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Klein, A.M.; Bakens, R.; van Niekerk, R.E.; Ouwens, M.A.; Rapee, R.M.; Bögels, S.M.; Becker, E.S.; Rinck, M.

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The relation between generalized anxiety disorder symptoms and content-specific interpretation biases for auditory stimuli in children

Anke M. Klein[a,d,*], Rian Bakens[a], Rianne E. van Niekerk[a], Machteld A. Ouwens[b], Ronald M. Rapee[c], Susan M. Bögels[d], Eni S. Becker[a], Mike Rinck[a]

[a] Behavioural Science Institute, Radboud University Nijmegen, the Netherlands
[b] GGZ Breburg, Tilburg, the Netherlands
[c] Centre for Emotional Health, Macquarie University, Sydney, Australia
[d] University of Amsterdam, the Netherlands

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ABSTRACT

Background and objectives: Cognitive theories of fear suggest that biases in interpretation are content-specific: Fearful children should only interpret materials negatively if they are specifically related to the content of their fear. So far, there are only a few studies available that report on this postulated content-specificity of interpretation processes in childhood fear. The goal of this study was to examine interpretation bias and its content-specificity in children with varying levels of Generalized Anxiety Disorder (GAD) symptoms.

Methods: In an Auditory Interpretation Task (AIT), two words that differ by one phoneme are acoustically blended so that one can hear only one of the words. In the current AIT, we included GAD-related blends, negatively-valenced fear-related blends and positive blends. Multiple-choice (n = 371) or open-ended (n = 295) responses were collected from 666 nonclinical children between 7 and 13 years of age.

Results: Children with higher levels of self-reported GAD showed significantly more negative interpretations of ambiguous GAD-related blends in the multiple-choice version than children with lower levels of GAD. There were no differences when interpreting the other ambiguous blends. This result was not found with the open-ended version.

Limitations: Effects were relatively small, some GAD-stimuli were sub-optimal, and the task was administered in a classroom setting. Even though we ensured that all children were able to hear all words clearly, this may have impacted the results.

Conclusions: The findings only partly support the idea that fearful children display cognitive biases specific for fear-relevant stimuli, and more research is needed to replicate the results and test the usability of the AIT.

1. Introduction

It is widely recognized that fearful children interpret the world as more threatening than their non-fearful peers. Cognitive theories indeed emphasize the importance of underlying automatic cognitive processes, such interpretation processes, in the onset and maintenance of fear (e.g., Beck, Emery, & Greenberg, 1985). The central assumption of these theories is that cognitive processes are driven by schemata. Schemata are cognitive structures of associations between knowledge elements that influence perception, attention, interpretation, and memory. In fearful individuals, schemata that are organized around the themes of threat and danger are chronically overactive, and many situations and stimuli are (automatically) associated with danger and fear, resulting in cognitive biases (e.g., Williams, Watts, MacLeod, & Mathews, 1997; for a schema-based theory of childhood fear, see; Daleiden & Vasey, 1997). These biases, such as biases in interpretation are thought to be content-specific: Fearful children should only interpret materials negatively if they are specifically related to the content of their fear and not to other-fear-related words or positive information. So far, there are only a few studies available that report on this postulated content-specificity of interpretation processes in childhood fear (see also Muris, 2010). Knowing more about the content-specificity of cognitive biases in children is important, because this could help us to improve treatment programs for fearful children. For example, would children profit more from generic treatments or is it important to focus on the specific fear cognitions of a child during treatment? Several authors have indeed expressed the need for more research on content-specificity in interpretation biases in fearful children (e.g., Muris, 2010;

* Corresponding author. Behavioural Science Institute, Radboud University Nijmegen, PO Box 9102, 6500 HC, Nijmegen, the Netherlands.
E-mail address: a.klein@psych.ru.nl (A.M. Klein).

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Stuijfzand, Dodd, Pearcey, Creswell, & Field, 2017). Therefore, the main goal of this study was to investigate the content-specificity of interpretation processes in a sample of children with varying levels of Generalized Anxiety Disorder (GAD) symptoms.

