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Forced choice reaction time paradigm in children with separation anxiety disorder, social phobia, and nonanxious controls

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ABSTRACT

Cognitive distortions refer to cognitive processes that are biased and therefore yield dysfunctional and maladaptive products (e.g., interpretation bias). Automatic aspects of information processing need to be considered and investigating these aspects requires forms of assessment other than self-report. Studies focussing on the specificity of cognitive biases across different types of anxiety disorders in childhood are rare. Thus, a forced choice reaction time paradigm with picture stimuli was used to assess the interpretation bias in anxious children online. The study investigated disorder-specific interpretation bias in 71 children with separation anxiety disorder (SAD), 31 children with social phobia, and 42 children without mental disorders, aged 5–13 years. Results indicated that children with SAD rated ambiguous separation pictures as significantly more unpleasant and more arousing than nonanxious children. However, no support was found that children with SAD and social phobia interpret ambiguous separation or social pictures in a more negative way than nonanxious children. Furthermore, no group differences were found in reaction times to all picture categories.

Cognitive models assume that cognitive phenomena mediate the relationship between experienced events and subsequent emotional responses. Thus, between the situation and the individual's response comes the important step of information processing and cognitive appraisal. Cognitive models of anxiety disorders have postulated that cognitive processes are crucial for the maintenance of anxiety disorders (e.g., Beck, Emery, & Greenberg, 1985; Foa & Kozak, 1986; Williams, Watts, MacLeod, & Mathews, 1997). According to these theories, anxious individuals interpret ambiguous information as threatening and it is this threat bias that maintains their anxious affect.

In order to understand the processes involved in cognitive biases, it is essential to differentiate between online and offline processes (Mathews & MacLeod, 2005). Online refers to interpretations made when encountering current ambiguous information and offline judgments refer to past or future interpretations of ambiguity. Offline judgments do not always reflect and thus cannot inform us about actual online processing of ambiguous information. Offline measures are typically assessed through self-report, where people are asked how they would interpret emotionally ambiguous situations.

So far, research on information processing has primarily focused on offline cognitive processes (Muris & Field, 2008). However, cognitive biases associated with childhood anxiety may be unavailable to conscious awareness (Vasey, Dalgleish, & Silverman, 2003). Therefore, the development of online forms of assessment is necessary (Alfano, Beidel, & Turner, 2002; Daleiden & Vasey, 1997; Vasey & Lonigan, 2000), but is currently very rare (Alfano et al., 2002; Muris & Field, 2008; Schniering & Lyneham, 2007). As yet, two types of measures have been used in investigating the interpretation bias. One approach is the use of homophones (e.g., Eley et al., 2008; Hadwin, Frost, French, & Richards, 1997). In studies using homophones reading abilities are required. Due to problems of individual differences in reading and writing, Hadwin et al. (1997) presented the homophones with words in auditory and visual forms. They found that the level of trait anxiety was associated with threatening interpretation of homographs. However, the use of homophones has limitations, e.g., its reliability, the limited number of homophone words that are age-appropriate, and significant different levels of threat intensity for the negative and neutral/positive interpretations (Eley et al., 2008). The other instrument to assess interpretation bias has been the use of questionnaires or vignettes. These studies found that anxious children and children at risk for anxiety disorders tend to favor threatening

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over nonthreatening interpretations in ambiguous situations (e.g., Barrett, Rapee, Dadds, & Ryan, 1996; Chorpita, Albano, & Barlow, 1996; Schneider, Unnewehr, Florin, & Margraf, 2002). However, Alfano, Beidel, and Turner (2002) mentioned in their review that negative cognitions are not consistently associated with clinically anxious children (e.g., Beidel, 1991; Kendall & Chansky, 1991). Bögels and Zigterman (2000) did not find significant differences between children with anxiety disorders and healthy children and Eley et al. (2008) found that correlations between interpretation of ambiguous situations, anxiety, and depressive symptoms were stronger in depression than anxiety, when controlling for the other disorder.

Contrary to studies with children, experimental tasks have frequently been employed in adult research to investigate the automatic manifestations of interpretation bias (see Harvey, Watkins, Mansell, & Shafran, 2004). For example, Hirsch and Mathews (1997, 2000) investigated an online interpretation bias in social phobia using narrative texts (Hirsch & Mathews, 1997) and a lexical decision task (Hirsch & Mathews, 2000). Both studies found no support for the hypothesis that social anxious individuals favor a negative interpretation of ambiguous stimuli in these online tasks. Similarly, McNally, Otto, Hornig, and Deckersbach (2001) found no evidence that the influence of strategic and automatic processing is stronger for completing threat stems than nonthreat stems in panic patients compared to healthy control participants when using a stem completion task involving threatening, positive, and neutral material.

