The Influence of Animal Fear on Attentional Capture by Fear-Relevant Animal
Stimuli in Children

Allison M. Waters¹ & Ottmar V. Lipp²

¹ School of Psychology, Griffith University, Gold Coast, Australia

² School of Psychology, University of Queensland, QLD, 4072, Australia

Running head:

Attentional capture in fearful children

Address for correspondence:

Allison M. Waters, Ph.D., School of Psychology, Griffith University, Gold Coast,
Australia. Phone: 61-(0)7-5552-8132 Fax: 61-7-(0)7-5552-8056

Email: a.waters@griffith.edu.au

Abstract

The present study demonstrated that pictures of fear-relevant animals, snakes and spiders, presented among backgrounds of other animal stimuli captured attention and interfered in the detection of a neutral target to the same extent in a large sample of unselected children ($N = 81$). Moreover, detection of a neutral target animal was slowed more in the presence of a feared fear-relevant distracter, e.g. a snake for snake fearful children, than in the presence of a not feared fear-relevant distracter, e.g. a spider for snake fearful children. These results indicate attentional capture by phylogenetically fear-relevant animal stimuli in children and the selective enhancement of this effect by fear of these animals. These findings are consistent with current models of preferential processing of phylogenetically prepared threat stimuli and with cognitive models of anxiety that propose an enhancing effect of fear in the processing of fear related stimuli.

Keywords: fear-relevance, visual search, attentional capture, anxiety, children

1. Introduction

Models of fear stimulus processing propose that phylogenetically-based fear stimuli, such as snakes, spiders and angry faces, are processed preferentially because they have long been associated with danger and threat to humans (Mineka and Öhman, 2002). Support for these theories comes from a diverse range of findings, such as preferential learning or retarded extinction after training with fear-relevant stimuli and enhanced responding to fear-relevant stimuli even when not consciously perceived (for a review see Öhman & Mineka, 2001). Strong support also comes from studies employing visual search tasks (e.g., Lundqvist & Öhman, 2005; Öhman, Flykt, & Esteves, 2001; Öhman, Lundqvist, & Esteves, 2001; Fox et al., 2000; Lipp, 2006). For example, Öhman, Flykt, and Esteves (2001) presented unselected adults with arrays of either four or nine pictures that were drawn either from one single category, e.g., all mushrooms, or contained one deviant, e.g., a snake among three flowers, and asked them to make judgments whether the pictures in the array were of the same category or whether a different picture was present. Across three experiments, participants were faster to find a fear-relevant deviant among non fear-relevant backgrounds than vice versa. Results were interpreted as reflecting attentional capture by the fear-relevant deviant in all participants, consistent with models of fear stimulus processing (Mineka & Öhman, 2002).

Cognitive models of anxiety disorders propose that stimuli depicting threat to safety or well-being capture the attention of highly anxious and fearful individuals more readily than in non-anxious controls (e.g., Mogg & Bradley, 1998; Williams, Watts, MacLeod, & Mathews, 1997). The disproportionate allocation of attention to threat stimuli in anxious individuals is considered a component of a maladaptive attempt to regulate negative emotion because it may interfere with habituation, thereby

contributing to the maintenance of fear and anxiety in the long-term (Mogg & Bradley, 1998). Consistent with these theories, Öhman, Flykt, and Esteves (2001) found that adults who were fearful of either snakes or spiders, but not both animals, were faster to detect feared fear-relevant deviants than not feared fear-relevant deviants. Similar findings have been reported in adults with social phobia who displayed a larger advantage in detection of angry/negative faces over happy/positive ones than did controls (e.g., Eastwood et al., 2005; Gilboa-Schechtman, Foa, & Amir, 1999).

The examination of fear stimulus processing in children and of selective attentional capture by fear-relevant stimuli in anxious children lags behind research with adults. However, such research is important for informing theoretical models of fear stimulus processing and the development of phobias and anxiety disorders (e.g., Mineka & Öhman, 2002; Mogg & Bradley, 1998; Rapee, 2001; Williams et al., 2007) because most of these disorders typically onset during childhood (e.g., Schneider, Johnson, Hornig, Liebowitz, & Wiessman, 1992). Thus, the demonstration that various forms of prepared stimuli, such as angry faces, snakes and spiders, are processed preferentially by all children and more so by children who display a specific fear may elucidate processes that contribute to the development of phobias and anxiety in children and/or the continuation of these disorders into adulthood (Vasey & MacLeod, 2001). Moreover, such findings may suggest the need to consider additional treatment methods, such as attention control training (e.g., Wells, 1997), in the treatment of childhood anxiety disorders.

