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Exploring Parent–Child Conversations about Live Snakes and Spiders: Implications for the Development of Animal Fears

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ABSTRACT

Snakes and spiders commonly elicit fear. However, despite the pervasiveness of these fears in adulthood, little is known about how they develop in early childhood. Informal learning environments, like zoos, allow for observation of parent–child conversations about these animals. Such naturalistic conversations may contain negative talk and may be one mechanism for the development of fears. In Study 1, we interviewed 241 preschool-aged children about snakes and spiders. In Study 2, 15 parent–child conversations were observed at a zoo. Across studies, we found that participants provided less positive (Study 2) and more negative (Study 1) information about snakes and spiders than other animals, and that children reported more fear (Study 1). Our results highlight the availability of negative information about snakes and spiders, and we discuss how we can use children's early experiences in informal learning settings to teach them about animals without contributing to the development of early fears.

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Introduction

For many adults, snakes and spiders evoke feelings of fear or anxiety. In fact, snake and spider fears are two of the most common fears among adults throughout the world (Agras et al., 1969; Curtis et al., 1998; Depla et al., 2008). Interestingly, research suggests that 18- to 36-month-old children *approach* live snakes and spiders in the lab, demonstrating equal (and avid) interest in these animals when compared to other animals (LoBue et al., 2013). While some work suggests that fear of snakes and spiders can be learned early in life (Rakison, 2009), retrospective studies suggest that the onset age for animal fears is not likely until around 7 years or older (Öst, 1987). However, very few studies have explored the everyday experiences that might lead to the development of animal fears, especially fear of snakes and spiders, which are so common in adults.

Several learning pathways for fear acquisition have been put forth in the literature, including classical conditioning, vicarious conditioning, and the transmission of negative

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verbal information (Rachman, 1977). However, for most children, it is unlikely that fear is the result of direct conditioning (e.g., being bitten by a snake) (Murray & Foote, 1979). Instead, a study of school-aged children in both American and Australia found that the vast majority (89%) of intense childhood fears came from threatening verbal information (e.g., negative information from parents) or seeing something threatening through media (Ollendick & King, 1991). In one study, Prokop et al. (2011) interviewed children about their interest and knowledge of wolves and found that children are indeed influenced by the way wolves are depicted in stories; children who claim that wolves are primarily depicted as negative displayed greater fear and less sympathy for these animals. In addition, a number of experimental studies have shown that children between the ages of 6 and 13 years show fear-related responses such as increased latency to approach (Field & Lawson, 2003; Kelly et al., 2010), increased heart rate (Field & Schorah, 2007), and an increased number of fear beliefs (e.g., Muris et al., 2010) after being presented with negative verbal information about a novel animal (see Muris & Field, 2010 for a review of this literature).

Importantly, before formal schooling begins, parents could be a particularly critical source of verbal information about animals (e.g., Jipson & Gelman, 2007; Tarlowski, 2006). Indeed, evidence suggests that informal learning environments can serve as a catalyst for science learning, particularly when such environments contain emotional or arousing information (Falk & Gillespie, 2009). Furthermore, especially for children in urban settings, informal learning environments such as museums and zoos may be some of the only places where children can directly observe animals like live snakes, making these sites important for informal, joint learning about animals in early childhood. Although previous studies have explored parent–child interactions at live animal exhibits (Ash, 2003; Geerdts et al., 2015; Kisiel et al., 2012; Kopczak et al., 2015; Rigney & Callanan, 2011), no previous research has explored the extent to which children are exposed to negative verbal information about snakes and spiders in informal learning environments, particularly in early childhood before animal fears become common.

This topic would have important implications for how we should best present information to children in educational and other informal settings. In some instances, negative information about animals is appropriate if it leads to safety. For example, Dart Frogs are poisonous to humans, and should not be touched. However, in other cases, negative information can be maladaptive, or elicit unnecessary avoidance or fear behavior, when it is inappropriate or inaccurate. For example, a tarantula is not particularly harmful to humans, and negative information provided about these animals may contribute to fear or avoidance responses of spiders (even the tiny household spiders). Furthermore, research suggests that negative emotions can serve as an impediment to environmental learning (Bixler & Floyd, 1999). For example, children who have more negative attitudes toward animals that are commonly seen as disgusting or scary are also more likely to endorse incorrect, common misconceptions about these animals (Prokop & Tunnicliffe, 2008). Likewise, fear of snakes among college biology majors is negatively related to naturalistic and scientific attitudes toward these animals (Prokop et al., 2009). Thus, while negative information about threatening animals can lead to adaptive avoidance behaviors in some instances, ensuring that children receive factual information that is not overly negative about these animals might help increase learning

and foster scientific knowledge and interest about reptiles, and may in turn reduce the number and severity of animal fears that they experience.

The current research aims to explore informal conversations that parents and children have about snakes and spiders to gain insight into the kinds of experiences that may support the development of animal fears. In Study 1, we asked a large sample of preschool-aged children about their prior experiences with snakes and spiders. As a comparison, we also included two similar, generally benign animals that do not commonly elicit fear responses: frogs and turtles. Studies examining snakes and spiders typically use similar comparison animals which evolutionarily have been of little threat to humans (e.g., LoBue, 2010; LoBue & DeLoache, 2008). We asked whether children cited more negative information about snakes and spiders, and whether they were more likely to report fear of snakes and spiders compared to the other animals. In Study 2, we examined the content of parent–child conversations in a setting in which snakes and spiders are presented in an educational environment—the Reptile House at a local zoo. We asked whether parents and children were more likely to use negative versus positive information to describe snakes and spiders when compared to other animals in the same exhibit.

Study 1

In Study 1, we conducted interviews with preschool aged children to assess their experience, knowledge, and fear of snakes, spiders, frogs, and turtles. We expected that children would report less experience with snakes and spiders relative to other animals, and that children would also report more fear of snakes and spiders than other animals. We also expected that children would report having learned more negative information about snakes and spiders than other animals.

Materials and methods

Participants

The participants were recruited from several private preschools in the greater New York City Area. At the start of the school year, parents were informed about the nature of our studies, and parents provided informed consent for their child to participate in research games during their free play period. The full sample included 241 preschool-aged children from ages 3 to 6 ($M = 4.6$, $R = 3.3$—6.4; 116 M, 124 F). Of the 241 children included in these analyses, 51.5% reported as female ($N = 124$) and 48.1% reported as male ($N = 116$), and gender for one student was not reported. Eight additional participants were tested but excluded because of equipment failure (7) or because of refusal to answer the questions (1). Additional demographic information was not reported.

