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Published in:
Cognition & Emotion

DOI:
10.1080/02699931.2017.1304359

COGNITION AND EMOTION
2018, VOL. 32, NO. 7, 1478–1486
https://doi.org/10.1080/02699931.2017.1304359

Biases in attention and interpretation in adolescents with varying levels of anxiety and depression

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ABSTRACT
This is the first study to investigate multiple cognitive biases in adolescence simultaneously, to examine whether anxiety and depression are associated with biases in attention and interpretation, and whether these biases are able to predict unique variance in self-reported levels of anxiety and depression. A total of 681 adolescents performed a Dot Probe Task (DPT), an Emotional Visual Search Task (EVST), and an Interpretation Recognition Task. Attention and interpretation biases were significantly correlated with anxiety. Mixed results were reported with regard to depression: evidence was found for an interpretation bias, and for an attention bias as measured with the EVST but not with the DPT. Furthermore, interpretation and attention biases predicted unique variance in anxiety and depression scores. These results indicate that attention and interpretation biases are unique processes in anxiety and depression. They also suggest that anxiety and depression are partly based on similar underlying cognitive mechanisms.

ARTICLE HISTORY
Received 29 April 2016
Revised 15 November 2016
Accepted 27 February 2017

KEYWORDS
Attention bias; interpretation bias; anxiety; depression; adolescence

Cognitive theories of anxiety and depression emphasise the importance of cognitive processes in the onset and maintenance of anxiety and depression disorders. According to these theories, anxious and depressed individuals have anxiety or depression-related schemata that direct processing resources towards threat-relevant or negative information, resulting in cognitive biases in attention, interpretation, and memory (e.g. anxiety: Williams, Watts, MacLeod, & Mathews, 1997; depression: Beck, 1976). There are indeed numerous studies that support the existence of biases in attention and interpretation in childhood and adolescent anxiety and depression (for overviews see Muris, 2010; Nightingale, Field, & Kindt, 2010; Platt, Waters, Schulte-Koerne, Engelmann, & Salemink, 2016).

Up to now, most studies have examined these biases in isolation. This is unfortunate, as some theoretical models suggest that these biases may also influence each other in the development and maintenance of anxiety and depression (e.g. Everaert, Koster, & Derakshan, 2012; Hirsch, Clark, & Mathews, 2006; Muris & Field, 2008). Furthermore, by studying biases in isolation, we cannot assess whether the different cognitive biases predict unique variance in anxiety and depression scores. There is some evidence in adults with varying levels of anxiety and subclinical depression that different biases measure separate aspects of anxiety and depression (e.g. Everaert, Duyck, & Koster, 2014; Van Bockstaele et al., 2011). For example, Van Bockstaele et al. (2011) studied adults with varying levels of spider fear, and found that higher levels of attention bias, more difficulties to disengage attention away from spiders and more negative associations towards spiders independently predicted increase in heart rate in response to the presentation of a spider. Everaert et al. (2014) studied multiple cognitive biases in adult subclinical depression and found that attention bias during a scrambled-sentences task predicted interpretation bias in the task, and later memory bias for the meaning of the sentences. There is also some

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evidence in pre-adolescent children that different cognitive biases independently predict unique variance in anxiety scores in unselected and non-clinical samples (Klein et al., 2012, 2014; Watts & Weems, 2006). For example, Klein et al. (2014) found that measures of interpretation and memory biases predicted unique variance components of spider fear in children with varying levels of spider fear aged between 7 and 13. In sum, there is some evidence in adult anxiety and depression and in pre-adolescent anxiety that different cognitive biases are able to predict unique variance in anxiety and depression scores. However, the evidence is scarce and none of the studies included adolescents.

Furthermore, studies on cognitive biases in children and adolescents rarely combine anxiety and depression, which is remarkable given the high comorbidity between these disorders, the strong overlap in the genetic factors underlying vulnerability for anxiety and depression, and the potential interaction between their associated biases (e.g. Luebbe, Bell, Allwood, Swenson, & Early, 2010; Nivard et al., 2015). Studying anxiety and depression simultaneously would give us more insight into the overlapping and distinctive features of anxiety and depression, which could shed light on different possible etiological pathways underlying their frequent comorbidity (see Cummings, Caporino, & Kendall, 2014). Moreover, an integrated understanding of how various biases may collectively influence the aetiology and maintenance of anxiety and depression has important implications for the identification, prevention and treatment of anxiety and depression in children and adolescents. Several authors have indeed expressed the need for more research studying different cognitive biases simultaneously in children and adolescents with varying levels of anxiety and depression to test proposed models of (childhood) anxiety and depression (e.g. Everaert et al., 2012; Hirsch et al., 2006; Muris & Field, 2008).