In extension of adult studies that have employed visual search paradigms to assess fear stimulus processing, Hadwin and colleagues (2003) conducted the first study of visual search for threatening (angry), neutral and happy schematic faces in 7 to 10 year old children and assessed the influence of trait anxiety. Hadwin et al. assessed children's reaction-time (RT) to determine the presence and absence of angry, happy

and neutral schematic faces or cartoon drawings amongst background faces with “mixed up” facial features. Children were faster to decide that targets were present than absent and faster to detect angry faces than happy or neutral ones. Moreover, increased levels of children’s trait-anxiety produced significantly shorter RT when an angry face was absent from backgrounds compared with when a neutral or happy face was absent. This contrasts with findings in adults who show facilitated detection of feared targets in fearful adults rather than differences on target absent trials (e.g., Gilboa-Schechtman et al., 1999; Öhman, Flykt, & Esteves, 2001). As participants must decide when to terminate the search on target absent trials, Hadwin et al, (2003) proposed that high trait anxiety may lead to a more rapid decision about the absence of angry faces in order to avoid prolonged attention on threat.

Waters, Lipp and Spence (in press) recently examined visual search for fear-relevant animal stimuli and whether high fear levels influenced children’s search across two experiments. In extension of findings in adults using similar procedures (i.e., Lipp, Derakshan, Waters, & Logies, 2004; Öhman, Flykt, & Esteves, 2001), children were faster to locate snakes and spiders among flowers and mushrooms than vice versa. Children were also faster to determine target absence from arrays of snakes and spiders than of flowers and mushrooms. These results were replicated in a second experiment. Moreover, the slowing in search time to determine target absence among snakes and spiders relative to among mushrooms and flowers was larger in children who were fearful of these animals than in low fearful children. These results suggest that high levels of animal fear may affect children’s ability to disengage attention from feared animals.

Recently, the extent to which performance in the “same/different” task employed by Öhman, Flykt, and Esteves (2001) reflects on attentional capture has been

questioned (e.g., Rinck, Reinecke, Ellwart, Heuer, & Becker, 2005). In the “same/different” task, pictures of fear-relevant animals are presented either as the targets for which participants must actively search or as the backgrounds among which non fear-relevant targets are presented. Thus, the task entails active search conditions. By contrast, attentional capture has been investigated mainly in spatial cueing tasks or in visual search tasks in which attentional capture is present if target detection is slowed in the presence of a task-irrelevant distracter stimulus presented among background stimuli (Folk & Remington, 1998). Thus, attentional capture is a passive attentional process engaged by a task-irrelevant distracter rather than an active attentional process engaged during search for a particular target (Graham, & Hackley, 1991).

Miltner, Krieschel, Hecht, Trippe, and Weiss (2004) employed a search task in which fear-relevant stimuli were used as task-irrelevant distracters. Adult participants were to search for a particular target: a mushroom presented among flowers; a spider presented among flowers; a mushroom presented among flowers and a spider; and a spider presented among flowers and a mushroom. The presence of a spider distracter did not slow detection of the mushroom target in non spider-fearful participants, but did so in spider fearful participants. More recently, Lipp and Waters (2007) conducted two experiments to investigate attentional capture by animal fear-relevant stimuli also under passive attention conditions. In Experiment 1, unselected adults were slower to detect a neutral target animal in the presence of a spider compared with a cockroach distracter and in the presence of a snake compared with a large lizard distracter. This confirmed that phylogenetically fear-relevant animals captured attention specifically and to a greater extent than did other animal stimuli. Moreover, in Experiment 2, detection of a neutral target animal was slowed more in the presence of a feared fear-relevant distracter, e.g. a snake for snake fearful adults, than in the presence of a not feared fear-relevant distracter, e.g. a spider for snake fearful adults. These results indicate preferential attentional

capture that is specific to phylogenetically-based animal fear-relevant stimuli and is selectively enhanced in individuals who fear these animals.