Procedure

Participant interviews took place in the child's preschool in a private room with the interviewer and the child. Interviews were video and audio recorded and later transcribed and coded offline. To assess the participant's prior experiences with the target animals, we administered a brief self-report questionnaire with binary outcomes (yes/no). This questionnaire featured four yes/no response questions for each animal: "Are

Table 1. Percentage of children who reported experience, knowledge, and fear by animal type.

		Animal			
		Snake	Spider	Frog	Turtle
Seen (%)		46%	59%	63%	64%
Q value	37.0				
P value	<0.001				
Held (%)		33%	32%	40%	49%
Q value	39.9				
P value	<0.001				
Knowledge (%)		63%	57%	62%	63%
Q value	4.6				
P value	0.200				
Negative Knowledge (%)		11%	6%	0%	< 1%
Q value	51.4				
P value	<0.001				
Fear (%)		64%	65%	23%	19%
Q value	224.0				
P value	<0.001				

you afraid of [snakes, spiders, frogs, turtles]?"; "Have you ever seen a live [snake, spider, frog, turtle]?"; "Have you ever held [snakes, spiders, frogs, turtles]?"; "Have you ever learned about [snakes, spiders, frogs, turtles], maybe in school, in a book, on TV, or at the Zoo?" If participants answered yes to the last question, we asked them an open-ended question about what they learned about that animal.

Coding

There were a total of 588 "yes" responses to "Have you ever learned about [animal] … " and thus were asked the open-ended follow-up question about what they learned. Children's responses to the open-ended questions were coded for the presence of any negative or threatening statements about the animals. Negative statements were defined and coded as containing either fear, disgust, threat, or dislike. A second researcher coded all of the data for reliability. There were only 6 disagreements among the 588 responses (99% agreement). Disagreements were resolved by discussion.

Results and discussion

The dependent variables were the answers to the survey questions; the design was within-subjects with all binary outcomes (yes/no). We first ran preliminary analyses with age and gender on each of the dependent variables (seeing, holding, learning, learning threat information, fear) using Pearson's chi-square tests. Next, we ran a series of Cochran's Q's tests on children's responses on each of the dependent measures for the individual animals (snakes, spider, frogs, and turtles; a summary is provided in Table 1). Cochran's Q was used because we had nominal dichotomous (yes/no) data for more than two groups (snakes, spiders, frogs, turtles). Finally, we ran an additional series of McNemar tests to examine whether our results remained when we group the animals, comparing snakes and spiders to frogs and turtles. McNemar tests were used because they are most appropriate for paired nominal data. Effect sizes are reported as *odds ratios (OR)* where interpretable, which quantifies the relationship between the odds of an event occurring divided by the probability that the event will not occur (Field,

2013). An odds ratio of 1 indicates that the odds of a given outcome are equal across categories, with higher values indicating a greater likelihood of an event occurring for one category over another.

Experience with animals

There were significant differences in whether children had seen the animals, *Cochran's* $Q = 37.0$, $p < 0.001$, with 46% of children claiming to have seen a snake, and 59%, 63%, and 64% had seen spiders, frogs, and turtles respectively. According to a series of post-hoc comparisons with a Bonferroni correction (critical $p = 0.001$), children were significantly less likely to have seen snakes than spiders, turtles, and frogs (all $p's < 0.001$), but there were no significant differences between whether they had seen spiders, turtles, and frogs ($p's > 0.05$). Using a McNemar test to determine differences in the proportion of children who reported seeing snakes and spiders versus frogs and turtles, there was a significant difference ($\chi^2 = 5.64$, $p < 0.05$, $OR = 5.93$, 95% CI [3.18, 11.08]), with a larger proportion of children reporting they had seen frogs and turtles compared to snakes and spiders.

There were also significant differences between whether the children claimed to have held each of the animals, *Cochran's* $Q = 39.9$, $p < 0.001$, with 33% and 32% of children claiming to have held a snake or spider, compared to 40% and 49% of children claiming to have held a frog or turtle respectively. According to a series of post-hoc comparisons with a Bonferroni correction, children were significantly more likely to have held turtles than spiders ($\chi^2 = 24.53$, $p < 0.001$, $OR = 13.18$, 95% CI [6.42, 27.05]) or snakes ($\chi^2 = 22.22$, $p < 0.001$, $OR = 10.58$, 95% CI [5.35, 20.89]); there were no other significant comparisons. A McNemar test also showed that the proportion of children who held snakes and spiders versus frogs and turtles remained significantly different when comparing the collapsed groups, ($\chi^2 = 21.25$, $p < 0.001$, $OR = 13.55$, 95% CI [6.75, 27.19]), with a larger proportion of children reporting they have held frogs and turtles compared to snakes and spiders.

Knowledge about the animals

Interestingly, although there were no differences in whether children had learned about the various animals, *Cochran's* $Q = 4.6$, $p = 0.200$, there was a significant difference in the number of children who provided negative or threatening information when asked what they learned about each animal, *Cochran's* $Q = 51.4$, $p < 0.001$ (Figure 1). While no participants cited negative/threatening information about frogs and only 1 for turtles, 11% of children cited negative/threatening information about snakes (27 children) and 6% cited learned negative/threatening information about spiders (15 children). Post-hoc comparisons with a Bonferroni correction indicated that learning negative/threatening information about snakes and spiders were not significantly different from each other and neither were frogs and turtles. However, there were significant differences in learning negative/threatening information about snakes and frogs ($\chi^2 = 25.04$, $p < 0.001$, $OR = .32$, 95% CI [.15, .68]), snakes and turtles ($\chi^2 = 22.32$, $p < 0.001$ $OR = .39$, 95% CI [.18, .85]), spiders and frogs ($\chi^2 = 13.07$, $p < .001$ $OR = .49$, 95% CI [.25, .98]), and spiders and turtles ($\chi^2 = 10.56$, $p = .001$ $OR = .53$, 95% CI [.32, 1.11]), demonstrating