Therefore, the main aim of this study was to investigate biases in attention and interpretation and their ability to uniquely predict variance in anxiety and depression scores in a sample of adolescents with varying levels of anxiety and depression. The first goal of this study was to replicate the findings of earlier studies that found evidence for attention and interpretation biases related to varying levels of anxiety and depression in adolescents. As attention bias might compromise different underlying mechanisms (Cisler & Koster, 2010), we decided to include two different types of attention bias measures. Based on theoretical conceptualisation and previous findings, we hypothesised that relatively high levels of anxiety and depression would be associated with stronger negative biases in attention and interpretation (e.g. Beck, 1976; Muris, 2010; Nightingale et al., 2010; Platt et al., 2016; Williams et al., 1997). The second goal of this study was to explore whether attention and interpretation biases would be (partly) independently associated with self-reported levels of internalising symptoms. Based on existing empirical evidence in pre-adolescent children and adults with varying levels of anxiety and subclinical depression (e.g. Everaert et al., 2014; Klein et al., 2012, 2014; Van Bockstaele et al., 2011; Watts & Weems, 2006), we expected that the different cognitive biases would predict unique variance in both anxiety and depression scores.

Methods

Participants

An unselected sample of adolescents was recruited from 14 regular secondary schools in the Netherlands. A total of 733 adolescents registered for this study (2312 adolescents were invited). In total, 52 adolescents were removed from the final analyses; 4 adolescents who dropped out wanted their data to be removed and 48 adolescents missed the complete assessment, because they were absent. The analytical sample consisted of 681 adolescents (59.2% female) between the ages of 11 and 18 ($M = 14.4$, $SD = 1.2$). Of these 681 adolescents, 148 adolescents scored above the clinical cut-off score on anxiety, 4 adolescents scored above the clinical cut-off score on depression, and 28 adolescents scored above the clinical cut-off score on both anxiety and depression, thus indicating that approximately 26% of the adolescents showed significant levels of anxiety and/or depression.

The current study was part of a large community-based project on (prevention of) adolescent anxiety and depression. As a result, the adolescents who participated in this study also took part in a subsequent training focused on reducing their cognitive biases. The adolescents participated in one of three studies about the efficacy of (a) attention bias modification, (b) interpretation bias modification, or (c) emotional working memory training (de Voogd, Wiers, De Jong, Zwitser, & Salemink, 2016; de Voogd, et al., 2016; de Voogd, Wiers, Zwitser, & Salemink, 2016). The Ethical

Committee of the psychology department of the University of Amsterdam, the Netherlands, approved this study and the study was carried out in accordance with the provisions of the World Medical Association Declaration of Helsinki. The study was registered in the Dutch trial register with number NTR3950.

Instruments

All assessment tasks and questionnaires were presented online on school computers or laptops. Participants could immediately start the next task upon completing a previous one.

Emotional Visual Search Task (EVST, de Voogd, Wiers, Prins, & Salemink, 2014; de Voogd et al., 2016). The EVST consisted of 2 blocks of 36 trials, where participants had to repeatedly select either the only happy face in a 4 × 4 grid of negative faces (angry, fearful or sad, 5 each) or the only face with a negative emotion in a grid of happy faces. Each grid was presented until the participant responded and trials were repeated in case of an incorrect response. The order of positive or negative blocks was counterbalanced over participants. Face stimuli (height 149, width 117 pixels) were randomly selected from two sets (counterbalanced over participants) of 36 adolescent faces (18 happy, 6 angry, 6 fearful, and 6 sad faces) from the NIMH Child Emotional Faces Picture Set (NIMH_ChEFS, Egger et al., 2011, for stimuli selection, see de Voogd et al., 2014). An attention bias index was computed by subtracting reaction times (RTs) for negative targets from RTs for positive targets, with higher scores indicating larger interference by negative information. See Figure 1(a) for an example of both trial types.