Research in fearful children has provided evidence of biased interpretation processes related to fear (for reviews, see Muris, 2010; Muris & Field, 2008; for a meta-analysis, see Stuijfzand et al., 2017). Interpretation bias refers to the phenomenon that fearful individuals have the tendency to interpret ambiguous situations as threatening. Interpretation biases are commonly assessed using direct measures, such as the Children's Negative Cognitive Error Questionnaire (CNEQ; Leitenberg, Leonard, & Carroll-Wilson, 1986). In direct measures, participants are asked directly about their feelings and opinions towards different situations. Advantages of these measures are that they are fast and easy to administer and that they are reliable in the sense that measurement errors are small. A limitation of direct measures is that participants only report what they are willing and able to report because responses are given in a controlled, deliberate manner (e.g., Nisbett & Wilson, 1977). As a result, answers may be biased by social desirability, limitations of introspection, or experimenter demands (e.g., Bijttebier, Vasey, & Braet, 2003). As a result, self-reports (direct measures) tap into more controlled processes related to fear, while indirect measure are needed to tap into more automatic processes, such as interpretation processes (e.g., Strack & Deutsch, 2004). Examples of indirect measures include reaction time tasks such as the Affective Priming Task (APT; De Houwer, 2003), the Approach Avoidance Task (AAT; Rinck & Becker, 2007), and the Emotional Expression Task (e.g., Richards, French, Nash, Hadwin, & Donnelly, 2007). It should be kept in mind, however, that reaction-based paradigms are usually less reliable than direct measures. This might especially be true in child samples, because children are generally distracted more easily and have relatively short attention spans (Huijding, Wiers, & Field, 2010).

To provide a compromise between direct and indirect measures, many studies of interpretation bias use variations of an “ambiguous scenario” paradigm. In this paradigm, children are asked to finish scenarios (short texts) about everyday situations. In this way, children are not directly asked how afraid they are, but are asked to finish stories about different situations related to fear. Commonly, responses to these scenarios involve a multiple-choice format in that children choose their ending from a number of provided possibilities. Alternatively, responses to scenarios can be open-ended in that children are asked to produce their own ending to the scenarios. Although the ambiguous scenarios task and its variations are not able to capture automatic aspects of cognitive processes as clearly as reaction time based paradigms, the general view is that this task relies less on insight than questionnaires or interviews as it does not directly ask how fearful a child is (see also, Muris, 2010).

So far, most studies using ambiguous scenarios found that fearful children show a tendency to interpret ambiguous situations in a negative way (for reviews, see Muris, 2010; Muris & Field, 2008). Some of these studies also explored whether interpretation biases are specific to the content of the fear, finding evidence for the specificity of interpretation biases related to fear (e.g., Bögels, Snieder, & Kindt, 2003; Klein et al., 2014). Also, Stuijfzand et al. (2017) found a moderating effect of the content of ambiguous scenarios in their meta-analysis; the relation between fear and interpretation bias was stronger when the ambiguous scenarios matched the fear subtype under investigation. However, the authors pointed out that this effect was mainly driven by studies that focused on social anxiety, and clearly more research is needed on other fears, such as generalized anxiety disorder.

Although the “ambiguous scenario” paradigm and its different variations are often seen as more indirect than questionnaires or interviews, this paradigm is still highly sensitive to experimenter demand and social desirability (e.g., Muris, 2010). Therefore, developing more sophisticated indirect measures may provide a clearer picture of biased interpretation processes that play a role in childhood fear. Examples of tasks that can be used to explore interpretation biases in children in a more indirect way without using reaction times include the homophone task (Hadwin, Frost, French, & Richards, 1997; Taghavi, Moradi, Neshat-Doost, Yule, & Dalgleish, 2000) and the Auditory Interpretation Task (AIT; Dearing & Gotlib, 2009; Lawson, MacLeod, & Hammond, 2002). In the homophone task, words with two different meanings are presented auditorily; the word has both a neutral meaning and a threatening meaning (e.g., pain versus pane). The child's task is to select a response (e.g., picture or sentence) that bests represents the meaning of the word. Several studies using this paradigm found that fearful children have a tendency to select homophones with a threatening meaning significantly more often than non-fearful control children (e.g., Hadwin et al., 1997; Taghavi et al., 2000). A disadvantage of the task is that in most languages other than English, it is close-to-impossible to find homophones with a neutral and a fearful meaning.