In the adult literature, interpretation bias is usually investigated for disorder specificity. Studies suggest that interpretation biases are content-specific (e.g., Foa, Franklin, Perry, & Herbert, 1996; Voncken, Bögels, & de Vries, 2003). However, in childhood anxiety research, most studies have investigated groups of mixed anxiety disorders without differentiating between specific subtypes (e.g., Barrett et al., 1996; Bögels & Zigterman, 2000; Chorpita et al., 1996), or content-specificity was only a side focus (Bögels, Snieder, & Kindt, 2003; Dalgleish et al., 2003; Muris et al., 2000). Bögels et al. (2003) found evidence for content-specificity only for SAD, but not for GAD, while no evidence for content-specificity could be found among children with GAD and PTSD (Dalgleish et al., 2003; Muris et al. (2000). As a result, it remains unclear whether cognitive biases among anxious children are specific to the type of anxiety disorder experienced.

One major weakness of studies on cognitive bias in childhood anxiety is that the material used was often not developed for investigating disorder-specific interpretation bias and since most methods were originally developed for adults, no reliability and validity data for children have been established (e.g., Bögels et al., 2003; Dalgleish et al., 2003; Muris et al., 2000). Few studies have systematically investigated the psychometric properties of the questionnaires or other measures of interpretation bias utilized in their studies (e.g., Muris, Jacques, & Mayer, 2004; Schneider, In-Albon, Rose, & Ehrenreich, 2006), which is an essential prerequisite for a solid investigation of disorder-specific interpretation bias. Another weakness of existing measures is that the currently used methods often include words, which require an ability to read. Thus, there is need for studies using language-free methods when investigating preschool children.

In this study, we focused on children with separation anxiety disorder (SAD) and social phobia. Children suffering from SAD have excessive and unrealistic fears of being separated from an attachment figure (Schneider & In-Albon, 2004). SAD is one of the most common anxiety disorders in childhood, and one of the earliest emerging (Cartwright-Hatton, McNicol, & Doubleday, 2006; Kessler et al., 2005). SAD is also a risk factor for various mental disorders in adulthood (Brückl et al., 2007; Lewinsohn, Holm-Denoma, Small, Seeley, & Joiner, 2008). The key feature of social phobia is a marked and persistent fear of situations in which the person feels that he or she is the focus of attention or evaluation by others. SAD and social phobia were selected for this study because these anxiety disorders are common in childhood and can be represented pictorially.

In summary, interpretation bias toward threat in anxious children is supported by several offline studies (e.g., Barrett et al., 1996; Chorpita et al., 1996). The focus of the present study was to investigate interpretation bias among children with SAD, social phobia, and nonanxious children using an online measure. A forced choice reaction time (FCRT) paradigm using pictorial stimuli was used to reflect online associations. We showed children separation and social phobia relevant photographs representing non-ambiguous and ambiguous situations. The child was shown one picture at a time and had to press a response button as quickly as possible indicating whether the picture represented a departure/arrival situation or a popular/unpopular child, respectively. Children's responses and reaction times were measured. We hypothesized that compared to nonanxious children, children with SAD and social phobia would choose more threatening interpretations when viewing ambiguous situations. According to the fear network theory, faster reaction times in clinical anxious children would be expected compared to nonanxious children.

Method

Participants

144 children took part in this experiment. Participants were 71 children with a primary diagnosis of SAD (37 girls and 34 boys), 31 children with a primary diagnosis of social phobia (15 girls and 16 boys), and 42 nonanxious children (20 girls and 22 boys). Mean age of the children with SAD was 8.73 years ($SD = 2.35$, Range = 5–13), and children with social phobia had a mean age of 8.9 ($SD = 2.21$, Range 5–13). Nonanxious children had a mean age of 9.26 ($SD = 1.96$, Range 5–13). There were no group differences in age, $F(2, 141) = .76$, $p = .47$, or gender, $F(2, 141) = .13$, $p = .88$. The children were recruited for a cognitive-behavioral treatment study of SAD at the University of Basel, Switzerland. Nonanxious children were paid for participation. Children with an anxiety disorder received free treatment. In addition, 22 of these children (10 SAD, 12 social phobia) were recruited at Macquarie University in Sydney. The Basel and Sydney samples did not differ significantly regarding age, $t(142) = 1.84$, $p = .07$, and gender, $t(142) = .68$, $p = .50$. The sample size provided 99% power to detect a medium effect size (Cohen's $d = .50$).

To examine the children's current or past DSM-IV diagnoses, we conducted separate structured interviews with each child and it's parents (i.e., either the mother or father or both together) using the *Diagnostic Interview for Mental Disorders in Children and Adolescents* (Kinder-DIPS; Schneider, Unnewehr, & Margraf, 2009) for the German-speaking sample and the *Anxiety Disorders Interview Schedule* (ADIS for DSM-IV; Silverman & Albano, 1996; see below) for the Sydney sample. Diagnoses were based on composite information from the two separate interviews. In both interviews, children are assigned a principal diagnosis, representing the most distressing/interfering current problem, and any additional diagnoses for which they meet criteria. Of the children who met criteria for a principal clinical separation or social anxiety disorder, 10 (9.8%) had a co-principal diagnosis (specific phobia, oppositional disorder, insomnia), 46 (45.1%) and 13 (12.7%) met criteria for one or two additional clinical disorders (specific phobia, oppositional disorder, insomnia), respectively. Children with a principal diagnosis of SAD and a co-principal diagnosis of social phobia were not included in the study ($n = 3$). The nonanxious control group never experienced any mental disorder when assessed with the Kinder-DIPS.