Dot Probe Task (DPT, see Abend, Pine, & Bar-Haim, 2014 for more details on the current version*).* In the DPT, two faces (angry or neutral, height 143, width 191 pixels) were presented at the top and the bottom of the screen for 500 ms. Participants had to identify a probe ("<" or ">") that appeared at the location previously occupied by one of the faces. Face presentation was preceded by a 500 ms fixation cross and each response was followed by an intertrial interval of 500 ms. In total, 120 trials were presented, with 80 neutral–angry trials and 40 neutral–neutral filler trials. Two stimuli sets were created (counterbalanced over participants), with faces from 12 actors (6 men) from the Nim-Stim stimulus set (Tottenham et al., 2009; retrieved from Abend et al., 2014). Actor, angry face location, probe direction, and probe location were all fully counterbalanced. An attention bias index was computed by subtracting RTs for congruent trials (probes replaced angry faces) from RTs for incongruent trials (probes replaced neutral faces), with higher scores indicating a stronger bias for negative information. See Figure 1(b) for an example of a congruent trial.

Interpretation Recognition Task (IREC-T, Mathews & Mackintosh, 2000). The IREC-T is a task in which participants complete ambiguous scenarios; each scenario consisted of a title and three short sentences, with a missing word at the end. The adolescents were asked to read each scenario and imagine themselves as the central character. After reading a scenario, the adolescent pressed the spacebar and the missing word appeared on the screen with one letter missing. The task of the adolescents was to fill out this missing letter after pressing the space bar as soon as they recognised the word and they received feedback by reading the correct response. Next, the adolescent was asked to answer "yes" or "no" to a question that measured comprehension of the story, also followed by feedback. After presentation of eight scenarios, titles of these scenarios were presented again in random order, once with a negative interpretation and once with a positive interpretation (randomised). Participants rated the extent to which the interpretation corresponded to the scenarios on a 4-point scale (1 = not at all, 4 = fully), and separate scores for positive and negative interpretations were computed. All steps in the IREC-T were self-paced. The IREC-T has been shown to differentiate between adults high and low in neuroticism (Salemink, van den Hout, & Kindt, 2010), and has also repeatedly been used in adolescent samples (e.g. Micco, Henin, and Hirshfeld-Becker, 2014; Salemink & Wiers, 2011).

An example scenario: "Summer party" (Title), "You invite your friends to a summer party in your parents' house. Ten classmates visit. The next day, you hear them talking …. about the party". (Scenario), "qui_tly" (Word fragment), "quietly" (Correct word), "Did your friends talk about the party?" (Comprehension question), "Yes" (Correct answer). The positive interpretation was "You hear your friends talking about how great the party was". The negative interpretation was "You hear your friends talking about how boring the party was".

Screen for Child Anxiety Related Emotional Disorders (SCARED, Birmaher et al., 1999). The SCARED is a self-report questionnaire that measures responses to 41 statements on a 3-point scale with "almost never", "sometimes" and "often" (0–2). The SCARED-41

