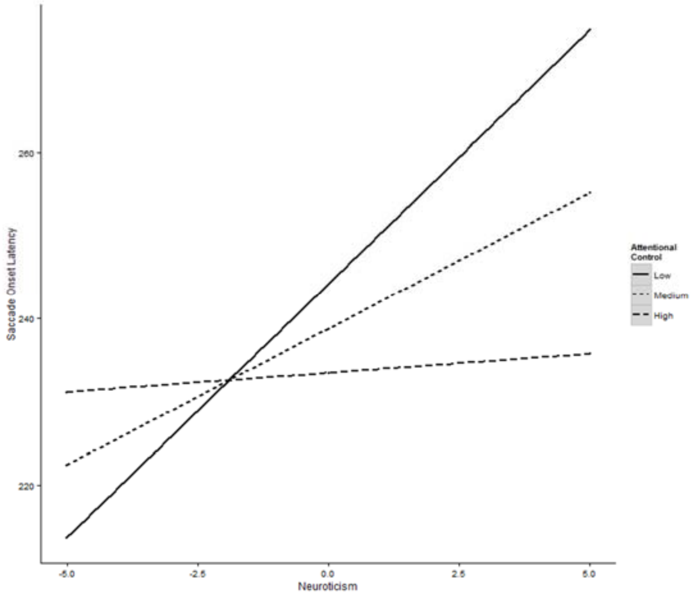

Figure 2: The moderating effect of attentional control (high, medium and low) on the relationship between neuroticism traits and saccade onset latency to the targets presented in the parafoveal or peripheral vision in the context of centrally presented angry faces.

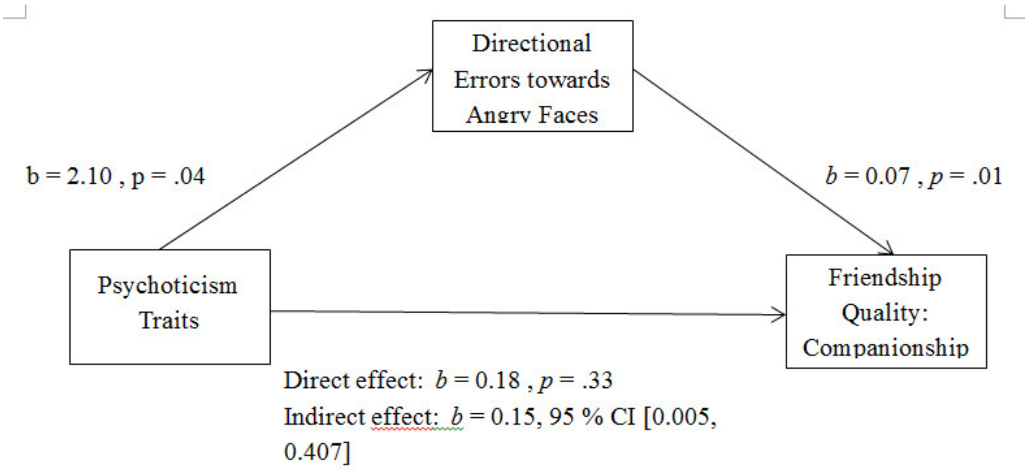

Figure 3: Mediation model demonstrating links between psychoticism personality traits and friendship quality (companionship) via directional errors towards angry faces.

Friendship quality was associated with both directional errors to angry faces and to psychoticism traits (to poorer quality friendship, as well as to subscales linked to companionship and security), we therefore tested the possibility across three models that selective attention to threat mediated the association between personality and friendship quality (for total scores, as well as those associated with companionship and security). In all models friendship quality was entered as the outcome variable. Considering the indirect effect of psychoticism on friendship quality (via directional errors), the analysis showed a significant effect only for the companionship subscale (b = .15, CI [.004 - .484]; see Figure 3. This analysis highlighted that the association between self-reported psychoticism traits and lower levels of companionship was mediated via directional errors to angry faces presented in parafoveal and peripheral vision in the RDP task.