Procedure

Children and their parents gave written consent to participate in the research project, approved by the Ethics Committee of Basel, Switzerland and by the Ethics Review Committee at Macquarie University, Sydney, which informed them of the child's right to withdraw at any time. No child withdrew from participation. Children were tested individually in a quiet room with the assistance of a graduate student.

Measures of clinical status

Anxiety Disorders Interview Schedule, Child and Parent Versions (ADIS-IV-C/P; Silverman & Albano, 1996). The ADIS-C/P is a semi-structured clinical interview for the diagnosis of childhood anxiety and related disorders with established psychometric properties (Silverman, Saavedra, & Pina, 2001; Wood, Piacentini, Bergman, McCracken, & Barrios, 2002), including good inter-rater reliability in the center where this study was conducted (SAD: kappa = .89; social phobia: kappa = .82; Lyneham, Abbott, & Rapee, 2007).

Kinder-DIPS (Schneider et al., 2009). The Kinder-DIPS, which is in German, is very similarly organized as the ADIS. However, it covers some additional disorders (e.g., elimination disorders, sleep disorders). In addition, it assesses all anxiety disorders, depression, attention-deficit hyperactivity disorder, oppositional defiant disorder, and eating disorders. Studies with the Kinder-DIPS have shown a good validity and reliability for anxiety disorders and other axis I disorders (SAD: kappa = .85; social phobia: kappa = .74; Adornetto, In-Albon, & Schneider, 2008).

Questionnaires

Child questionnaires

Short versions of widely used anxiety and depression self-report questionnaires were empirically developed and evaluated in a German-speaking sample (Scalbert, In-Albon, & Schneider, 2006) and used instead of full length questionnaires. The *Revised Children's Manifest Anxiety Scale* (RCMAS; Reynolds & Richmond, 1978; German version: Boehnke, Silbereisen, Reynolds, & Richmond, 1986) is a self-report measure to assess manifest anxiety. The short version of the RCMAS used in this study consisted of 6 items, of which the sum of the individual "yes" or "no" responses was calculated to yield a total anxiety score. The test–retest reliability of the German RCMAS short version was .74 (Boehnke et al., 1986) and Cronbach's alpha for the German short version was .67. The *Children's Depression Inventory* (CDI; Kovacs, 1981; German version: DIKJ, Stiensmeier-Pelster, Schürmann, & Duda, 2000) is a self-report measure of depression for children and adolescents. The CDI used in this study included 10 items related to the cognitive, affective, and behavioral signs of depression. Each item has a range of three choices. Children were told to choose the choice that best characterizes them during the past 2 weeks. The German short version of the CDI had an internal consistency of .76.

Furthermore, as a disorder-specific measure, the children completed the *Separation Anxiety Inventory for children* (SAI-C; Scalbert et al., 2006). The SAI-C is a questionnaire consisting of 12 items assessing the degree of avoidance of different separation situations. The stem of each item is "Because I am anxious, I avoid… e.g., going to school, sleep in my own bed." The SAI-C had an internal consistency of .85, test–retest reliability of .84 and good construct validity (Scalbert et al., 2006). The SAI-C was developed and evaluated only as a German version and therefore not used in the Sydney sample.

In addition, 5 items (SAD items) were chosen from the separation subscale of the *Spence Children's Anxiety Scale* (SCAS; Spence, 1998; German version: Essau, Muris, & Ederer, 2002) to assess separation anxiety. Each item was rated on a 4-point scale in terms of its frequency from "never" (1) to "always" (4). Internal consistency of the SCAS subscale was .66. Social anxiety was assessed with 5 items (SOC items) of the *Social Anxiety Scale for Children* (SASC; La Greca, Dandes, Wick, Shaw, & Stone, 1988; German version: Melfsen & Florin, 1997). The SASC is designed to assess anxiety in children in relation to social interactions. To remain consistent with the scale used in the SCAS, children were asked to respond to various statements using a 4-point scale (1 = not at all true to 4 = always true). Internal consistency of the SASC subscale was .59.