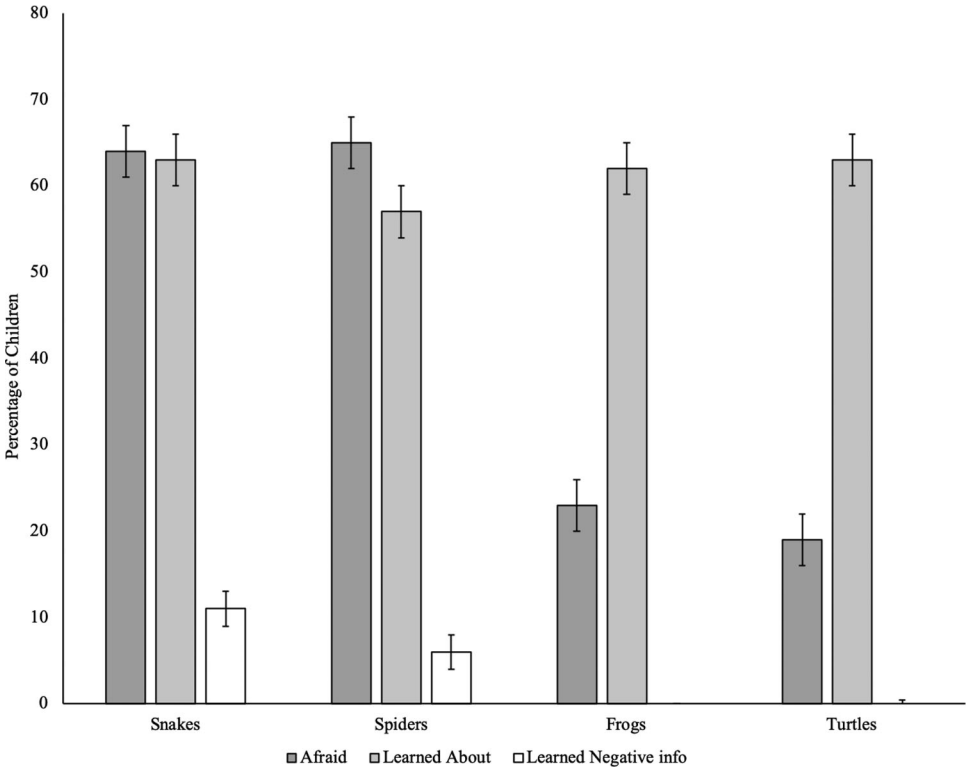


Figure 1. The percentage of children who claimed to be afraid of each animal, who said that they had learned about each animal, and the percentage of children who cited negative/threatening information about each animal when asked what they had learned.

that significantly more children provided negative information about snakes and spiders than frogs and turtles. Follow-up McNemar's tests confirmed that there were no differences in whether children had learned about snakes and spiders versus frogs and turtles, ($p > 0.05$). However, a greater proportion of children reported learning negative information about snakes and spiders than frogs and turtles ($\chi^2 = 30.25$, $p < .001$, $OR = 9.40$, 95% CI [4.87, 18.15]).

Fear of animals

In terms of fear, while 64% and 65% of children claimed to be afraid of snakes and spiders (respectively), only 23% and 19% of children were afraid of frogs and turtles, respectively. This difference was significant, *Cochran's* $Q = 224.0$, $p < 0.001$, and post-hoc comparisons with a Bonferroni correction indicated that fear of snakes and spiders were not significantly different from each other and neither were turtles and frogs. All of the other comparisons were significant; there were significant differences among snakes and frogs ($\chi^2 = 81.68$ p<.001 $OR = 3.11$, 95% CI [1.48, 6.56]), snakes and turtles ($\chi^2 = 92.82$ $p < .001$ $OR = 2.59$, 95% CI [1.18, 5.67]), spiders and frogs ($\chi^2 = 78.74$, $p < .001$ $OR = 2.04$, 95% CI [1.03, 4.06]), and spiders and turtles ($\chi^2 = 90.98$, $p < .001$ $OR = 1.88$, 95% CI [.90, 3.92]), indicating again that children were more likely to report

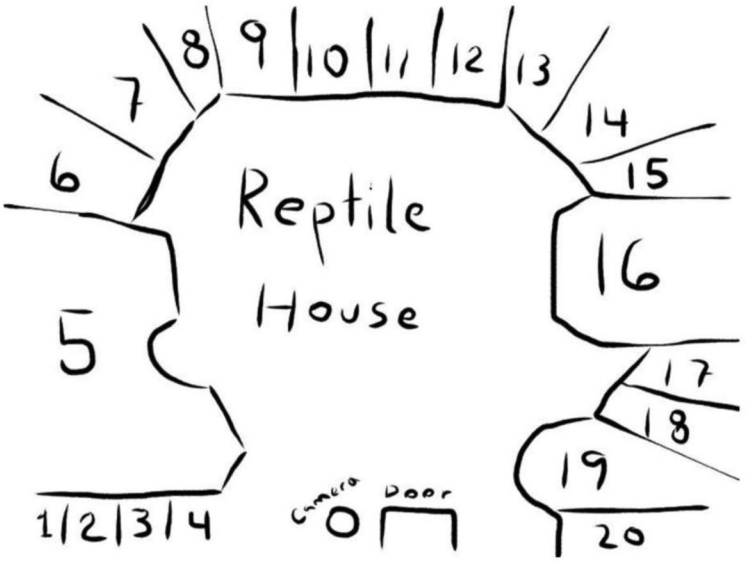
being afraid of snakes and spider than frogs and turtles (Figure 1). Using the broader categories, a greater proportion of children reported fear of snakes and spiders than frogs and turtles ($\chi^2 = 99.67$, $p < 0.001$, $OR = 2.46$, 95% CI [1.13, 5.34]).

One interesting exploratory question is whether children who had learned negative information about the animals were also more likely to be afraid of them. We did not have a big enough sample size to examine this question statistically, but our descriptive statistics do suggest there is a trend in this direction. Of the 27 children who had learned negative/threatening information about snakes, 18 (67%) claimed to be afraid of them; 9 of the 15 (60%) who cited negative information about spiders were also afraid of spiders; and the one child who heard negative information about turtles was also afraid of turtles.