The aim of the present study was to examine attentional capture by fear-relevant animal stimuli in young children and whether the extent of attentional capture is enhanced in children with high levels of snake and spider fear. These aims were investigated using the methodology described in our previous study of attentional capture in adults (Lipp & Waters, 2007). If fear stimuli are processed preferentially across the lifespan, it was expected that children would be slower to detect a neutral target animal (a cat) among backgrounds of other animals (horses, fish and birds) when a distracting fear-relevant animal picture (i.e., a snake or spider) was embedded among the background animal pictures. Moreover, if fear selectively enhances attentional capture by fear-relevant animal stimuli, then target detection in children selectively fearful of one, but not the other fear-relevant animal, would be slower in the presence of the feared fear-relevant animal than in presence of the not feared fear-relevant animal.

2. Method

2.1 Participants

Eighty-one children (51 girls; 30 boys) aged between 9 and 13 years ($M=11.02$; $SD=0.86$) participated. They were recruited from a local primary school following education department and school principal approval and parental written consent. This represented a 30% response rate from children initially invited to participate.

Sixty-six percent of children lived with biological parents who were married; 15% with a biological parent who was divorced or separated; 13% with biological parents who never married; 4% with a biological parent in a de facto relationship; and 1% with a widowed parent. Ninety-five percent of children were born in Australia,

3% were born in New Zealand, 1% in the Solomon Islands, and 1% in Sudan. All children spoke English as their first language. Seventy-five percent of mothers and 88% of fathers were employed in the workforce. Mean scores of 4.5 for mothers and 4.01 for fathers on the Daniel Prestige Scale (Daniel, 1983) a measure of Australian occupational prestige (range 1 = high; 7 = low), indicated children came from average income Australian families. All children were reported by parents to be free from learning disabilities, organic brain damage, psychiatric disorders and vision and motor impairments.

2.2 Apparatus and Stimuli

The search tasks were presented on a PC with a 17" color monitor (Dell Trinitron) and controlled by custom written software run under DOS to ensure millisecond timing accuracy. Participants sat in a comfortable chair facing the monitor at a distance of 70 cm. Responses were collected with a two-button box (button diameter: 1 cm; placed 4 cm apart centre to centre) attached to the games port of the computer and labeled 'Present' or 'Absent'. Participants were asked to respond with the index and middle fingers of the preferred hand with the response options assigned to each finger rotated across participants. Nine pictures each of cats, horses, fish, birds, spiders and snakes served as stimuli and have been used in our previous work (Lipp & Waters, 2007). Pictures were edited with Jasc Paint Shop Pro software and given a palette of 256 colours (Web save format, error diffusion method) at a size of 260 x 195 pixels (7.52° x 5.97° of visual angle if presented centred).

Children completed the Snake (SNAQ) and Spider (SPQ) fear questionnaires (Klorman, Weerts, Hastings, Melamed, & Lang, 1974), which were designed to assess specific fears of snakes and spiders. Both measures have good psychometric characteristics and are frequently used in research and clinical practice. On both the SNAQ and the SPQ, participants respond "true" or "false" to indicate their attitudes

towards and beliefs about snakes and spiders (e.g., “I avoid going to parks or on camping trips because there may be snakes about”). Although there is a shortened version of SPQ which has been adapted for use with children (e.g., Kindt, Brosschot, & Muris, 1996), there is not an equivalent shortened version of the SNAQ. Hence, the full scales of both measures were utilized so that percentile cut-offs could be determined for selected spider and snake apprehensive participants. Children had no difficulty completing these measures.

2.3 Procedure

The study was introduced to children in their classrooms and interested children gave their parents a research information package containing a study information sheet, a family demographic form and the study consent form. Children returned the completed forms if parental consent was given. Children were assessed individually in a resource room during regular class time. They completed the visual search task first followed by the SNAQ and SPQ to avoid sensitization to snakes and spiders before the task. Questionnaire items were read aloud to children by the research assistant to avoid problems associated with variability in children’s reading ability.

In the search task, participants were instructed to focus on a white cross presented in the centre of the screen (1 pixel wide, subtending $1.53^\circ \times 1.53^\circ$) for 1 s before indicating as rapidly and accurately as possible the presence or absence of a designated target animal, a cat, within an array of nine animal pictures subtending $22.42^\circ \times 17.90^\circ$ of visual angle (3 rows x 3 columns). Responses were initiated by pressing the corresponding buttons with the index and middle fingers of the dominant hand. The picture array was displayed for 8 s or until a button was pressed.

Presentation of the fixation cross for the next trial commenced 2000 ms after the picture array disappeared.