Parent questionnaires

The *Separation Anxiety Inventory for parents* (SAI-P; Brugger, Schneider, & In-Albon, 2006) was used as a parent-completed measure. In accord with the child version, the questionnaire consists of 12 items assessing the degree of the child's avoidance of different separation situations. Internal consistency of the current sample was .88. In addition, the *Revised Children's Manifest Anxiety Scale-Parent version* (RCMAS-P; Pina, Silverman, Saavedra, & Weems, 2001; German version: Schneider, Adornetto, & Blatter, 2004) was used as a parent-completed measure consisting of 37 items. Parents were asked to rate anxious symptoms in their children. The stem of each item on the RCMAS was changed from "I…" to "My child…". Internal consistency of the German version and the current sample for the total anxiety scores and lie scores were .86 and .77, respectively. The parent questionnaires were not assessed in the Sydney sample.

Children's state anxiety

Because high levels of state anxiety are associated with increased threat perception and lower threat thresholds (MacLeod, 1990; Muris, Rapee, Meesters, Schouten, & Geers, 2003), we assessed children's level of state anxiety before and after the paradigm. Using paper and pencil, each child indicated his or her current anxiety on a 0–10-point Likert scale ranging from "not at all anxious" to "very anxious". The purpose was to allow judging whether experimental effects might have been affected by state anxiety differences.

Stimuli

A match between stimuli and the specific anxiety disorder is recommended by Mogg and Bradley (1998) and Öhman, Flykt, and Esteves (2001) for research on biased cognitions in anxiety. Therefore, as we investigated children with SAD and social phobia, there was need for separation and social phobia related pictures. Pictures were used since anxious children are often in preschool and may therefore have no or only limited reading abilities. Color photographs representing separation and social phobia relevant situations were developed and empirically validated in a previous study with unselected school children (In-Albon, Klein, Rinck, Becker, & Schneider, 2008). Separation situation pictures depicted arrival and departure situations between a mother and a child and social situation pictures depicted social interactions between children. Pictures consisted of three different types of separation situations (departure, arrival, ambiguous departure/arrival) and social situations (popular, unpopular, ambiguous popular/unpopular). Girls and boys had separate sets of gender specific pictures. Fig. 1 presents an example of the separation situation pictures and Fig. 2 presents an example of the social situation pictures. All pictures had a size of 600 × 450 pixels and were presented on a computer screen with a resolution of 1024 × 768 pixels. Results of the prior study confirmed the content-specificity of the material (In-Albon et al., 2008).

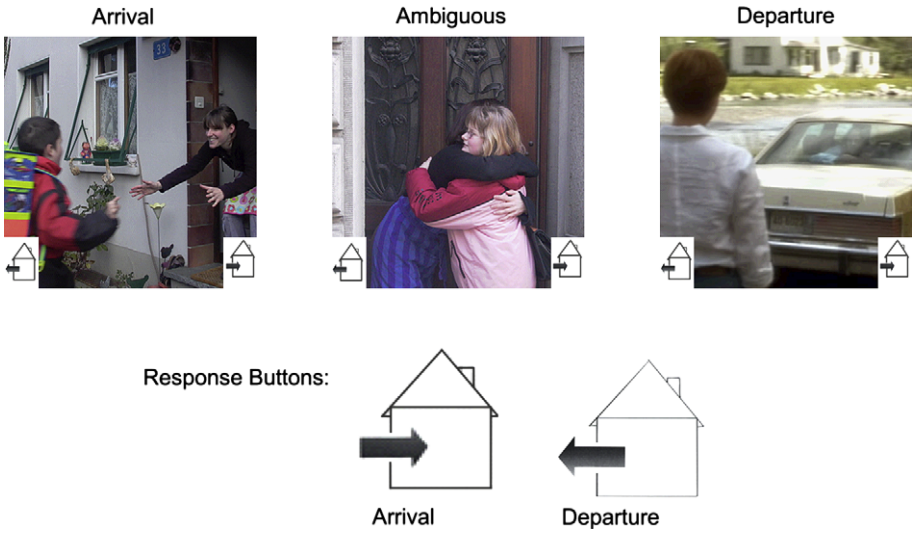

Fig. 1. Separation related pictures (arrival, departure, ambiguous) and response buttons.

Forced choice reaction time paradigm

A fixation cross in the center of a white screen was presented for 500 ms. The child was shown one picture at a time and was asked to press one of two response buttons (departure or arrival and popular or unpopular, respectively) as quickly and as accurately as possible to indicate whether the picture represented a departure/arrival situation or a popular/unpopular child. Response buttons for arrival displayed a house with an arrow leading into it; an arrow leading out of the house indicated departure. The symbol for popular displayed a group of figures all standing together, unpopular was represented by children standing together except for one standing alone (see Figs. 1 and 2).