In the AIT, two words that differ by only one phoneme (e.g., “threat” and “thread”) are presented acoustically at the same time. Due to the fact that phoneme perception is categorical (e.g., Eimas & Corbit, 1973), listeners do not hear a blend of phonemes, but either one phoneme or the other. As a result, they will hear only one of the two words, usually without being aware of the fact that there might be a second possible interpretation of the perceived sound stream. When using this task to assess threat interpretation, one of the words is related to fear, while the other word has a neutral valence. The children's task is to simply listen to the words and report what they hear. The potential advantages of the AIT are manifold: The task is probably less sensitive to experimenter demand and social desirability than questionnaires and ambiguous scenarios as the child generally only hears one word without being aware that there are more words possible, it is more versatile than the homophone task, and it is possible to choose all kinds of different words. This task might therefore be a better alternative than the homophone task or the “ambiguous scenarios” paradigm.

To the best of our knowledge, only Dearing and Gotlib (2009) have used an AIT to study interpretation bias in children. In their study, daughters of mothers with a history of at least two depressive episodes or daughters of healthy mothers were asked to listen to 50 word pairs and choose the word they thought they heard out of two possible options. The test words were either related to depression, social situations, or positive situations. The two groups did not differ on current depression symptoms. Children of mothers with a history of depression identified significantly more depression-related words than the control group, but there was no difference in words related to social situations. The children of mothers with a history of depression also chose the positive words significantly less often than the control group.

The present study was based on the study by Dearing and Gotlib (2009), and was designed to investigate whether children with varying levels of Generalized Anxiety Disorder (GAD) symptoms display a negative interpretation bias, and whether this bias is specific for GAD-related materials. We created two different versions of the AIT; approximately half of the children in this study performed a multiple-choice version that was very similar to the study of Dearing and Gotlib (2009). The only two differences were the content of the words which were GAD-related, negatively-valenced fear-related or positively-related words, and we used a multiple-choice version that included four options instead of two options to reduce the effect of a possible response bias. Additionally, the other half of the participating children performed an open-ended version. In this version, children were asked to simply write down the word they heard. We created this version in order to make the task even more indirect to reduce possible bias due to the multiple-choice format.

Based on earlier studies on interpretation bias in fearful children, we hypothesized that children with higher levels of GAD symptoms would interpret GAD-related-neutral word blends as negative more often than children without symptoms of GAD. In line with the content-specificity hypothesis, we expected that children with higher levels of GAD would display an interpretation bias for GAD-related stimuli only,

and not for the negatively-valanced fear-neutral word blends or the positively valenced-neutral word blends when compared to children with lower levels of GAD symptoms.

2. Methods

2.1. Participants

The current study was part of a large community-based project on childhood fear. An unselected sample of children was recruited from eleven regular elementary schools in the Eastern part of The Netherlands. Most children had a Caucasian background. After parental consent had been granted, a total of 688 children participated in the project. The response rate was approximately 60–80% per school, and we did not have any reason to suspect a selection bias. In total 22 participants did not perform the AIT, because they were absent on the testing day. As a result, the data of 666 children (339 boys) between 7 and 13 years of age (M = 10.0, SD = 1.2) were used. In total, 371 children (190 boys) with a mean age of 10.0 years (SD = 1.2) performed the *AIT multiple-choice version*, and 295 children (149 boys) with a mean age of 10.0 years (SD = 1.3) performed the *AIT open-ended version*. Not all data was complete for every child, due to missing information of the child, or they did not finish the session (GAD-subscale: n = 40; Age: n = 9). We decided to analyze all available data. Please see Table 1 for the gender and age distribution across both versions of the AIT. The Ethical Commission of the Behavioural Science Institute of Radboud University, The Netherlands, approved this study. The current study overlapped with two other studies that aimed to explain fear-related social anxiety (Van Niekerk et al., 2017) and spider fear (Klein et al., 2017).

2.2. Instruments

2.2.1. Auditory interpretation task (AIT)

The AIT that was used in this study was based on the AIT developed by Dearing and Gotlib (2009). In this task, children listened to presentations of ambiguous auditory stimuli that were created by acoustically blending emotional words and neutral words that only differed by only one phoneme. Children were asked to write down the word they heard in the first version of the task, or to choose their answer out of four possible answers in the second version of the task; 1) the neutral word, 2) the emotional word or the positive word, 3) a word physically similar to both words, or, 4) a word with a related meaning to the neutral word. All words in both versions were coded as 'neutral', 'positive', 'emotional' or 'other'. Each classroom of children was randomly assigned to either the multiple-choice version or the open-ended version of the AIT.