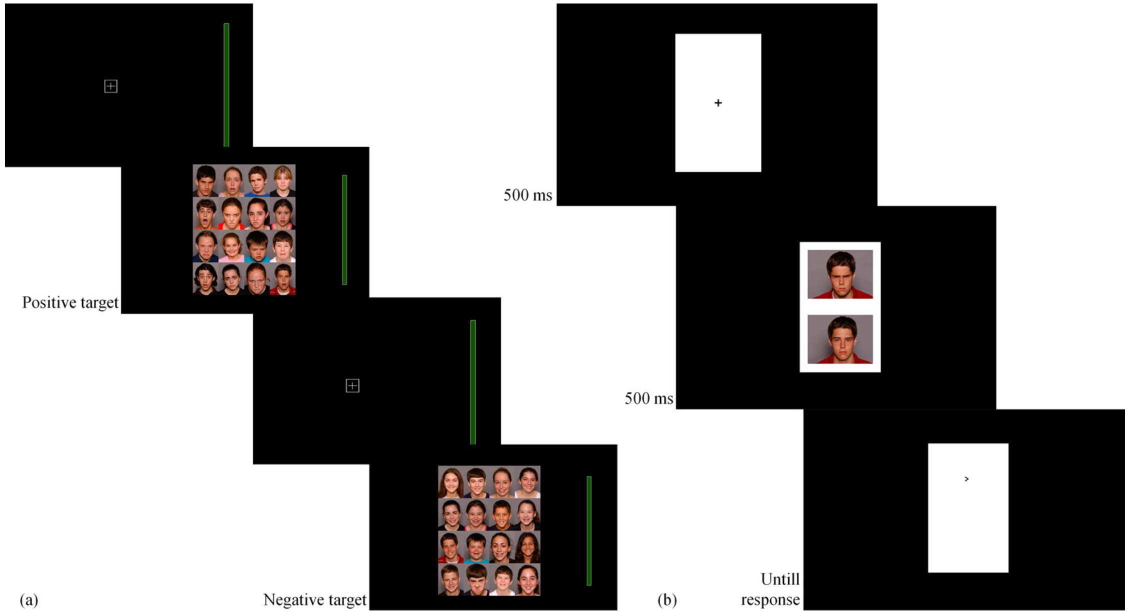

Figure 1. (a) Example of a positive and negative target trial of the EVST (note that these trials types are presented in two separate blocks). Matrices are displayed after moving the mouse cursor over the fixation cross and until participants respond. (b) Example of a congruent (angry-neutral) trial in the DPT. Face stimuli displayed in this Figure are publicly available at http://devepi.duhs.duke.edu/NIMH_Pictures.html (NIMH_ChEFS, Egger et al., 2011). Written permission to reproduce these sample facial stiumuli was obtained.

measures DSM-IV symptoms of anxiety, social phobia, separation anxiety, generalised anxiety, panic/somatic symptoms, and school phobia. Internal consistency is shown to be good ($\alpha = .90$; Birmaher et al., 1999). Internal consistency in the current study was excellent, $\alpha = .92$.

Children's Depression Inventory (CDI; Kovacs, 1985). The CDI is a self-report questionnaire with 27 items consisting of 3 statements each indicating varying levels of depressive symptomology (0–2). Internal consistency of the original scale is shown to be good, retest reliability is shown to be moderate (e.g. Kovacs, 1985). Internal consistency in the current study was good $\alpha = .86$.

Procedure

Participating schools selected classes to invite, which were visited and instructed about the contents and aim of the study. The aim was explained as "investigating a training to make adolescents more resilient to stress and negative emotions, by learning to worry less and have a more positive view on your environment". Information letters were also sent to the adolescents and their parents and both provided written informed consent. All tasks were completed in classrooms at school during regular school hours, under supervision of graduate students or the second author. The participants first completed the different cognitive bias tasks in a fixed order (DP, IREC-T, EVST), followed by filling in the SCARED-41 and the CDI. We chose this order to optimise motivation and because we did not want the two attention bias tasks to follow each other. The assessment took approximately 80 minutes and also included a working memory assessment and six other questionnaires, which were not used for the current study (see de Voogd et al., 2016; de Voogd et al., 2016; de Voogd et al., 2016).

Results

Descriptives

Not every adolescent was able to perform all experimental tasks and/or questionnaires because of technical problems with the tasks or they dropped out during the session (EVST: $n = 12$; DPT: $n = 11$; IREC-T: $n = 2$; SCARED-4: $n = 2$; CDI: $n = 3$). See Table 1 for an overview of the descriptive statistics for all measures.

For the EVST, incorrect trials, correct repetitions of incorrect trials, and trials with RTs more than 2 SDs

Table 1. Means standard deviations and minimum and maximum scores of the three experimental tasks and the questionnaires.