The child was asked to categorize 8 ambiguous pictures and 6 non-ambiguous pictures into each of the two categories (departure or arrival; popular or unpopular). The pictures within each category were presented to each child in random order. The dependent variables were the frequency of chosen category and reaction time. There were 4 practice trials to familiarize the child with the response buttons, which were positioned next to each other on the keyboard and which the child was instructed to press with the index finger of the dominant hand. During the practice trials, simple and decision reaction times (Jerger, Martin, & Pirozzolo, 1988) were recorded to control for individual reaction time differences. Simple reaction time was assessed by having the children press the space button as soon as a picture of an apple appeared on the computer screen. The decision reaction task consisted of pictures illustrating fruits or other foods. The experiment was created and run using the E-Prime 1.1.3 software package (Psychology Software Tool, Inc., Pittsburgh, USA). To evaluate the paradigm and its feasibility, the paradigm was investigated in an unselected school sample of 265 children (In-Albon et al., 2008). The paradigm demonstrated good internal consistency and construct validity.

Ratings of photograph content, valence, and arousal

After the FCRT, each child rated the set of 28 pictures with regard to their category (e.g., arrival/departure; popular/unpopular) with paper pencil and without time pressure, as was done during the

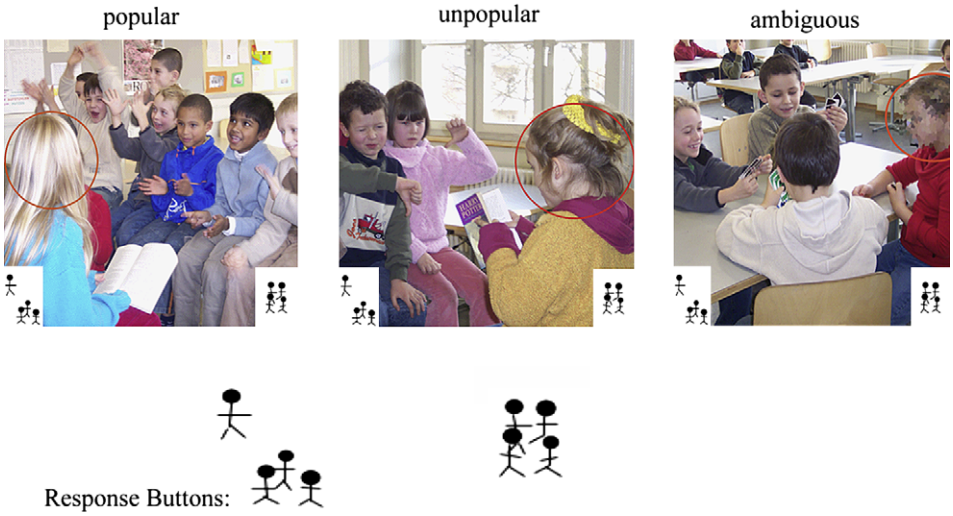

Fig. 2. Social related pictures (popular, unpopular, ambiguous) and response buttons.

Table 1
Means and range of anxiety and depression measures, group differences, and state anxiety pre- and post-test for children with SAD, social phobia (SoP), and nonanxious children (NC).

Questionnaire	Range	(1) SAD M (SD)	(2) SoP M (SD)	(3) NC M (SD)	*F* test	Comparisons
SAI-C	0–48	22.25 (9.35)	15.54 (6.12)	8.04 (10.27)	$F(2,85) = 19.64^{**}$	1 > 2 > 3
SAI-P	0–48	26.79 (9.55)	20.08 (8.3)	8.92 (10.09)	$F(2,87) = 29.11^{**}$	1 > 2 > 3
RCMAS-C	6–12	8.13 (1.73)	9.04 (1.66)	7.74 (1.81)	$F(2,97) = 3.81^{*}$	1, 2 > 3
RCMAS-P	0–37	13.08 (5.55)	9.92 (3.84)	6.78 (5.85)	$F(2,86) = 11.08^{**}$	1, 2 > 3
SOC Items	5–20	9.52 (2.87)	11.59 (2.87)	7.94 (2.34)	$F(2,74) = 7.67^{**}$	2 > 1 > 3
SAD Items	5–20	11.55 (3.49)	10.41 (3.34)	7.44 (2.18)	$F(2,74) = 10.38^{**}$	1 > 2 > 3
CDI	0–30	7.2 (4.82)	10.32 (5.75)	2.2 (2.19)	$F(2,93) = 22.74^{**}$	1, 2 > 3
State anxiety pre	0–10	1.60 (2.22)	1.50 (1.72)	.24 (.58)	$F(2,139) = 8.32^{*}$	1, 2 > 3
State anxiety post	0–10	.51 (1.28)	.43 (1.01)	.05 (.22)	$F(2,140) = 2.80$	

Note. SAI-C = Separation Anxiety Inventory, Child version; SAI-P = Separation Anxiety Inventory, Parent version; SAI-C/P and RCMAS-P were only assessed in the Basel sample. RCMAS-C = Revised Children's Manifest Anxiety Scale, Child version; RCMAS-P = Revised Children's Manifest Anxiety Scale, Parent version; CDI = Children's Depression Inventory; SOC = 5 items on social phobia; SAD = 5 items on SAD. Multiple comparison procedure (Bonferroni) was conducted at $^{*}p < .05$. $^{**}p < .001$.

pre-study. Children were asked to indicate to what extent each picture displayed an arrival/departure situation (for the separation anxiety related pictures) or a popular/unpopular child (for the social phobia related pictures), using a 9-point Likert scale ranging from "1 = definite arrival" to "9 = definite departure", or "1 = really popular" to "9 = really unpopular", respectively. Furthermore, valence and arousal associated with the viewing of each picture was measured using the Self-Assessment Manikin, a pictorial 9-point scale (SAM; Bradley & Lang, 1994) ranging from "1 = very pleasant" to "9 = very unpleasant", and "1 = very excited" to "9 = very calm", respectively.