The task comprised 216 trials in total ordered in four blocks of 54 trials. In each block, there were 27 trials containing a target, i.e., a picture of a cat, and 27 trials with no target. No distracter was presented among the background animals, i.e., horses, fish, and birds, on nine Target and nine No target trials (i.e., neither a spider nor a snake). A spider distracter was presented among the background animals on a further nine No target and Target trials, whereas a snake distracter was presented among the background animals on the final nine No target and Target trials. Trials were randomised within each block of 54 trials and target and distracter stimuli appeared equally often at each picture location in the nine picture array. The experiment started with 10 practice trials which were not repeated in the main task and included trials from all experimental conditions.

2.4 Scoring, Response Definitions, and Statistical Analyses

Analyses were based on mean reaction times and percentage of errors, defined as an incorrect button press or failure to respond within 4000 ms. Reaction-times from incorrect responses and extreme scores – defined as values more than two standard deviations above or below the mean relative to each participant's mean reaction-time – were excluded from the analyses. Response times and errors for the entire group were subjected to separate 2 x 3 (Target [Absent, Present] x Distracter [No, Snake, Spider]) factorial analyses of variance (ANOVA).

For the assessment of the effects of self-reported fear of snakes and spiders on search performance, participants were selected who were fearful of either snakes but not spiders or of spiders but not snakes based on scores on the SPQ and the SNAQ (e.g., Lipp & Waters, 2007; Öhman, Flykt, & Esteves, 2001). Spider fearful participants (N = 6) scored above the 75th percentile on the SPQ (> 12) but below the

median on the SNAQ (< 7). Participants scoring above the 75th percentile on the SNAQ (> 13) and below the median for the SPQ (< 7) ($N = 6$) were assigned to the snake fearful group. Snake and spider fearful participants were grouped together ($N = 12$) and the effect of self-reported fear on task performance was assessed in 2×3 (Target [Absent, Present] $\times$ Distracter [No, Feared distracter, Not feared distracter]) factorial ANOVAs for response time and error data. Follow-up comparisons of significant effects were performed using Bonferroni adjustments to control against the accumulation of alpha error. An alpha level of .05 was set for all analyses. Partial eta squared (η_p^2) was calculated as an estimate of effect size.

3. Results

As shown in Figure 1, upper left panel, participants were faster to determine target presence than absence, significant main effect for Target, $F(1, 80) = 411.31, p < .001, \eta_p^2 = .84$, and were slowed by the presence of a snake and a spider distracter, main effect of Distracter, $F(2, 79) = 30.75, p < .001, \eta_p^2 = .44$. The Target $\times$ Distracter interaction was not significant, $F = 1.75, ns$. Means and standard deviations for RT and error percentages are shown in Table 1.

Insert Figure 1 about here

Follow-up comparisons of the Distracter main effect confirmed that participants were slower to determine target presence or absence if a spider or a snake distracter was embedded in the background compared with no distracter ($t(80) = 6.18, p < .001$ and $t(80) = 6.60, p < .001$ respectively). The difference in reaction-time between the two distracter conditions was not significant ($t(80) = 0.40, ns$).

Mean percentages of errors are presented in the upper right panel of Figure 1. As can be seen, fewer errors were committed when targets were absent than present,

main effect of Target, $F(1, 80) = 7.29, p = .008, \eta_p^2 = .08$. The Distracter main effect and the Target x Distracter interaction were not significant, both $F < 2.0$, ns.

Insert Table 1 about here

3.1 Effect of self-reported snake and spider fear

As expected, snake fearful children had significantly higher SNAQ mean scores ($M = 15.83; SD = 2.13$) compared with spider fearful children ($M = 5.83; SD = 1.94$), $t(10) = 5.81, p < .001$. Similarly, spider fearful children endorsed significantly greater spider fear on the SPQ ($M = 15.00; SD = 2.60$) compared with snake fearful children ($M = 6.42, SD = 2.37$), $t(10) = 4.65, p = .001$.

As shown in Figure 1, lower left panel, snake and spider fearful children were faster to determine target presence than absence, Target main effect, $F(1, 11) = 47.23, p < .001, \eta_p^2 = .81$. Moreover, their search performance was differentially affected by the presence of a distracter, Distracter main effect $F(2, 10) = 21.50, p < .001, \eta_p^2 = .81$. The Target x Distracter interaction was not significant, $F = 2.09$, ns. Means and standard deviations are shown in Table 1.