		Mean	SD	Min.	Max.
EVST	RT positive	4041.42	995.67	1805.01	9972.13
	RT negative	3505.53	794.17	1739.71	8502.12
	Bias index	535.90	986.28	−2735.89	3793.95
DP	RT neutral	525.04	68.08	382.94	890.59
	RT threat	523.65	68.62	378.91	876.78
	Bias index	1.37	20.59	−73.55	76.70
IREC-T	Positive score	2.6	0.49	0	3.90
	Negative score	2.1	0.45	0	3.75
SCARED-41		18.8	12.0	0	65
CDI		8.5	6.0	0	36

EVST: Emotional Visual Search Task; DP: Dot Probe Task; IREC-T: Interpretation Recognition Task; Screen for Child Anxiety Related Emotional Disorders; CDI: Children's Depression Inventory

from the individual's mean were removed ($M = 6.3\%$, $SD = 2.6$ l; de Voogd et al., 2014). Furthermore, data of participants with an error rate 3SDs above the mean error rate were excluded ($n = 9$). A one-sample *t*-test revealed that adolescents showed significant interference by negative information $t(659) = 13.96$, $p < .001$ ($M = 535.90$, $SD = 38.39$). For the DPT, incorrect trials and trials with RTs more than 2.5 SDs from the individual's mean were removed ($M = 4.4\%$, $SD = 5.5$) (note that different outlier cut-offs were used for the EVST and DPT to keep results comparable to other studies with these tasks: Abend et al., 2014; de Voogd et al., 2014). Furthermore, data of participants with an error rate 3SDs above the mean error rate were excluded ($n = 10$). A one-sample *t*-test revealed that adolescents showed marginally significant attention bias for negative information $t(659) = 1.71$, $p = .088$ ($M = 1.37$, $SD = 20.59$).

Correlations

All correlations were controlled for gender and age. As expected, the correlation between anxiety and depression was strong ($r = .67$, $p < .001$).

Adolescents with higher self-reported levels of anxiety displayed stronger negative attention biases than adolescents with lower self-reported levels of anxiety; this was found with the EVST as well as with the DPT (EVST: $r = .12$, $p = .002$; DPT $r = .09$, $p = .024$). Furthermore, adolescents with higher self-reported levels of depression also displayed a stronger negative attention bias than adolescents with lower self-reported levels of depression, but only when assessed with the EVST, $r = .09$, $p = .018$, and not with the DPT, $r = .06$, $p > .1$. With respect to interpretation bias, adolescents with higher self-reported levels of anxiety or depression reported lower scores on the positive interpretations (Anxiety $r = -.13$, $p = .001$; Depression $r = -.15$, $p < .001$) and higher scores on the negative interpretations than adolescents with lower self-reported levels of anxiety or depression (Anxiety $r = .08$, $p = .038$; Depression $r = .14$, $p < 001$).

Regression analysis

To test whether the different cognitive biases explained unique variance in self-reported levels of

Table 2. Hierarchical regression analyses predicting self-reported anxiety and depression.

Criterion variable	Step	R^2	R^2 change	Predictor	β
Regression 1 with self-reported anxiety ($n = 640$)					
Anxiety					
	1	.08**		Age	.12*
				Gender	.24**
	2	.13**	.05*	Age	.13**
				Gender	.23**
				IREC-T_pos	−.14**
				IREC-T_neg	.09*
				EVST	.11*
				DP	.10*
Regression 2 with self-reported depression ($n = 639$)					
Depression					
	1	.04**			
				Age	.18**
				Gender	.09*
	2	.10**	.06*		
				Age	.19**
				Gender	.07
				IREC-T_pos	−.17**
				IREC-T_neg	.16**
				EVST	.08*
				DP	.07+

+$p < .1$, two-tailed.
*$p < .05$ two-tailed.
**$p < .001$ two-tailed.
Note: Standardised β coefficients are reported.

anxiety and depression, we performed two hierarchical regression analyses (separately for anxiety and depression, see Table 2). The bias scores were entered as predictors; EVST scores, DPT scores, positive IREC-T scores, and negative IREC-T scores. Furthermore, we also included Gender and Age in the first step of the analyses in order to control for these variables.

For self-reported anxiety, the first step of the model was significant, and explained 7.9% of the variance in self-reported social anxiety, $F(2, 637) = 27.4$, $p < .001$. Gender and age were significant positive predictors; girls and older adolescents reported higher levels of self-reported anxiety than boys and younger adolescents. After the second step $F(6, 633) = 115.18$, $p < .001$, the model was also significant, and explained 12.6% of the variance in anxiety. This second model was also significantly better than the first model $F(4, 633) = 8.4$, $p < .001$ (R^2 Change = .05). For this second model, EVST scores, DPT scores, positive IREC-T scores, and negative IREC-T scores were significant predictors. Thus, the different indices of attention and interpretation biases each predicted unique variance in self-reported levels of anxiety.