We developed enough stimuli for this study to have a full set of simple age appropriate emotional and neutral words. Stimuli included GAD words, negatively-valenced fear-related words, and positively-valenced words that were all matched with neutrally-valenced words. As children with GAD tend to worry about different topics, we included words related to each of the three topics most relevant to GAD in children (Muris, Bodden, Hale, Birmaher, & Mayer, 2007), namely, health, school, and social situations complemented with words that are very typical for GAD, namely 'worry', 'worrying', and 'doubt'. We also included word blends that consisted of a combination of a negatively-valenced fear-related word and a neutral word to test for the content-specificity of the interpretation bias. The most important difference between the GAD-related words and the negatively-valenced fear-related words was that the negatively-valenced fear-related words were words with a generally negative fear-related valence, such as 'fear' and 'anxiety'. There were a few words that were related to spiders. We have included these words, as we found in our previous studies that children in this age range had an overall negative avoidance reaction towards spider-related stimuli (see also, Klein, Becker, & Rinck, 2011b). Finally, we included word blends that consisted of a positively-valenced word and a neutral word to make a distinction between the expected disorder-specific interpretation bias and a general bias for emotional information. The different words were derived from previous Dutch studies focused on fear-related associations and approach and avoidance tendencies in children and on words that were used in Dutch questionnaires developed for children that were related to GAD (Klein et al., 2011b, 2012, 2014; Muris et al., 2007). The second author audio-taped the words in a music studio located at Radboud University. The word blends were created with sound-editing software Adobe Audition 3.0. Every word-pair was created by averaging the distinct waveforms of each component word. The resulting waveforms were combined into a single audio output to achieve each final ambiguous word blend (see also Dearing & Gotlib, 2009). This resulted in a set of 230 word blends.

In a pilot study of 33 elementary school children, we tested the set of 230 words to ensure that children were able to hear both interpretations. From a theoretical point of view, one expects that only children with symptoms of an anxiety disorder would choose the negative word instead of the positive word. As our pilot group consisted of typically developing children, we decided that both words had to be chosen at least 25%, because we wanted to make sure that there was enough variability. This resulted in the selection of 76 appropriate word blends. In order to reduce the length of the task to approximately 15 min, only 56 word blends were chosen randomly for the final task with the restriction that each (sub)category would consist of approximately 10 word blends. Internal consistency of the three AIT categories was low to moderate (Multiple-choice: GAD-related words: α = .10; negative-fear-related words: α = −.04; positive words α = .15; Open-ended version: GAD-related words: α = .58; negative-fear-related words: α = .24; positive words α = .27).

Table 1
Overview of the distribution of children over both versions of the AIT as a function of Age[a] and Gender.

Age	Multiple-choice		Open-ended	
	Male	Female	Male	Female
7	0	1	1	0
8	23	25	17	20
9	36	39	35	37
10	59	48	36	34
11	50	45	39	37
12	21	17	20	15
13	0	1	1	0
Total	189	176	149	143

[a] Please note that the age of nine children was missing.

2.2.2. Screen for child anxiety related emotional disorders (SCARED; Bodden, Bögels, & Muris, 2009)

The SCARED is a self-report questionnaire that measures responses to 71 statements on a 3-point scale with 'almost never = 0', 'sometimes = 1' and 'often = 2'. The SCARED measures DSM-IV symptoms of anxiety, including Separation Anxiety Disorder, Generalized Anxiety Disorder (GAD), Panic Disorder, Social Phobia, Specific Phobia, Obsessive Compulsive Disorder, Posttraumatic Stress Disorder, and School Phobia. Due to time constraints, we only used the GAD subscale, consisting of 9 items. Bodden et al. (2009) found that the mean sum-score from a sample of control children from a general population was 3.7 (SD = 3.2) and that the mean sum-score for a clinical group of children was 7.8 (SD = 4.5) Internal consistency as well as test-retest reliability of the original GAD subscale (α = .80, r = .68) were satisfactory (Muris et al., 2007), and the scale validly identified children with the diagnosis GAD (Bodden et al., 2009). In this study, internal consistency was also satisfactory (α = .81).