Follow-up tests of the Distracter main effect confirmed that the presence of the not feared fear-relevant distracter slowed performance compared with the no distracter condition ($t(11) = 2.54, p = .03$). Moreover, search performance in the presence of the feared fear-relevant distracter was slower than in the presence of the not feared fear-relevant distracter ($t(11) = 3.99, p = .006$) or in the absence of a distracter ($t(11) = 6.84, p = .001$). There were no significant main effects or interactions for the error data, all $F < 2.30$, ns (see right lower panel of Figure 2).

4. Discussion

The present study demonstrated that pictures of fear-relevant animals, snakes and spiders, presented among backgrounds of other animal stimuli captured attention to the same extent and interfered with the detection of a neutral target in a large sample of normally developing children. These results replicate our previous findings with unselected adults (Lipp & Waters, 2007) and are consistent with the model of preferential fear stimulus processing suggested by Öhman and Mineka (2001). Moreover, the extent of attentional capture by fear-relevant stimuli was enhanced in children who were fearful of one fear-relevant animal but not the other. This finding also accords with our previous observation of selectively enhanced target detection slowing in snake and spider apprehensive adults (Lipp & Waters, 2007) and is consistent with cognitive models of anxiety (e.g., Mogg & Bradley, 1998; Williams et al., 1997). One difference between the results found in adults and children is that the presence of feared fear-relevant pictures slowed the performance of fearful adults on target present but not target absent trials whereas in fearful children performance was affected on Target and No target trials. A similar difference, consistent distracter effects on target and no target trials in children, but only on target trials in adults, was found for the entire sample of children, rejecting the notion that a lack of power prevented the observation of a Trial x Distracter interaction in the present study. Thus, the consistent pattern across target and no target trials in children may be due to developmental limitations on children's ability to inhibit the processing of distracting stimuli in general (Harnishfeger, 1995). Further studies comparing visual search performance in children and adults would help clarify this difference in results.

Although the present results demonstrate attentional capture that was selectively enhanced for feared fear-relevant animals in fearful children, the present methodology cannot elucidate the underlying processes that mediate this effect. In our

previous study of visual search for fear-relevant animal stimuli in children (Waters et al., in press), the slowing to determine target absence among snakes and spiders relative to flowers and mushrooms was larger in high snake and spider fearful children than in low fearful children. Together with the present finding of slower target detection in the presence of feared fear-relevant distracters versus non-feared fear-relevant distracters, one possibility is that fearful children have difficulty disengaging attention from feared animal stimuli (e.g., Fox et al., 2000). However, Hadwin et al.'s (2003) finding that high trait-anxious children were quicker to terminate the search when angry compared with neutral and happy faces were absent from arrays suggests the utilisation of a different processing strategy indicating that anxious children might regulate attention to threat differently depending on task requirements. When threat targets for which anxious children have been asked to search are absent (e.g., Hadwin et al., 2003), quicker search termination might reflect on an avoidance strategy. When threat stimuli cannot be avoided due to their presence within the visual array as in the present study and in Waters et al. (in press), anxious children appear to show slowed attentional disengagement. Further research with children utilising methodologies that permit a clearer separation of the underlying processes that mediate these effects are required before firm conclusion can be drawn. For example, studies with anxious adults (e.g., Fox et al., 2000; 2001; Georgiou et al., 2005; Yiend & Mathews, 2001) suggest that spatial orienting tasks with emotional faces may permit the separation of attentional engagement and disengagement in anxious children.

Although the present study extends previous demonstrations that animal fear-relevant stimuli capture attention to young children, there are notable limitations. The present study did not include non-phylogenetically-based fear-relevant animal stimuli as distracters. Although we showed in our previous study (Lipp & Waters, 2007) that

phylogenetically fear-relevant animals capture attention specifically and to a larger extent than do other animal stimuli, this specificity has not been shown in children and future studies in children should include non fear-relevant animal distracters. These distracters were omitted in the present study to permit the assessment of selective enhancement of attentional capture by fear-relevant distracters by fear, which requires the inclusion of two fear-relevant distracters. Also, the present study was based on a large unselected sample of children. Future studies should assess visual search performance in children with clinically-significant phobias to examine the role of these biases in explanations of childhood anxiety disorders. Finally, future studies should obtain children's subjective ratings of the valence and arousal of the animal stimuli. This would clarify whether differences in visual search performance are associated with differences in stimulus appraisal.