For self-reported depression, the first step of the model was significant $F(2, 636) = 14.1$, $p < .001$, and explained 4.2% of the variance in self-reported depression. Gender and age were significant positive predictors; girls and older adolescents reported higher levels of self-reported depression than boys and younger adolescents. After the second step $F(6,632) = 11.8$, $p < .001$, the model was also significant, and explained 10.1% of the variance in self-reported depression. This second model was also significantly better than the first model, $F(4,632) = 10.2$, $p < .001$ (R^2 Change = .06). For this second model, EVST scores, positive IREC-T scores, and negative IREC-T scores were significant predictors. The variable DPT was a marginally significant predictor. Thus, similarly to anxiety, attention biases and interpretation biases also predicted unique variance in self-reported levels of depression.

Discussion

This is the first study to investigate attention and interpretation biases simultaneously, and to test the independent ability of these biases to predict anxiety and depression scores in an unselected sample of adolescents varying in their levels of anxiety and depression. The first goal of this study was to replicate earlier findings of biased attention and interpretation in adolescents with varying levels of anxiety and depression (for overviews see Muris, 2010; Nightingale et al., 2010; Platt et al., 2016). Consistent with earlier results, we found that adolescents with relatively high levels of self-reported anxiety and depression displayed stronger biases in both attention and interpretation than adolescents with lower levels of self-reported anxiety and depression, although correlations were rather small.

The second goal of this study was to explore whether attention and interpretation biases would be (partly) independently associated with self-reported levels of internalising symptoms. The results showed that attention and interpretation biases predicted unique variance in self-reported anxiety and depression. The explained variance of the anxiety model (12.6%) and the depression model (10.1%) was comparable. These results show that attention and interpretation biases are both partly independent processes that are relevant in explaining anxiety as well as depression. These results are in line with our hypotheses and with previous studies of child and adult anxiety and depression (Everaert et al., 2014; Klein et al., 2012, 2014; Rinck & Becker, 2007; Van Bockstaele et al., 2011; Watts & Weems, 2006). They also confirm current cognitive models of anxiety disorders and depression. These models predict that different cognitive biases, to some extent, have a unique relation with anxiety and depression (e.g. Beck, 1976; Williams et al., 1997).

The current results not only confirm current cognitive models, but they could also be used to further specify these models and to improve interventions. First, we found that two measures of attention bias predicted unique variance in anxiety and depression. The unique contribution of both EVST and DPT scores suggests that these indices might tap into distinct aspects of attention bias. The precise underlying mechanisms are not yet fully understood (Cisler & Koster, 2010), but given the explicit instructions in the EVST, this task might assess more controlled processes compared to more automatic processes in the DPT. Identifying both automatic and controlled aspects of each bias could help us to improve assessment tools (see also Daleiden & Vasey, 1997).

Furthermore, our results indicate that anxiety and depression share similar underlying cognitive mechanisms. The next step would be to test whether anxiety and depression possess discriminant validity, which could shed more light on different possible etiological pathways underlying their frequent comorbidity (see also Cummings et al., 2014). For example, are attention processes more relevant in anxiety or depression, are biased cognitive processes more relevant in individuals with both anxiety and depression, and are there specific types of anxiety specifically linked to depression? These questions would also be relevant for treatment as they could give an indication of what works best for whom. For example, a recent study from our lab showed that socially anxious adolescents thought that they were less liked by their peers, whereas they were in fact equally liked by their peers as non-anxious adolescents (Klein et al., 2016). However, if socially anxious adolescents showed co-morbid higher levels of depression, they were indeed less liked. These results might indicate that adolescents with anxiety only might benefit from another treatment approach than adolescents with a mixed anxiety/depression profile.

Taken together, data of different studies including our study indicate likely continuity in the existence of cognitive biases in children, adolescents and adults and the additive influence of different cognitive biases on anxiety and depression across the course of development, in line with cognitive theories of psychopathology. It may be that patterns of cognitive functioning associated with emotional states are established at a relatively early age, and tend to continue into adulthood.