Discussion

The current study utilised the RDP and threat and non-threat distractor stimuli to explore the relationship between attentional processes and friendship quality with individual differences in neuroticism and psychoticism personality traits. The results showed basic RDP effects in children aged 9-11 years, and further indicated that angry faces presented in peripheral vision increased directional errors to these stimuli and reaction times to make decisions about the target identity. With respect to individual differences, increased neuroticism traits were linked to hypervigilance for threat; children showed a delay in making a saccade to move their eyes towards a target stimulus in the presence of angry faces and across all distractor eccentricities. In addition, this association was most evident for children with low levels of attentional control (children's self-reported ability to focus and shift attention between tasks) in trials that required the disengagement of attention from centrally presented angry faces towards the target. The results also showed that psychoticism traits were positively linked to distractibility; more eye movements towards emotional and non-emotional face distractors. Furthermore, psychoticism (and not neuroticism) traits were associated with self-reported poor quality friendships, reflecting increased conflict and lower levels of feeling secure, and being able to rely on friends for help and companionship (see Bukowski et al., 1991). Moreover, the negative association between psychoticism and companionship was mediated by increased selective attention (i.e., directional errors) to threat stimuli.

These results are consistent with previous findings with adults which highlight that eye movement methods reliably identify associations between individual differences and cognitive processes in childhood (Richards et al., 2012). They replicate Richards et al.'s findings that anxious affect is linked to hypervigilance for threat (see Eysenck, 1982) and extend these findings to show that disengaging from centrally presented threat is most difficult for children who reported increased neuroticism symptoms and low levels of attention control. The results fit with a growing body of research with children and adolescents which has found that elevated trait and clinical levels of anxiety have been linked to attentional biases towards threat stimuli that interferes with task relevant goals (Hadwin, Donnelly, Richards, French & Patel, 2009; Waters, Mogg, Bradley & Pine, 2008; review by Dudeney et al., 2015).

Difficulties disengaging attention from angry faces in children who reported increased neuroticism traits links to anxiety research with adults who show similar difficulties in shifting attention away from threat (e.g., Fox, Russo, Bowles, & Dutton, 2001; Reinholdt-Dunne et al., 2012). The current study extends this evidence base to highlight that difficulties disengaging attention from threat stimuli was only evident for children who also reported lower levels of attentional control. Attentional control has been shown to moderate associations between anxiety and threat processing in previous studies (Lonigan & Vasey, 2009; Susa et al., 2012). This finding is important in the development of translational research that aims to impact poor developmental outcome in children with elevated anxious affect. It suggests that interventions that focus on improving attentional control could attenuate the impact of threat processing on individuals' abilities to meet task goals (see Hadwin & Richards, 2016).

The broadening of attention for the detection of threat was specific in the current study to neuroticism traits. Self-reported psychoticism traits were unrelated to delays in making a saccade towards the target; however, they were positively linked to directional errors to distractors across all emotional stimuli and in parafoveal and peripheral vision, suggesting a general difficulty in supressing exogenous (reflexive) saccades towards both threatening and non-threatening face distractors. The study further showed that psychoticism traits were associated with poor quality friendships and that directional errors to threat stimuli were important in understanding this association. Early research using models of social information processing have found biases to hostile social cues in children with aggressive and conduct problems (e.g., Cadesky, Mota & Schachar, 2000) and have argued that this processing style underpins increased aggression across development (Dodge, 2006). In support, the current study highlighted that selective attention to angry faces was important in understanding links between psychoticism traits and poor quality friendships as reflected in lowered reports of companionship (e.g., spending time with friends in their spare time). The results fit with previous research which has found that attentional biases to threat are linked to difficulties with social interaction over time (Pérez-Edgar et al., 2010). The findings are also consistent with theoretical frameworks that focus on attentional processes to understand academic and social outcomes in children and adolescents (Rueda et al., 2010). One implication of the findings is that children who show early emerging psychoticism traits and attentional biases to threat are at increased risk of having fewer opportunities for social development with peers. In practical terms the findings highlight that children might benefit from attention bias modification interventions to improve peer relationships that focus on training attention away from angry/ hostile cues (review by Lowther & Newman 2014).

In summary, the results from the current study indicate differential attentional processes in late childhood for self-reported neuroticism and psychoticism personality traits, that have important implications for the development of prevention and intervention methods in development and psychopathology. Hypervigilance for threat in neuroticism and the moderating effect of attentional control to shift attention away from threat suggest that young people with elevated anxious affect might benefit from attentional training to allow them to effectively meet task goals. In contrast, the significance of selective attention to threat in children with elevated self-reported psychoticism traits in understanding lower quality friendships indicates that interventions aimed to attenuate attentional capture may be important in the development of effective peer relationships. Future research should aim to replicate to increase an understanding of the impact of attention on the emergence of internalising and externalising symptoms over time.

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