Data reduction and analysis

The data from each participant were initially screened for outliers. Reaction times smaller than 300 ms were excluded in order to eliminate anticipatory responses. Furthermore, reaction times larger than three standard deviations above each individual *z* score were eliminated. In total, 1.4% of reaction times were removed. Data were analyzed using analysis of variance (ANOVA) for unrelated samples, with condition (response, reaction time, picture rating, valence and arousal rating, pre-post state anxiety) as the independent variable. Post-hoc Bonferroni-corrected contrasts were computed to assess the direction of the differences.

Results

Group characteristics

Presented in Table 1 are the mean scores of children with SAD, social phobia, and nonanxious children on the various questionnaire measures. There were significant group differences in children's self-report and parent reported anxiety and depressive symptoms. Follow-up comparisons showed that children with anxiety disorders scored significantly higher on the child and parent questionnaires compared to nonanxious children. Children with SAD scored highest on the disorder-specific SAD questionnaire, and children with social phobia scored highest on the SOC questionnaire.

State anxiety

State anxiety of the three groups before and after the FCRT paradigm is presented in Table 1. Analyses of variance (ANOVA) showed significant group differences in pre-test state anxiety, $F(2, 139) = 8.32$, $p < .01$. Post-hoc Bonferroni-corrected contrasts revealed a significant higher pre anxiety score for children with SAD and social phobia compared to nonanxious children (p's $< .01$). However, state anxiety was low in both clinical groups (SAD: $M = 1.6$ ($SD = 2.22$), social phobia: $M = 1.5$ ($SD = 1.72$), Range: 0–10). At post-test, state anxiety did not differ significantly between the groups, $F(2, 140) = 2.79$, $p = .06$.

Forced choice reaction time paradigm

Forced choices

Table 2 shows the results of the three groups during the FCRT paradigm. No significant group effects were found for the ambiguous separation and social related pictures (ambiguous separation: $F(2, 129) = 1.44$, $p = .24$; ambiguous social: $F(2, 129) = .23$, $p = .79$). Of the children with SAD, 46.21% chose departure for the ambiguous separation pictures compared to 45.72% of nonanxious children. Of the children with social phobia, 36.16% chose unpopular for ambiguous social pictures compared to 32.24% of nonanxious children. As hypothesized, children categorized the non-ambiguous pictures in the expected manner. Arrival, departure, popular, and unpopular pictures were assigned to the correct category in at least 79% of cases.

Reaction times

Reaction times are shown in Table 3. No significant group differences in simple reaction times, $F(2, 97) = 2.19$, $p = .12$ and in

Table 2
Percent (standard deviation) of the forced choices of children with SAD, social phobia, and nonanxious children for the indicated picture category.

	SAD	Social phobia	Nonanxious children	*F*(2,129)
Arrival	90.40% (19.18)	95.24% (11.88)	93.86% (13.1)	1.08, $p = .34$
Departure	80.30% (28.63)	79.76% (29.17)	83.33% (21.57)	.19, $p = .82$
Popular	79.29% (27.28)	83.33% (27.96)	85.96% (22.77)	.82, $p = .44$
Unpopular	83.84% (26.31)	89.29% (22.32)	89.47% (19.15)	.91, $p = .40$
Ambiguous separation- departure	46.21% (21.59)	54.46% (24.82)	45.72% (25.21)	1.44, $p = .24$
Ambiguous social- unpopular	33.99% (20.51)	36.16% (26.64)	32.24% (24.77)	.23, $p = .79$

Note. High percentages of the non-ambiguous pictures indicate that children categorized them in the expected manner. For the ambiguous separation picture the percentage of departure choices and for ambiguous social pictures the percentage of unpopular choices are provided.

Table 3
Mean reaction times (standard deviation) in milliseconds for the picture categories of children with SAD, social phobia, and nonanxious children.