Additional findings

Age. We expected that older children would have more experience with the animals than younger children, so we ran a series of preliminary analyses on age. We had a large age range (ages 3 to 6), so we divided the children into a younger age group of children under 4 ½ ($N = 103$, $M = 4.0$, $R = 3.3$—4.5) and an older age group of children older than 4 ½ ($N = 138$, $M = 5.0$, $R = 4.5$—6.4). This was done to simply confirm that older children reported having more experience with the animals than younger children. Chi-square analyses confirmed that older children were more likely to report seeing turtles than were younger children ($\chi^2 = 5.66$, $p < .05$, $OR = 1.94$, 95% CI [1.12, 3.37]) but we found no significant differences for the other animals. Older children were also more likely to report having experience holding snakes ($\chi^2 = 3.30$, $p < .05$, $OR = 1.65$, 95% CI [.96, 2.85]), spiders ($\chi^2 = 3.78$, $p < .05$, $OR = 1.72$, 95% CI [.99, 2.97]), frogs ($\chi^2 = 12.48$, $p < .001$, $OR = 2.58$, 95% CI [1.52, 4.39]), and turtles ($\chi^2 = 11.13$, $p < .001$, $OR = 2.42$, 95% CI [1.43, 4.09]) than were younger children, and they were more likely to report having learned information about snakes ($\chi^2 = 9.82$, $p < .05$, $OR = 2.42$, 95% CI [1.38, 4.22]), turtles ($\chi^2 = 6.71$, $p < .05$, $OR = 1.90$, 95% CI [1.10, 3.29]), and frogs ($\chi^2 = 5.34$, $p < .05$, $OR = 2.06$, 95% CI [1.19, 3.57]) than were younger children, but there was no difference in learning for spiders. There were no significant differences between younger and older children's reports of learning negative information about any of the animals (p's $> .05$), and although there were no age differences in whether children claimed to be afraid of snakes or spiders (p's $> .05$), a larger proportion of younger children said that they were afraid of frogs ($\chi^2 = 10.60$, $p = 0.001$, $OR = 2.75$, 95% CI [1.48, 5.10]) and turtles ($\chi^2 = 5.11$, $p = 0.021$, $OR = 2.12$, 95% CI [1.10, 4.08]) than older children. When the animals were collapsed into two categories (snakes/spiders vs. frogs/turtles), there were no age differences in whether children claimed to be afraid of snakes and spiders ($p > 0.05$), but a greater proportion of younger children said they were afraid of frogs and turtles than snakes and spiders ($\chi^2 = 10.91$, $p = 0.001$, $OR = 2.61$, 95% CI [1.47, 4.65]).

Gender. Previous research has reported significant gender differences for particular fears and for animal fears specifically, with females reporting more fear than males (i.e., Fredrikson et al., 1996; see McLean & Anderson, 2009 for a review). Thus, we ran a series of preliminary chi-square analyses examining the effect of gender on each dependent variable. We found no gender differences for seeing, holding, or learning threatening information about any of the animals (p's > 0.05). However, females were more likely to report



(1) Goliath Bird Eating Tarantula
(2) Tanzanian Giant Tailless Whip Scorpion
(3) Thailand Stick Insect
(4) Empty
(5) Komodo Dragon, Finches
(6) Red-Eyed Crocodile Skink
(7) Empty
(8) Bog turtle
(9) Aquatic Caecilian
(10) Eastern Hellbender
(11) Axolotl
(12) Unidentified Lizard
(13) Green Tree Python
(14) Gila Monster
(15) Dart Frogs
(16) Elongated Tortoise
(17) Vietnamese Mossy Frogs
(18) Vietnamese Long Nosed Snake
(19) Reticulated Python
(20) Thai Bamboo Racer

Figure 2. Diagram of the Reptile House at the local zoo. Each number corresponds to the animal in each tank.

learning about spiders than males ($\chi^2 = 3.86$, $p < 0.05$, $OR = 1.68$, 95% CI [1.00, 2.82]); there were no differences in learning for snakes, frogs, or turtles (p's > 0.05). Consistent with previous research, females were more likely than males to report having a fear of snakes ($\chi^2 = 6.19$, $p < 0.05$, $OR = .51$, 95% CI [.30, .87]) and spiders ($\chi^2 = 3.30$, $p < .05$, $OR = .61$, 95% CI [.36, 1.04]). There was a non-significant trend in the same direction for turtles ($\chi^2 = 2.57$, $p = 0.075$, $OR = .58$, 95% CI [.30, 1.13]), and frogs ($\chi^2 = 2.08$, $p = 0.098$, $OR = .64$, 95% CI [.35, 1.188]). When the animals were collapsed into two categories, females (81%) were also more likely to report fear of snakes and spiders than males (71%; $\chi^2 = 3.68$, $p < 0.05$, $OR = .56$, 95% CI [.30, 1.02]). Females (32%) were also more likely to report being afraid of frogs and turtles than were males (23%), but this effect was not statistically significant ($\chi^2 = 2.53$, $p = 0.074$, $OR = .63$, 95% CI [.36, 1.12]).

Study 2

The results of Study 1 indicate that children were more likely to claim to fear of snakes and spiders frogs and turtles, and likewise, were more likely to provide negative/threatening

information about these animals. In Study 2, we examined parent–child conversations in a Reptile House at a local zoo in order to see whether fear information about these animals is presented by parents in an informal learning context. Here, we expected that parents would both initiate negative conversations and provide more negative information about snakes and spiders relative to other animals commonly found in the Reptile House.

Materials and methods

Participants

Participants were families who visited the Reptile House exhibit at a small, regional zoo located in Essex County, New Jersey. Families were told that they would be part of a study exploring the kinds of conversations that parents and children naturally have while viewing animals at the zoo. Fifteen families (14 mothers, 2 fathers) participated. Nearly all children were accompanied only by their mothers (13 families) and the rest were accompanied by either their father (1 family) or by both their father and mother (1 family). Each family had at least 1 child between the 3 and 8 years of age (age was missing for one child). Our final sample included 26 children (16 female) ranging in age from 3 years, 2 months to 8 years, 4 months ($Mdn = 5$ years, 3 months). The majority of parents self-identified as Caucasian (13 families), while the remainder self-identified as Asian (1 family) and Hispanic (1 family). Similarly, the majority of parents identified their children as Caucasian (9 families); the remainder identified their children as multi-racial (3 families), and African-American (1 family). Most parents (80%) had attained a college degree or higher. Three mothers reported that they were not employed outside the household.

Setting

We recorded families' interactions as they walked through the Reptile House. The Reptile House was a large, indoor room with 17 exhibits of differing sizes distributed around the outside of the room, each containing different kinds of animals that included insects, lizards, snakes, turtles, birds, and frogs (Figure 2). Five of the 17 tanks contained snakes or spiders: Goliath Bird Eating Tarantula, Reticulated Python, Thai Bamboo Racer, Green Tree Python, and the Vietnamese Long Nosed Snake. However, the Vietnamese Long Nosed Snake was difficult to see in the tank and was seldom spoken about, likely due to this lack of visibility. Only 6 of the 26 children spoke about it, only 2 of these children saw it, and none of the participants provided any valenced information about it; thus, the Vietnamese Long Nosed Snake was removed from all subsequent analyses on parent–child conversations. Each tank had an educational panel with information about the specific animals in the tank. The center of the room featured an interactive exhibit with flip panes containing additional information about the animals in the Reptile House. Conversations at the center exhibit were not included in the current analysis as we were interested only in interactions around the live animals.