In summary, the present study showed that fear-relevant animal stimuli, snakes and spiders, interfered equally with children's ability to perform a search for a neutral target and that these attentional capture effects were selectively enhanced in children who feared one of these animals but not the other. These findings are consistent with theories of preferential processing of fear-relevant stimuli and with cognitive models of anxiety (Mogg & Bradley, 1998; Öhman & Mineka, 2001; Williams et al., 1997).

Acknowledgments

This research was supported by a Griffith University Research Grant to Dr Allison Waters. Thanks are due to Paul Jackson who programmed the task.

References

- Croake, J. W. (1969). Fears of children. *Human Development, 12*, 239-247.
- Eastwood, J. D., Smilek, D., Oakman, J. M., Farvolden, P., van Ameringen, M., Mancini, C., & Merikle, P. M. (2005). Individuals with social phobia are biased to become aware of negative faces. *Visual Cognition, 12*(1), 159-179.
- Folk, C.L., & Remington, R. (1998). Selectivity in distraction by irrelevant feature singletons: Evidence for two forms of attentional capture. *Journal of Experimental Psychology: Human Perception and Performance, 24*, 847-858.
- Fox, E., Lester, V., Russo, R., Bowles, R.J., Pichler, A. & Dutton, K. (2000). Facial expressions of emotion: Are angry faces detected more efficiently? *Cognition and Emotion, 14*, 61-92.
- Fox, E., Russo, R. Bowles, R. J., & Dutton, K. (2001). Do threatening stimuli draw or hold visual attention in sub-clinical anxiety? *Journal of Experimental Psychology: General, 130*, 681-670.
- Georgiou, G. A., Bleakley, C., Hayward, J., Russo, R., Dutton, K., Eltiti, S., Fox, E. (2005). Focusing on fear: Attentional disengagement from emotional faces. *Visual Cognition, 12*(1), 145-158.
- Gilboa-Schechtman, E., Foa, E. B., & Amir, N. (1999). Attentional biases for facial expression in social phobia. *Cognition and Emotion, 13*, 305-318.
- Graham, F. K., & Hackley, S. A. (1991). Passive and active attention to input. In J. R. Jennings & M. G. H. Coles (Eds.), *Handbook of cognitive psychophysiology* (pp. 251-356). New York: John Wiley.
- Hadwin, J. A., Donnelly, N., French, C. C., Richards, A., Watts, A., Daley, D. (2003). The influence of children's self-report trait anxiety and depression on visual search for emotional faces. *Journal of Child Psychology and Psychiatry, 44*(3), 432-444.

- Harnishfeger, K. K. (1995). The development of cognitive inhibition. Theories, definitions, and research evidence. In F. N. Dempster & C. J. Brainerd. (Eds.), *Interference and inhibition in cognition*. (pp. 175-204). San Diego: Academic Press.
- Kindt, M., Brosschot, J. F., & Muris, P. (1996). Spider phobia questionnaire for children (SPQ-C): A psychometric study and normative data. *Behaviour Research and Therapy*, 34, 277-282.
- Klorman, R., Weerts, T. C., Hastings, J. E., Melamed, B. G., & Lang, P. J. (1974). Psychometric descriptions of some specific fear questionnaires. *Behavior Therapy*, 5, 401-409.
- Lipp, O. V. (2006). Of snakes and flowers: Does preferential detection of pictures of fear-relevant animals in visual search reflect on fear-relevance? *Emotion*, 6, 296-308.
- Lipp, O. V., Derakshan, N., Waters, A. M., & Logies, S. (2004). Snakes and cats in the flowerbed: Fast detection is not specific to pictures of fear-relevant animals. *Emotion*, 4(3), 233-250.
- Lipp, O. V., & Waters, A. M. (2007). When danger lurks in the background: Attentional capture by animal fear-relevant distracters is specific and selectively enhanced by animal fear. *Emotion*, 7(1), 192-200.
- Lundqvist, D., & Öhman, A. (2005). Emotion regulates attention: The relationship between facial configuration, facial emotion, and visual attention. *Visual Cognition*, 12(1), 51-84.
- Miltner, W. H. R., Krieschel, S., Hecht, H., Trippe, R., & Weiss, T. (2004). Eye movement and behavioral responses to threatening and nonthreatening stimuli during visual search in phobic and nonphobic subjects. *Emotion*, 4, 323-339.