While strong points of this study are its large sample size, the inclusion of several measures to study different cognitive biases simultaneously, and to combine anxiety and depression, there are also some limitations to acknowledge. First, the correlations and the explained variances of the different bias tasks in the regression analyses were mostly significant, but the strength of the correlations was rather weak. One might speculate that different cognitive biases are simply not as closely related to anxiety because they tap into separate underlying processes (see also Van Bockstaele et al., 2011; Watts & Weems, 2006). However, there are other possible explanations of these findings related to the recruitment, the measures and the procedure of our study, and these could be seen as shortcomings.

The first alternative explanation for the weak correlations is the insufficient reliability of the measures that were used. For example, Brown et al. (2014) found that the test–retest reliability of measures comparable to the ones used in our study was very low and largely non-significant. The second alternative explanation is that the test environment could (also) have resulted in relatively low correlations as adolescents were tested in groups in classrooms. Although all adolescents had the availability of their own computer, and we took great care to create a quiet environment and provided as much privacy as possible (e.g. separating tables, providing a wall), the group testing might have caused extra variability on the tasks, especially because some of the tasks were based on reaction times. The third alternative explanation could be that the adolescents in the current study were unselected adolescents from a community sample. There are indeed other studies that used unselected adolescent samples that have found similar weak correlations between cognitive biases and anxiety (for overviews see Muris, 2010; Nightingale et al., 2010) and depression (for an overview see Platt et al., 2016). The anxiety- or depression-related schemata of the adolescents studied here might not be as chronically active as those of adolescents with a diagnosed anxiety or depression disorder. Therefore, attention biases and interpretation biases might be less visible in an unselected sample of adolescents than in clinically anxious and depressed adolescents. Clearly more research in selected and clinical samples is needed before firm conclusions can be drawn. The fourth alternative explanation could be that we only related the experimental tasks to self-reported anxiety and depression, and not to other measures, such as a behavioural measure or a structured interview. There are several other studies that also found relatively low correlations between self-reports and experimental tasks measuring cognitive biases, but the experimental tasks then did correlate with a behavioural measure (Klein et al., 2012, 2014). The relatively low correlation between self-reports and experimental tasks is theoretically supported by dual processing models (Strack & Deutsch, 2004). Future studies could therefore include a behavioural measure or a structured interview in addition to using self-reports when studying cognitive processes with experimental tasks. Finally, another feature of this study was that the tasks were administered in a fixed order. This has pros and cons. One the one hand, this limits the possibility to study the relative contribution of the different tasks (direct comparison of tasks), on the other hand, it increases power to detect individual differences, important in a correlational design (Perugini, Richetin, & Zogmaister, 2010). Hence, a follow-up study focusing on the relative contribution of the different tasks should preferably counterbalance tasks.

In conclusion, the current results underline the importance of several cognitive biases in anxiety and depression and they support the use of several indirect measures in research settings. Based on our findings, we recommend the simultaneous assessment of different cognitive biases, as it seems that adolescents with high levels of anxiety and depression differ from other adolescents with respect to several cognitive processes. In this study, we found that the current versions of the EVST (attention bias), and the Recognition Task (interpretation bias) were able to independently predict self-reported levels of anxiety as well as depression. To the best of our knowledge, this is the first study to find evidence that different cognitive biases are uniquely related to anxiety and depression in an adolescent sample. Our findings point to the possibility that anxiety and depression are partly based on similar underlying cognitive mechanisms. These results could be used to further conceptualise and specify theoretical models of adolescent anxiety and depression and to inform interventions targeting cognitive biases.

Acknowledgements

We thank all schools that participated in this study. We also thank the adolescents and their parents who participated in the study, and all graduate students for their assistance in the recruitment, data collection, and data entry. We thank Thomas Pronk for his assistance in data processing and Mike Rinck for his assistance with the data-analyses. We are grateful to Simon Blackwell, Kathryn Lester, and Claudia Menne-Lothmann for providing us with the stimuli for the Recognition Task, and to Yair Bar-Haim for sharing the stimuli and programming details for the DP task.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

Anke Klein and Leone de Voogd are supported by a grant from the Netherlands Organization for Health Research and Development, ZonMW (grant number 200210010).

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