Materials

A questionnaire was given to parents prior to study participation, asking about demographic information and about snake and spider experiences. Specifically, we asked

whether parents were afraid of snakes and/or spiders and whether each child was afraid of snakes and/or spiders. We also asked parents whether their children had ever seen a live snake or spider and, if yes, to describe the experience. In the one family where both parents participated, only one parent (mother) completed the family forms.

Procedure

A recruitment booth was set up at the entrance of the Reptile House, and parents were invited to participate in a study of families in informal learning environments. Parents who agreed to participate signed a consent form and completed a family information questionnaire. Stickers were used to identify families participating in the study. When a participating family entered the Reptile House, a researcher handed the parent a small wireless microphone to wear around his/her neck. Parents were instructed to spend as much time at the exhibit as they wanted and to explore the exhibit however they wished. A video camera near the entrance unobtrusively recorded families' progress through the entire Reptile House. Families averaged 14 min 6 s exploring the Reptile House (range = 6 min, 30 s to 26 min, 20 s). An undergraduate research assistant who was familiar with the exhibit transcribed all videos, and a second research assistant checked all the transcripts for accuracy. The two research assistants jointly reviewed any portions of the recordings that were difficult to understand.

Coding conversations

Transcripts were broken down into individual utterances and labeled with respect to speaker (parent or child) and the specific animal that each utterance was about. Each utterance was then coded for valence, meaning whether the statement included positive or negative content about the animals. Only talk about the animals was coded; language about exhibit navigation, child behavior, or unrelated aspects of the environment were not coded. Positive statements were defined and coded as one of the following categories:

1. **Approach**: This category included comments about wanting to touch or be closer to the animal, or a desire to have the animal at home;
2. **Social Approach**: This category included positive social attributions to the animals ("these guys are friends!") or social interactions directed toward the animals ("Hello skink!");
3. **Attraction**: This category included positive physical attributions about the animals, such as being "cute" or "pretty";
4. **Preference**: This category included statements about preferring this animal to others ("This is my favorite"), or otherwise endorsing positive feelings toward the animals ("I like him");
5. **General**: This category included other kinds of positive information about the animal, such as being "awesome", "amazing", or "cool."

Negative statements were defined and coded as one of the following categories, as in Study 1:

1. **Fear**: This category included expressions of fear toward the animal ("I'm scared of it");
2. **Disgust**: This category included expressions of aversion toward the animal due to unpleasant or negative qualities, such as indicating that it is "gross", "dirty", "ugly", or "yucky";
3. **Threat**: This category included statements about the likelihood that this animal would cause harm or injury to other animals or people, such as being poisonous, stinging, biting, or being a predator. Statements simply about the kinds of things the animal eats ("He eats fish, snakes, and insects") were not coded as threat;
4. **Dislike**: This category included any statements about generally not liking the animal.

To establish interrater reliability, two trained coders independently coded 66.7% of the transcripts. Cohen's kappa was .908 (99.44% agreement) for positive codes and .898 (99.29% agreement) for negative codes, indicating a very good level of agreement (Fleiss et al., 2003). Any disagreements were reviewed and discussed by both coders and a final code was agreed upon. The total number of utterances within each category (positive, negative) for each animal type (spiders and snakes, other) was then summed for each participant (parent, child).

Coding signage. The same coding scheme was used to code the text of the informational signs at each animal tank. This was done to ensure that provided information did not simply lead parents to provide more negative information about snakes and spiders as compared to other animals. If valanced language in the signage did not differ across animal types, and parents were not simply quoting valanced information from the signs, then we can be more confident that the conversations we captured reflected typical parent–child interactions.

Initiating conversations

We further examined conversations by looking at the first instance of any valenced language at each tank to explore who (parents or children) is introducing valenced conversations about each animal type. For this analysis, we looked at each family conversation at each tank and considered the *first* coded (valenced) statement. We coded this statement for speaker (parent/child) and valence (negative/positive). For example, if the first valenced utterance for a family at the Reticulated Python was a fear statement by a parent, it would be counted as a negative initiation by the parent for this animal. Comments that did not fall into the coding scheme were not included in this analysis. This was counted for every family's conversations at each tank of the exhibit.

Results and discussion

We first describe information on the family questionnaire and Reptile House signage. We then provide a quantitative statistical analysis comparing positive and negative language use during conversations about snakes and spiders to conversations about the other animals in the Reptile House. We also provide descriptive data on the parent-child conversations in the Reptile House, including a detailed description of the kinds

of conversations occurring for two of the most talked about animals in the exhibit, to further illustrate differences in conversations between snakes and other kinds of animals. Finally, we provide an analysis looking at differences in conversational initiations to see whether parents are playing a guiding role in conversations about snakes spiders.

Family questionnaire

Three parents (20%) reported that their children were afraid of snakes and six (40%) reported that their children were afraid of spiders. Four parents (26.7%) reported that they were themselves afraid of snakes and four (26.7%) reported that they were afraid of spiders. All but one (93.3%) parent said that their child had seen a live snake before. When asked where they had seen these animals, the majority of parents said these experiences were at the zoo or a similar educational setting (73.3%). Many parents also said that their child had seen snakes outside their homes or on nature walks (53.3%). Every parent said that their child had seen live spiders. The majority of parents said these experiences were inside of their homes (66.7%), outside in nature (46.7%), or at the zoo (20%).

Reptile house content

Signage at each tank was coded for valenced (positive and negative) language. Seven of the 17 tanks had accompanying signage that contained valenced language. Signs for 2 out of the 5 snake and spider exhibits (40%) contained negative information (all danger). Signs for 4 out of the 12 other animals (33%) contained negative information (all danger). Signs for 1 of the 5 snake and spider exhibits (20%) contained positive information (attraction). None of the signs for the other animals (0%) contained positive information.

Next, we reviewed all transcripts for valenced information that came directly from families reading the content of the signs. Only 4 conversations across all 15 families had coded language that resulted directly from information on the signs. All of these were negative information (e.g., information about poison, venom, killing other animals). Only 1 of these was a about a snake (the Reticulated Python), while the other three were about the Gila Monster and Dart Frogs. Taken together, negative signage did not appear to differ across the different types of animals in the Reptile House.

Conversation analyses

We first provide a quantitative analysis of whether parents and children were more likely to provide negative information about snakes and spiders compared to other animals contained in the Reptile House. Effect sizes are reported as *Cohen's d* with 95% confidence intervals (CI) where interpretable. Cohen's d of .2 indicates a small effect, .5 indicates a medium effect, and .8 or greater indicates a large effect (Cohen, 1988, 1992). Table 2 shows the overall positive and negative language after categorizing the animals into two groups: snakes and spiders compared to other animals. As expected, parents generally provided more utterances while walking through the Reptile House overall ($M = 9.75$, $SD = 6.73$) than did children ($M = 4.31$, $SD = 3.44$), $t(40) = 3.47$, $p = .001$.