	SAD	Social phobia	Nonanxious children
Arrival	2143.16 (883.35)	2270.59 (1350.69)	2212.27 (1199.83)
Departure	3205.90 (1900.31)	2774.19 (1356.72)	2605.21 (1478.6)
Popular	2817.88 (1439.93)	2848.82 (1356.35)	2718.59 (1545.09)
Unpopular	2936.18 (1851.07)	2916.06 (1877.52)	2684.58 (1657.30)
Ambiguous separation – arrival	2487.02 (1174.71)	2391.87 (1123.96)	2585.16 (1123.21)
Ambiguous separation – departure	2898.85 (1497.08)	2814.25 (1546.79)	2691.13 (1137.77)
Ambiguous social – popular	2756.41 (1535.56)	2572.24 (1074.23)	2862.88 (1825.02)
Ambiguous social – unpopular	3335.44 (2180.86)	3033.40 (1949.63)	3304.71 (1635.37)

Note. All group differences were non-significant when controlling for age.

decision reaction times, $F(2, 48) = .85$, $p = .43$ were found. Age showed a significant covariation in the reaction times of all picture categories (p's $< .01$), in that younger children showed slower reaction times than older children, regardless of the pictures category (p's $< .01$). However, no significant group differences were found in the forced choice reaction times (p's $> .45$) when controlling for age.

Ratings of photograph content, valence, and arousal

Group means and standard deviations for valence, arousal, and picture ratings are presented in Table 4. The validity of the pictures was confirmed: children rated the pictures correctly in the hypothesized manner. Ratings of non-ambiguous pictures across all groups was 1.42 for arrival, 1.78 for popular, 7.84 for departure, and 8.21 for unpopular. Ambiguous pictures lay in between with a mean of 5.23 for ambiguous separation and 4.38 for ambiguous social pictures (Ratings: 1 = definitely arrival/popular, 9 = definitely departure/unpopular). There were no significant group interactions for the ratings of the pictures (p's $> .12$).

Valence and arousal ratings indicated that the pictures elicited different emotional responses in the three groups. As can be seen in Table 4, both groups of anxious children rated the valence of arrival, $F(2, 138) = 3.11$, $p = .04$, and popular pictures, $F(2, 138) = 3.69$, $p = .03$, as significantly more unpleasant than nonanxious children. Group differences on the other valence and arousal ratings of the non-ambiguous pictures were not significant. A significant group difference was found for the valence, $F(2, 138) = 3.10$, $p = .04$, and arousal, $F(2,138) = 7.40$, $p < .01$, of the ambiguous separation related pictures. Post-hoc Bonferroni-corrected contrasts indicated a significant difference, in that children with SAD rated these pictures as more unpleasant ($p = .04$) and arousing ($p < .01$) than nonanxious children. The group difference regarding the valence of the ambiguous social related pictures approached significance $F(2, 137) = 2.96$, $p = .06$). However, there was a significant group difference in arousal when viewing ambiguous social related pictures, $F(2, 137) = 4.27$, $p = .02$). Post-hoc Bonferroni-corrected contrasts revealed that children with SAD were significantly more aroused than nonanxious children ($p = .02$).

Discussion

The aim of this study was to investigate online information processes in children with SAD, social phobia, and nonanxious children using an FCRT paradigm with disorder-specific pictures as stimuli. Results indicated that children with SAD and social phobia did not interpret ambiguous disorder-specific pictures in a negative way more often than nonanxious children. However, children with SAD rated these pictures as more unpleasant and more arousing than nonanxious children. No differences were found in the reaction times between the groups. In line with results of the previous study with school children (In-Albon et al., 2008), the picture rating indicated that the pictures triggered an emotional state. The ratings of the pictures confirmed that the majority of the children, independent of age, were accurate at identifying non-ambiguous separation and social pictures. Furthermore, valence and arousal ratings indicated that pictures defined as positive (arrival and popular) were rated as more pleasant and relaxing than pictures defined as negative (departure and unpopular). The unpleasantness of the departure picture was only mildly threatening.

Several explanations are offered for why no interpretation bias could be found in clinically anxious children even though the material elicited arousal and was rated as unpleasant. One explanation could be that the pictures were not threatening enough and thus did not elicit cognitive distortions. It is also assumed that one reason for lack of cognitive biases is low state anxiety (Mogg & Bradley, 2004). State anxiety, which was assessed before and after the paradigm, was low in both clinical samples (<2, Range 1–10) and displayed little variance ($SD < 2.22$).

A second explanation may be that anxiety disorders in children are not as chronic as in anxious adults, since children are likely to be closer in age to the onset of the disorder. Using Foa and Kozak's (1986) emotional processing model, one might assume that anxious children may not yet possess elaborated fear networks and

Table 4
Means (standard deviation) of valence, arousal, and picture ratings for children with SAD (1), social phobia (2), and nonanxious children (3) and group comparisons (C).