2.3. Procedure

The children first performed the AIT as a group in their regular classroom environment. In each class, the experimenter read the instructions aloud, depending on the version of the AIT. Next, the children listened to the 56 word blends that were presented on a laptop with external sound speakers, so that all children were able to hear the words clearly. Directly following the AIT, the children filled out the GAD subscale of the SCARED.

3. Results

3.1. Descriptives

3.1.1. Auditory interpretation task (AIT)

First, we excluded all incorrect answers (i.e. endorsed words that were neither of the two words used in the word blend; see also Table 2. As expected, children who performed the open-ended versions made significantly more mistakes (26.2%) than children who performed the multiple-choice version (0.5%), F (1,664) = 2426.4, $p < .001$. Next, we calculated percentages in which children wrote down the emotional words from each category, separately for the AIT-multiple-choice version and the AIT-open ended version. The higher the percentage, the more often children chose the emotional words (see Table 2, for the percentages per category). An independent-samples t-test with Version of the AIT as independent variable and Age as the dependent variable revealed no significant difference on age between the two versions of the AIT t (655) = < .001, p = .24. A chi-squared test also revealed no gender differences between the two versions X^2 (1, N = 666) = .03, p = .88.

3.1.2. SCARED GAD-subscale

The mean sum score on the GAD subscale of the SCARED was 4.08 (SD = 3.59; min = 0, max = 17). To map possible influences of gender on the GAD subscale, we calculated an ANOVA with the GAD subscale as dependent variable and Gender as independent variable. There was an effect of gender, F (1,662) = 35.50, $p < .001$, because girls (M = 4.93, SD = 3.81) scored significantly higher than boys (M = 3.26, SD = 3.16). To map possible influences of age, we calculated a correlation between age and the GAD subscale, but we did not find a significant correlation ($r = -.008$, $p > .1$).

3.2. Correlations

Correlations between the GAD subscale of the SCARED and the AIT responses were computed separately for each version of the AIT. All correlations were controlled for gender, because of the effects of gender on the GAD subscale of the SCARED.[1]

3.2.1. AIT multiple-choice version

As expected, the mean score on the GAD-related words of the AIT correlated significantly with the SCARED-GAD subscale, r = .17, p = .002. Children with a higher level of self-reported level of GAD symptoms chose the GAD-related words significantly more often than children with lower levels of GAD symptoms. As expected, the SCARED-GAD subscale did not correlate significantly with the other emotional categories of the AIT (negatively-valenced fear-related words: $r = -.03$, *n. s.*; positive words: r = .06, *n. s.*). Thus, children with symptoms of GAD did not choose the negatively-valenced fear-related words of the AIT more often, nor did they have a general tendency to always choose the neutral words. This indicates that the negative interpretation of children with a higher GAD score on the self-reports was exclusive to GAD-related words.

Table 2
Percentages, standard deviations, minimum and maximum chosen emotional words, and percentages of incorrect answers for all categories of the AIT, separately for the multiple-choice version and the open-ended version.

	AIT Multiple-choice				
	Mean[a]	*SD*	*Min*	*Max*	*Incorrect*[b]
GAD words	54.3%	7.6%	34.3%	74.3%	0.3%
Neg. valanced fear	63.5%	12.0%	27.3%	90.9%	0.8%
Pos. valenced words	45.2%	15.0%	10.0%	80.0%	0.6%
	AIT Open-ended				
	Mean[a]	*SD*	*Min*	*Max*	*Incorrect*[b]
GAD words	49.7%	10.4%	17.1%	77.1%	23.4%
Neg. valanced fear	42.7%	12.7%	9.1%	81.8%	39.3%
Pos. valenced words	27.1%	14.9%	0.0%	70.0%	21.2%

[a] The higher the percentage, the more often the emotional words were chosen.

[b] Percentages of incorrect answers, i.e. children did not choose any of the blended words.

3.2.2. AIT open-ended version

The mean score on the GAD-related words of the AIT did not correlate significantly with the SCARED-GAD subscale ($r = -.07$, *n. s.*). Children who reported higher levels of GAD did not significantly write down more often the GAD-related words than children with lower levels of GAD symptoms. The SCARED-GAD subscale did not correlate with the negatively-valenced fear-related words, ($r = -.06$, *n. s.)* or the positive words of the AIT ($r = -.05$, *n. s.*). This indicates that children with a higher GAD score did not report more often hearing the emotional words on GAD-related or negatively-valenced fear-related words of the AIT, nor did they have a general tendency to always write down neutral words when compared to the children with lower levels of GAD.