Table 2. Mean-valenced language use for animal group by speaker.

		Positive utterances			Negative utterances			Total valenced utterances		
Animal	Speaker	*N*	Mean	*SD*	*N*	Mean	*SD*	*N*	Mean	*SD*
Snakes and Spiders	Parents	16	.44	.63	16	2.63	3.22	16	3.06	3.37
	Children	26	.12	.33	26	1.19	1.41	26	1.31	1.44
	Overall	42	.24	.48	42	1.74	2.35	42	1.98	2.48
All other animals	Parents	16	4.19	4.35	16	3.88	4.47	16	6.69	6.04
	Children	26	1.08	1.70	26	1.69	2.00	26	2.35	2.90
	Overall	42	2.26	3.32	42	2.52	3.30	42	4.00	4.80

Preliminary analyses were conducted looking at differences in child's speech based on age and gender. Correlational analyses using age in months revealed no significant relationships between age and the number of either positive or negative utterances about either snakes and spiders or other types of animals (all p's $> .09$). Independent samples t-tests with gender revealed no significant differences between males and females in the number of either positive or negative utterances about either snakes and spiders or other types of animals (all p's $> .42$). Thus, age and gender were not included in the following analyses.

To investigate differences in the type of language used about snakes and spiders compared to other animals by both parents and children, an omnibus 2 (animal: snake/spider versus other animals) by 2 (information: positive versus negative) by 2 (speaker: parent versus child) ANOVA was conducted, with number of coded utterances as the outcome variable.

We found a main effect of animal, $F(1, 40) = 14.04$, $p = 0.001$, $d = .55$, 95% CI [.08, 4.17] with participants talking less about snakes and spiders ($M = 2.96$) than other animals ($M = 5.09$) overall. There was also a main effect of speaker, $F(1, 40) = 18.00$, $p < .001$, $d = 1.02$, 95% CI [2.05, 8.81] with parents ($M = 9.75$) talking more overall than children ($M = 4.32$). We also found a main effect of information, $F(1, 40) = 6.07$, $p = .02$, $d = .19$, CI [-1.14, 2.48], with participants providing more negative information ($M = 4.56$) than positive information ($M = 3.89$) overall.

In addition to the main effects, there were also two, 2-way interactions. First, there was a significant animal by information interaction, $F(1, 40) = 4.48$, $p = 0.04$. Follow-up one-way ANOVAs with a Bonferonni correction (critical $p = 0.025$) indicated that participants provided significantly less positive information about snakes and spiders ($M = 2.26$) compared to the other animals ($M = .24$) overall, $F(1, 40) = 9.81$, $p = 0.003$, $d = .85$, 95% CI [0.99, 3.05]. There was no significant difference in the amount of negative information provided about snakes and spiders versus other animals, $F(1, 40) = .34$, $p = .57$, $d = .27$, 95% CI [-.46, 2.03] (Figure 3).

Second, there was an animal by speaker interaction, $F(1, 40) = 4.21$, $p = 0.047$. Follow-up one-way ANOVAs with a Bonferroni correction (critical $p = 0.025$) indicated that parents and children did not significantly differ in the amount of information provided about snakes and spiders, $F(1, 40) = 2.63$, $p = 0.12$ $d = .60$, 95% CI [-.40, 3.41], but parents provided marginally more information about other animals ($M = 7.13$) than did children ($M = 3.39$), $F(1, 40) = 5.51$, $p = 0.026$, $d = .80$, 95% CI [.49, 7.00] (Figure 4).

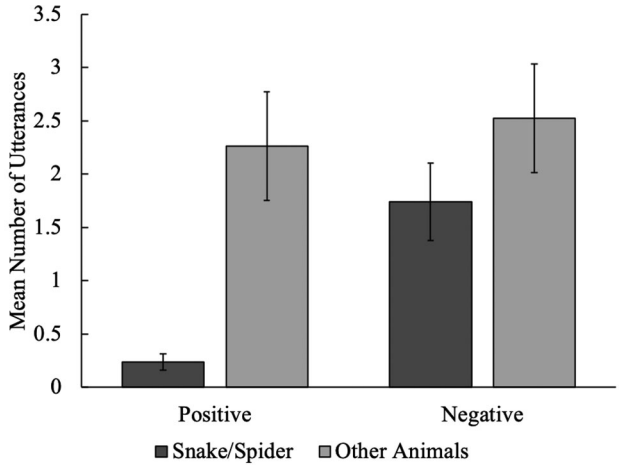


Figure 3. Mean number of positive and negative utterances provided for snakes and spiders compared to other animals.

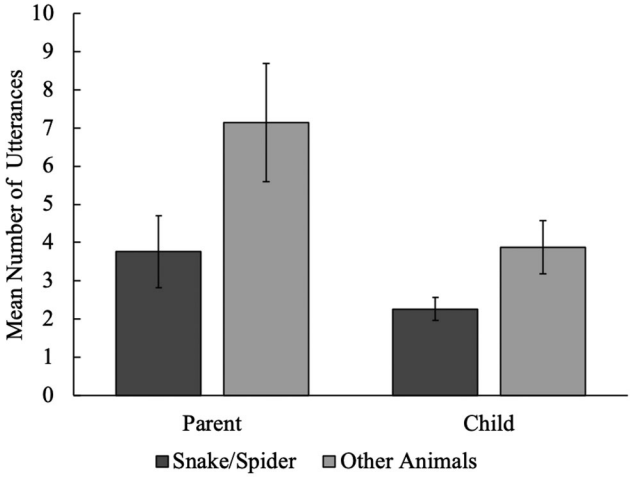


Figure 4. Mean number of utterances spoken by parents and children for snakes and spider compared to other animals.

In sum, we found that parents spoke more overall when compared to children, and both adults and children engaged in fewer valenced conversations about snakes and spiders compared to other animals. Importantly, while parents and children produced similar amounts of negative information about snakes and spiders as they did for other kinds of animals, they generated fewer positive conversations about snakes and spiders.

Descriptive data

In order to take a more in-depth look at the content of conversations in the Reptile House, here we present a more detailed description of family conversations at the two exhibits that produced the most valenced utterances: the Komodo Dragon and

Reticulated Python. These were the two largest animals in the Reptile House and each were housed in the largest tanks, so it is not entirely surprising that these animals drew the most attention. Importantly, one of these animals is a snake and the other is not, allowing for a unique comparison of the types of conversations parents and children provide about a snake compared to another frequently talked about animal in the Reptile House (which poses a similar threat to humans, yet is not as commonly feared).