- Miller, L. C., Barrett, C. L., Hampe, E., & Noble, H. (1972). Factor structure of childhood fears. *Journal of Consulting and Clinical Psychology, 39*(2), 264-298.
- Mineka, S. & Öhman, A. (2002). Phobias and preparedness: The selective, automatic, and encapsulated nature of fear. *Biological Psychiatry, 52*, 927-937.
- Mogg, K. & Bradley, B. P. (1998). A cognitive-motivational analysis of anxiety. *Behaviour Research and Therapy, 36*(9), 809-848.
- Muris, P., Merckelbach, H., Ollendick, T. H., King, N. J., & Bogie, N. (2001). Children's night-time fears: parent-child ratings of frequency, content, origins, coping behaviors and severity. *Behaviour Research & Therapy, 39*, 13-28.
- Öhman, A., Flykt, A., & Esteves, F. (2001). Emotion drives attention: Detecting the snake in the grass. *Journal of Experimental Psychology: General, 130*, 466-478.
- Öhman, A., Lundqvist, D., & Esteves, F. (2001). The face in the crowd revisited: A threat advantage with schematic stimuli. *Journal of Personality and Social Psychology, 80*, 381-396.
- Öhman, A. & Mineka, S. (2001). Fears, phobias, and preparedness: Toward an evolved module of fear and fear learning. *Psychological Review, 108*, 483-522.
- Rapee, R. M. (2001). The development of generalized anxiety. In M. W. Vasey, Michael W & M. R. Dadds (Eds). *The developmental psychopathology of anxiety. (pp. 481-503). New York, NY, US: Oxford University Press.*
- Rinck, M., Reinecke, A., Ellwart, T., Heuer, K., & Becker, E. S. (2005). Speeded detection and increased distraction in fear of spiders: evidence from eye movements. *Journal of Abnormal Psychology, 114*, 235-248.
- Schneider, F. R., Johnson, J., Hornig, C. D., Liebowitz, M. R., & Wiessman, M. M. (1992). Social phobia: Comorbidity and morbidity in an epidemiologic sample. *Archives of General Psychiatry, 49*, 282-288.

- Vasey, M. W., & MacLeod, C. (2001). Information-processing factors in childhood anxiety: A review and developmental perspective. In M. W. Vasey & M. R. Dadds (Eds.), *The developmental psychopathology of anxiety* (pp. 27-42). New York: Oxford Uni Press.
- Waters, A. M., Lipp, O. V., & Spence, S. H. (in press). Preferential processing of animal fear relevant stimuli in children, *Australian Journal of Psychology*.
- Wells, A. (1997). *Cognitive therapy of anxiety disorders: A practice manual and conceptual guide*. Chichester, UK: Wiley.
- Williams, J. M. G., Watts, F. N., MacLeod, C., & Mathews, A. M. (1997). *Cognitive psychology and emotional disorders (2nd ed.)*. Chichester, UK: Wiley.
- Yiend, J., & Mathews, A. (2001). Anxiety and attention to threatening pictures. *Quarterly Journal of Experimental Psychology*, 54A, 665-681.

Table 1

Mean reaction-times and errors on Target and No target trials as a function of distracter type for the full sample of 81 children and for the 12 selectively snake or spider fearful children (standard deviations in parentheses).

Distracter	Mean Reaction-Time (ms)		Mean Errors (%)	
	Target Absent	Target Present	Target Absent	Target Present
<i>Full sample (n = 81)</i>				
None	1981 (470)	1307 (353)	4.08 (6.76)	5.34 (6.16)
Snake	2021 (490)	1380 (364)	4.04 (6.80)	6.55 (6.94)
Spider	2039 (497)	1371 (377)	4.28 (6.13)	5.69 (6.31)
<i>Fearful sample (n = 12)</i>				
None	1861 (401)	1295 (239)	1.85 (2.16)	3.47 (3.37)
Not Feared	1911 (421)	1327 (244)	1.38 (1.87)	4.62 (5.07)
Feared	1992 (437)	1371 (243)	3.70 (3.20)	4.62 (5.07)

Figure Captions

Figure 1 Response times (left) and error percentages (right) on No target and Target trials in the entire sample (upper panels) and in selectively snake or spider fearful participants (lower panels; error bars indicate standard errors of the mean).