4. Discussion

The aim of this study was to investigate whether children with varying levels of Generalized Anxiety Disorder (GAD) symptoms display a content-specific interpretation bias for GAD-related words using a novel auditory word-blend task: The AIT. As expected, children with higher levels of GAD chose the GAD-related words significantly more often than children with lower levels of GAD did. Moreover, children with higher levels of GAD did not choose the negatively-valenced fear-related words or positively-related words significantly more often than children with lower levels of GAD. However, this significant relation between self-reported GAD and the number of chosen GAD-words was not found with the open-ended version. These results suggest that children with GAD symptoms may display an interpretation bias for content-specific materials only, and not for negatively-valenced fear-related or positive materials in general, but also that the results depend on the research method that is used to assess interpretation bias in the AIT.

To the best of our knowledge, this study is the first to provide some preliminary support for the content-specificity of an interpretation bias in children with varying levels of GAD symptoms. As the validity and reliability of the GAD diagnosis in children is often questioned (e.g., Andrews et al., 2010), it is remarkable that we found some evidence for a specific interpretation bias in children with varying levels of GAD symptoms. However, it should be kept in mind that the relation between self-reported GAD symptoms and GAD-related words was quite

[1] Multi-level analyses were performed to nest the data within classroom and school. The two nested variable showed almost no variance and were non-significant (all p-values > .1). As the results were also identical to the correlations, we decided to report the correlations only.

weak (r = .17). Moreover, we only included negatively-valenced fear-related blends to test for content-specificity besides the GAD-related blends, and no blends related to other fears, such as social- or separation-related blends were included. Also, we did not include other self-reported fears, for example, to test whether socially anxious children also display a negative interpretation bias towards GAD-related word blends. Clearly more research is needed before conclusions can be drawn with respect to the content-specificity of GAD.

Interestingly, self-reported fear did not correlate significantly with the open-ended version of the AIT. Also, the significant correlation between the GAD items in the multiple-choice version of the AIT and self-reported fear was low; it explained only 3% of the variance. An explanation for the null-results of the open-ended version may be that children who performed the open-ended version made significantly more mistakes than the children who performed the multiple-choice version. Even though phoneme perception is categorical and one expects listeners to hear only one phoneme, children may need a prompt in order to hear one of the two words. As a result, only the multiple-choice AIT may be suitable for measuring interpretation biases related to fear.

Given the large sample size of this study, we can be quite confident that the correlation of r = .17 observed in the multiple-choice AIT is a fairly accurate estimate of the real link between interpretation bias and self-reported GAD symptoms, rather than a chance finding. However, it raises the question why the link seems to be so weak. An explanation may be that the AIT is a relatively indirect measure compared to, for example, the recognition task or the ambiguous story task. While self-reports (direct measures) tap into more controlled processes related to fear, the AIT (indirect measure) taps into more automatic processes (e.g., Strack & Deutsch, 2004). As a result, one would not expect these two measures to correlate highly with one another. A similar result was reported by Klein, Becker, and Rinck (2011a; 2012), who did not find significant correlations between direct and indirect measures of spider fear at all. In their studies, however, both direct and indirect measures correlated significantly with a behavioral measure of spider approach. Therefore, the addition of a behavioral measure in future studies could further test the usability of the AIT.

Second, another obvious explanation of the small correlation is the very low reliability of both AITs. As a result, the observed correlations only reflect the link between reliably measured self-reported fear and roughly measured interpretation biases. Clearly, more research is needed to improve the reliability of the AIT, which may then also show higher correlations with other measures.