In terms of codable statements, the Komodo Dragon was the most talked-about animal for both parents ($N = 11$) and children ($N = 10$). Parents provided slightly more positive ($M = 2.70$, $SD = 2.11$) than negative ($M = 2.29$, $SD = 1.11$) information about the Komodo Dragon, whereas children provided slightly more negative ($M = 2.08$, $SD = 1.16$) than positive ($M = 1.33$, $SD = .52$) information. Most parents and children provided negative comments related to danger ($N = 14$), talking about whether the Komodo Dragon ate other animals (possibly due to various finches that also occupied this tank). For example, several children made reference to the Komodo Dragon eating other animals using statements such as, "[Komodo Dragons] *don't eat the birds*." Other danger related comments included, "*he fights, he fights with [birds]"* or *"you don't wanna [sic] be drooled on by him."* However, participants also provided positive information, mostly related to social approach ($N = 6$), such as wanting to touch or engage with the Komodo Dragon. Parents often provided positive statements likely aimed to engage their child with the exhibit, such as "*how cool is that?*" or "*you like him*?" and positive statements related to the animal interacting with the child, such as "*he wouldn't eat you guys,*" "*is he trying to kiss you*."

The Reticulated Python was the other most-commonly discussed animal by parents ($N = 10$) and children ($N = 10$) in terms of codable statements. Both parents ($M = 3.75$, $SD = 1.28$) and children ($M = 1.56$, $SD = .88$) mostly provided negative information about the Reticulated Python; only one parent and one child provided one positive statement about this animal. Most parents ($N = 7$) and children ($N = 5$) provided negative comments related to the danger of the animal. While negative statements about both the Komodo Dragon and the Reticulated Python commonly referenced the animals' eating habits, comments about the Reticulated Python were generally more focused on eating humans than other animals, especially eating the child, with statements including, "*that snake can eat us in his tummy,*" or "*did you know that snake can eat a person in one bite.*" Parents used similar language such as, "*this snake eats people too,*" "*I bet it eats small children*." Only one parent provided a positive approach statement about the Reticulated Python, "*you want that big snake to come home with us*?" Four children also provided fear-relevant comments about the Reticulated Python (i.e., "*Momma can he break through the glass?*"), whereas only one child provided fear-relevant comments about the Komodo Dragon.

Initiating conversations

Finally, we examined whether parents or children *initiated* valenced conversations about snakes and spiders compared to other animals in the Reptile House. We conducted an omnibus 2 (speaker: parent versus child) by 2 (valence: positive versus negative) by 2 (animal: snake/spider versus other animals) ANOVA, with number of initiated valenced

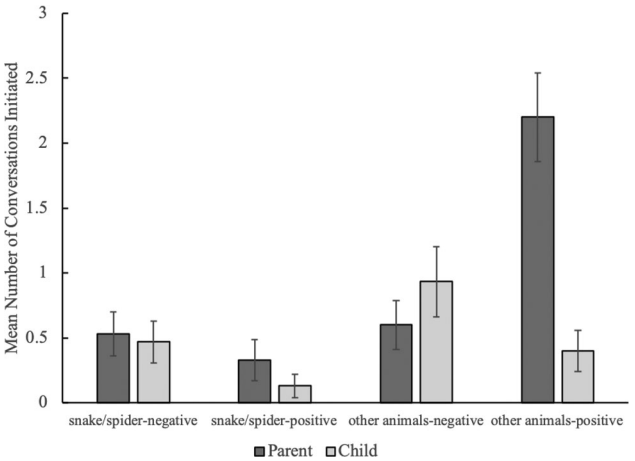


Figure 5. Mean number of conversations initiated by parents and children for snakes and spider compared to other animals.

conversations as the outcome variable. We found a main effect of animal, $F(1, 28) = 39.44$, $p < .001$, $d = 1.07$, 95% CI [.41, 2.27], with participants providing fewer initiated valenced utterances about snakes and spiders ($M = .73$, $SD = .74$) compared to other animals ($M = 2.07$, $SD = 1.60$). We also found a main effect of speaker, $F(1, 28) = 5.83$, $p = .02$, $d = .88$, 95% CI [.27, 3.21], with parents ($M = 3.67$, $SD = 2.29$) initiating more valenced conversations than children ($M = 1.93$, $SD = 1.58$).

There were also several 2-way interactions and one 3-way interaction. More specifically, there was a significant animal by valence interaction, $F(1, 28) = 17.21$, $p < .001$, a significant animal by speaker interaction, $F(1, 28) = 7.99$, $p = .01$, and a significant valence by speaker interaction, $F(1, 28) = 12.08$, $p = .002$. Most importantly, there was a significant three-way interaction between animal, valence, and speaker, $F(1, 28) = 17.21$, $p < .001$. Follow-up two-way ANOVAs with a Bonferroni correction (critical $p = .0125$) revealed that for children, there were no differences for initiating positive conversations about snakes and spiders ($M = .13$, $SD = .35$) compared to other animals ($M = .40$, $SD = .63$), $F(1, 28) = 2.04$, $p = .17$, $d = .53$, 95% CI [-.11, .65] and there were no differences for initiating negative conversations about snakes and spiders ($M = .47$, $SD = .64$) compared to other animals ($M = .93$, $SD = 1.03$), $F(1, 28) = 2.21$, $p = .15$, d = .54, 95% CI [-.18, 1.10]. Parents also showed no difference in negatively initiated conversations about snakes and spiders ($M = .53$, $SD = .64$) compared to other animals, ($M = .60$, $SD = .74$), $F(1, 28) = .07$, $p = .79$, $d = .10$, 95% CI [-.45, .59], but initiated significantly fewer positive conversations about snakes and spiders ($M = .33$, $SD = .62$) compared to other animals ($M = 2.20$, $SD = 1.32$), $F(1, 28) = 24.61$, $p < .001$, $d = 1.81$, 95% CI [1.10, 2.64]. (See Figure 5).

General discussion

Although some fears—like fears of snakes and spiders—are more common than others in adults, there is little data on how these fears develop over the lifespan. And while survey data suggests that the vast majority (89%) of intense fears that develop early in

life come from threatening verbal information (Ollendick & King, 1991), there is no research on the availability of negative information about animals like snakes and spiders in everyday experiences, particularly in the preschool years before animal fears are likely to emerge.