	Valence			C	Arousal			C	Category rating		
	(1)	(2)	(3)		(1)	(2)	(3)		(1)	(2)	(3)
Arrival	2.23 (1.65)	2.05 (1.17)	1.56* (1.02)	1, 2 > 3	7.75 (1.63)	7.52 (2.26)	8.4 (1.61)		1.36 (1.06)	1.73 (1.7)	1.31 (.79)
Departure	4.48 (2.64)	3.73 (2.27)	3.37 (2.37)		7.33 (1.97)	6.96 (2.18)	7.91 (1.81)		7.61 (1.91)	7.97 (1.59)	8.13 (1.41)
Popular	2.54 (1.84)	2.41 (1.31)	1.74* (1.07)	1, 2 > 3	7.72 (1.81)	7.73 (1.8)	8.42 (1.08)		2.08 (1.66)	1.51 (1.02)	1.5 (1.06)
Unpopular	4.97 (2.6)	4.5 (2.53)	4.02 (2.64)		7.27 (1.87)	7.34 (1.85)	7.98 (1.72)		7.99 (1.98)	8.36 (1.23)	8.45 (1.08)
Ambiguous separation	3.51* (1.89)	3.08 (1.61)	2.66 (1.63)	1 > 2 > 3	7.26** (1.7)	7.31 (1.96)	8.39 (1.1)	1,2 < 3	4.94 (1.82)	5.69 (1.67)	5.36 (1.56)
Ambiguous social	3.62 (1.85)	3.02 (1.7)	2.79 (1.92)		7.43** (1.67)	7.49 (1.8)	8.31 (1.31)	1,2 < 3	4.20 (1.76)	4.37 (1.99)	4.69 (1.54)

Note. *$p < .05$, **$p < .01$, indicating significant group difference. Multiple comparison procedure (Bonferroni) was conducted at $p < .05$. Valence: 1 = very pleasant, 9 = very unpleasant; Arousal: 1 = very excited, 9 = very calm; Ratings: 1 = definitely arrival/popular, 9 = definitely departure/unpopular.

that these networks are not chronically activated. Thus, they do not reside in working memory, as is the case with disordered adult patients who constantly dread the next panic attack. This may also be a reason why no differences in reaction times were found other than a significant age effect, in that younger children had higher reaction times on all categories. Therefore, when investigating cognitive biases, these fear networks may have to be initially primed to become activated.

A third explanation could be that the interpretations (departure/arrival; unpopular/popular) offered to the children were not personally salient enough; a more personalized interpretation may be better. This assumption would be supported by findings of Micco and Ehrenreich (2008) who found that anxious children had higher threat perceptions and lower coping expectations in response to personally salient situations but not for non-salient situations. Similarly, Mathews and Mackintosh (2000) showed that the interpretation bias was weaker when the characters were fictional instead of personally relevant. More research is needed to be able to make recommendations for the kind of interpretations that can be offered to children.

Yet another explanation may be that the stimuli manipulated the "wrong" level of interpretation. In other words, anxious children might not differ in their ability to detect the first representation of a stimulus, e.g., they recognize a situation as departure as often as nonanxious children, but rather they may differ at the next level of interpretation, e.g., the meaning of the departure and its consequences. In children with SAD, the departure situation may lead to the thought that they will never see the mother again, whereas nonanxious children may expect the mother to return soon. Therefore, both groups recognize the situation as a departure, as indicated in the ratings, but the groups differ in their interpretation of the meaning of departure. This would correspond to findings indicating that anxious children tend to expect a disproportionate number of negative outcomes (e.g., Chorpita et al., 1996). The FCRT paradigm did not tap into this level of interpretation. Therefore, this conclusion remains to be investigated in future studies.

As mentioned above, it is important to distinguish between online and offline interpretations (Mathews & MacLeod, 2005). So far, research in children has primarily focused on offline cognitive processes (Muris & Field, 2008). Online studies investigating the interpretation bias in anxious children and measures assessing online processes are currently very rare (Alfano et al., 2002; Muris & Field, 2008; Vasey et al., 2003). In adult research, studies using online tasks also found less support for the hypothesis that socially anxious individuals favor a negative interpretation of ambiguous stimuli compared to offline studies (Hirsch & Mathews, 1997, 2000). Similarly, McNally et al. (2001) did not find evidence for their hypotheses that the influence of strategic and automatic processing is stronger for completing threat stems than nonthreat stems in panic patients compared to healthy control participants. Furthermore, cognitive biases may be represented in beliefs, rather than in the selective processing of threat stimuli. More research is warranted to investigate differences between offline and online processes in anxious children to better understand the development of anxiety disorders and to be able to develop more effective treatment strategies than those currently available (In-Albon & Schneider, 2007).

Although the reliability and validity of the pictures were validated in a previous study (In-Albon et al., 2008), the complexity of the pictures may have influenced the investigation of very early information processing. Furthermore, we did not include other types of threatening pictures, e.g., weapons. Although no interpretation bias toward threat was found, the current study benefits from homogenous groups of anxiety disorders and disorder-specific stimuli.

In summary, online studies investigating interpretation bias in anxious children and adults are currently rare and so far show no convincing support for current cognitive theories. Adequate (e.g., age-appropriate) assessment methods in the online assessment of cognitive biases and more online studies are needed before further conclusions can be drawn.

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