Third, children in this sample varied in their level of GAD, but did not display an anxiety disorder. The fear-related schemata of the fearful children studied here might not be as chronically active as in children with an anxiety disorder. Therefore, interpretation biases might be less visible in fearful children than in children with an anxiety disorder. There are indeed other studies that also report small to moderate effects between interpretation and self-reports in nonclinical children (e.g., Klein et al., 2014; Muris et al., 2000; Schneider, Unnewehr, Florin, & Margraf, 2002). Schneider et al. (2002) for instance, only found biases in children after these children were primed with a video about their mothers' fear. This might also be a reason for the difference between the multiple-choice version and the open-ended version. In the open-ended versions, children were asked to simply write down the word they heard, whereas in the multiple-choice version, they were prompted with four possible endings. This might be seen as some sort of priming, because children read fear-related words on their answering sheet which could have activated their fear network. However, it should be noted that these prompts could also have resulted in a response bias instead of a priming effect. Future research in children varying in their level of fear could therefore focus on (other) priming techniques to activate fear-related schemata. Moreover, studying children with an anxiety disorder might also clarify the role of close-ended versus open-ended measures of interpretation biases in GAD.

A few other limitations of the current study also need to be mentioned. First, the number of items in the GAD category (n = 35) was larger than in the neutral (n = 10) and negative category (n = 11). The AIT that we used in this study was based on the task developed by Dearing and Gotlib (2009). They created two main categories with 20 items each, but divided one of these categories into two subcategories (depressive/fear). This means that the number of words in each category also differed in the number of words. The reason for choosing more words in the GAD category is that we wanted to make sure that the GAD category would be relevant for all children experiencing GAD symptoms. As children with GAD tend to worry about different topics, we decided to include words related to the three topics that are most relevant in GAD (approx. 10 items each). However, the uneven number of words may have caused differences in reliability.

Second, and related to the first limitation, creating words related to GAD is in itself rather difficult, as it is a non-specific fear. We decided to include words related to the three topics most relevant in GAD, but it might well be that these words were not relevant for all children, or also relevant for children with higher levels of other fears (e.g., separation anxiety, social anxiety). Additionally, we included words related to the underlying key process of GAD (e.g., worry), which might be evaluated differently than the non-specific words.

Third, even though we piloted 230 different word blends and only wanted to include 56 final word blends, we were unfortunately not able to include unique emotional words for all categories. For example, the social words of the GAD scale include two similar emotional words both combined with different neutral words. Fourth, the internal consistencies of the different subscales of both tasks were low to moderate, as mentioned above. Unfortunately, this is often seen in studies that use indirect measures related to biased processes (for a discussion, see Brown et al., 2014). Finally, the entire procedure was administered in a classroom setting. Even though we made sure that all children were able to hear all words clearly, this may have impacted the results.

In conclusion, we found that the multiple-choice version of the AIT might be a useful instrument for assessing biased interpretation processes in children with varying levels of GAD symptoms. Furthermore, we also found some evidence for this bias to be content-specific, but the effect was small. Clearly more research is needed to test the usability of the AIT for assessing biased interpretation processes and content-specificity, while improving the reliability of the AIT, including stimuli and self-reports related to other fears and anxieties, and also adding a behavioral measure. Advantages of the AIT include that it measures interpretation bias more indirectly than questionnaires and the “ambiguous scenario” paradigm, and that it does not rely on reaction times.

Conflicts of interest

All authors state that they have no conflict of interest.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.jbtep.2018.06.011.

Appendix B. Overview of all emotional words, separately for each category

GAD_social	GAD_school	Neg-valenced fear-related
chatter (gesprek)	mistake (fout)	anxiety (bang)
ashamed (schamen)	evaluation (rapport)	spiderweb (web)
bullying (pesten)	exam (toets)	danger (gevaar)
public (publiek)	test (toets)	web (web)
blush (blozen)	class (les)	sweat (zweten)
scold (schelden)	fault (fout)	cobweb (rag)
shy (verlegen)	gym (gymmen)	spiders (spinnen)
snitch (klikken)	speech (spreekbeurt)	frightened (bang)
laugh at (uitlachen)	read out loud (voorlezen)	fear (bang)
chat (gesprek)	calculations (sommen)	scare (schrikken)
group (groep)	exercise (gymmen)	silk (rag)
GAD_health	**GAD_general**	**Positively valenced**
dead (dood)	worry (zorgen)	happy (blij)
pain (pijn)	ponder (piekeren)	pretty (knap)
health (gezond)	rumination (zorgen)	sweet (lief)
fall (vallen)	doubt (twijfel)	beautiful (mooi)
needle (spuit)		enjoyment (leuk)
wound (wond)		free (vrij)
dead (dood)		pretty (mooi)
doctor (dokter)		lovely (leuk)
ill (ziek)		neat (knap)
injury (wond)		smile (lach)

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