The current research examined the availability of negative verbal information in parent–child conversations about various animals, and. In Study 1, we explored children's reports of what they have learned about these animals through their everyday experiences. As expected, children were more likely to provide threatening information about and reported more fear of snakes and spiders than frogs and turtles. Critically, Study 2 explored one learning context within which children have direct opportunities to observe and learn about snakes and spiders. Here we found that both adults and children provided significantly less positive information about snakes and spiders than other kinds of animals. Further, the nature of their conversations appeared to differ; for example, although parents and children both discussed animals like the Komodo Dragon and Reticulated Python eating prey, discussions of the Komodo Dragon's prey rarely involved people, whereas similar discussions about the snake often involved the snake eating people, and even the participants. These results suggest that negative verbal information about animals like snakes and spiders is present in parent–child conversations, even in a safe, educational setting like a zoo Reptile House.

Importantly, the current results suggest that parents can play an important role in transmitting accurate information about animals to their children. Indeed, we found that parents were the ones driving most of the conversations that took place in the Reptile House: Parents provided more valenced information overall than did their children, and they provided less positive information about snakes and spiders than other kinds of animals. Given that parents are taking the lead in these interactions, informal learning environments such as the community zoo can provide an *opportunity* for parents to relay accurate information about the different animals so that children may learn avoidance responses when appropriate, while preventing the development of irrational fears about animals that pose no threat to humans.

There are a few limitations to the current research. First, while we collected data from both preschools and a local zoo from the diverse area of Essex County, N.J., the final sample was still made up of predominately White children of highly educated parents. Future studies should further explore these relations among a more diverse sample that is more representative of children around the United States. Similarly, in Study 2, as in many studies with informal learning environments, we relied on visitors who chose to visit the zoo and furthermore were willing to enter the Reptile House. Therefore, it is likely that only parents and children with minimal fear of snakes would be willing to participate. Indeed, while only 4 parents (26.7%) reported that they were afraid of snakes in Study 2, rates of normative snake fear in the general population are higher, around 40% (e.g., Agras et al., 1969). Thus, our data might *underestimate* the amount of negative information parents provide about snakes and spiders. Further, while we were able to capture parent–child conversations at a local zoo, we were limited in space and time to conduct the study, leading to a small sample size. As such, the results of the interaction data should be read with caution, and future research should be aimed at replicating the current results with a larger sample. One final limitation of the current work is that our

assessments of children's experience, fear, and knowledge of the different animals in Study 1 used simple yes/no questions. Although these simple response items allowed children to respond easily, we did not use more detailed batteries that have been previously vetted and could provide more nuanced measurements of fear.

Additionally, the nature of conducting research in informal learning environments makes it difficult to know whether the conversations we captured are representative of typical parent–child interactions. For example, it is possible the awareness of being observed may have led to less negative talk by parents and more positive talk overall. Further, in order to increase survey participation, we had parents complete the survey regarding snake and spider fear *before* entering the Reptile House. This may have inadvertently heightened their awareness of these fears and increased negative talk about snakes and spiders. However, given that parents and children did not differ in their initiation of negative conversations about snakes and spiders, we think this is unlikely. In fact, it might be more likely that filling out the survey made parents more self-conscious of any negative feelings about snakes and spiders and also contributed to a positivity bias.

As mentioned previously, there was also signage present in the exhibit hall, and although our analyses showed that the signs for snakes and spiders were just as likely to have positive or negative information compared to the other animals, the signs still may have inadvertently shaped some conversations. It may be beneficial for designers of ILEs to consider how positive and negative information present in exhibit signage may contribute to valenced conversations families produce when visiting these exhibits, and the subsequent effect on the development of positive and negative attitudes toward these animals. It is possible that providing emotional information can enhance patron's understanding of the exhibit, as is often the case for Dark Tourism museums. However, in the case of zoos or other science and nature museums more broadly, the use of emotional content may lead to biases in their perception and beliefs about animals. Future research investigating parent–child conversations about snakes and spiders in the home could provide converging evidence of the data we presented here.

Another factor to consider for future research is the role of direct experience in the development of fears. While children in Study 1 produced more negative information about animals like snakes and spiders and reported more fear of these animals, their direct experiences with these animals might be lacking. Although children were equally likely to have reported learning about snakes and spiders as frogs and turtles, fewer children reported having *seen* a real snake than the other animals, and fewer children reported having *held* snakes and spiders than the others animals. Indeed, it could be that children who are afraid of snakes and spiders refuse opportunities to hold or see these animals when offered; but conversely, less exposure to these animals in a positive, benign setting might make negative information more likely to lead to fear. Research has shown that direct contact with animals like snakes and snails, for example, can lead to more positive attitudes about them and less fear or disgust (Ballouard et al., 2012; Prokop & Fančovičová, 2017; Stanford, 2014). Especially for children in urban environments, informal learning environments like zoos, science centers, and museums may be an important opportunity children have for direct interaction with animals like snakes, and thus may serve a critical role in mitigating

animal fears. Future work should examine how direct exposure to commonly feared animals in such environments affects children's learning and fear beliefs, and importantly, how these informal learning environments might be used to *reduce* existing animals fears.

In conclusion, the current findings are the first to document the availability of negative information about commonly feared animals like snakes and spiders in children's everyday experiences, like a trip to the local zoo. The transmission of negative information is one mechanism that can lead to the development of fear in children, and when combined with direct or observational learning experiences, may exacerbate the development and maintenance of animal fears. While some avoidance responses may seem warranted due to the threatening nature of certain animals, providing accurate and positive information may buffer the odds of developing irrational fears toward benign animals that may become severe over time. Our results highlight the need for parents and educators to consider how information is provided to children to ensure accuracy while avoiding the tendency to provide overly negative and threatening information about animals. In doing this, we can provide children with important facts about the dangers of threatening animals, while limiting the likelihood of the emergence of specific fears.

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Megan Conrad is an Assistant Professor of Psychology and PI of the Center for Development Science at William Paterson University. Her research examines conceptual development about naïve biology across childhood and adolescence, incorporating research from cognitive, educational, developmental, cultural, and social psychology. Her research investigates children's early learning opportunities within informal contexts, including science centers, zoos, parent–child interaction, and media exposure.

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Vanessa LoBue is an Associate Professor and PI of the Child Study Center at Rutgers University – Newark. Dr. LoBue studies humans' behavioral responses to negative or threatening stimuli and the mechanisms that guide the development of these behaviors. In one line of work, she studies how humans perceive the presence of threatening stimuli across the lifespan. In a related line of work, she studies the development of children's avoidance responses to threats, and how they are learned. Her most recent research examines whether early perceptual biases for threat contribute to maladaptive avoidance behaviors, such as those associated with the development of fear and anxiety, and how children learn adaptive avoidance responses, such as avoidance of contagious people or contaminated objects.