

“It Bites!”: The Transmission of Negative Information About Snakes and Spiders Through a Naturalistic Picture Book Interaction

Lori B. Reider, Elise M. Mahaffey, Brian Barylski, and Vanessa LoBue

Department of Psychology, Rutgers University – Newark

Snakes and spiders are two of the most commonly feared animals worldwide, yet we know very little about the mechanisms by which such fears are acquired. We explored whether negative information about snakes and spiders from parents shapes children’s fear beliefs. Study 1 included 27 parents (22 mothers, five fathers) and children (12 female, 15 male, $M_{age} = 5.33$ years, 18 White, one Hispanic, eight more than one race). Most parents reported having an advanced degree (78%) and an annual household income of above \$100,000 (74%). Participants read an animal picture book and then rated their fear toward each animal. Study 2 included 54 parents (44 mothers, eight fathers, two legal guardians) and children (27 female, 27 male, $M_{age} = 5.52$ years, 30 White, one Hispanic, seven Asian/Pacific Islander, four South Asian/Indian, 12 more than one race). Most parents reported holding an AA/BA degree (28%) or an advanced degree (59%) and reported an annual household income of \$60,000–\$100,000 (28%) or above \$100,000 (59%). In Study 2, half of the parents were primed about how their conversations might shape children’s fear prior to reading the book. Across both studies, we found that participants provided more negative than positive information about snakes and spiders and provided less positive (Study 1) and more negative (Study 2) information compared to other animals. Our results highlight the prominence of negative information in conversations about snakes and spiders and suggest that the way parents talk about these animals may shape the development of children’s fears.

Keywords: animal fear, fear learning, negative information, parent-child interactions, childhood fear


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Animal phobias are some of the most common irrational fears among both adults (Curtis et al., 1998; Depla et al., 2008) and children (Costello & Angold, 1995; Essau et al., 2000), with a lifetime prevalence rate ranging from 3.3% to 5.7% (LeBeau et al., 2010). Among these animal fears, snakes and spiders are the most widespread (Conrad et al., 2021; Davey, 1994; Davey et al., 1998; Mineka et al., 1980). Of the more than 3,000 snake species worldwide, approximately 26% of snakes are venomous and pose a significant threat to humans (World Health Organization, 2021). Within the United States, an estimated 13,000 individuals are harmed by snakes annually, with only six of these injuries resulting in death (Centers for Disease Control & Prevention, 2016; Conover, 2019; Forrester et al., 2018).

Similarly, according to a Centers for Disease Control and Prevention report, spider bites were cited as the cause of only 99 deaths between 1979 and 1999 (Forrester & Stanley, 2004). In fact, out of the large number of spider species (approximately 38,000), only a small portion of spiders (0.1%–0.3%) pose a significant threat to humans (Gerdes et al., 2009; Maretic, 1987). Thus, while both snakes and spiders are a potentially deadly threat to humans, such threats are incredibly rare, especially within Western industrialized countries, leaving open the question of why snake and spider fears are so common.

One possible explanation for the prevalence of snake and spider fears is that such fears are innate, as the result of an evolutionary advantage of associating threatening animals with fear (Nesse, 1990; Öhman, 1986). Researchers have proposed that snakes and spiders were a significant threat to humans throughout evolutionary history, and as a result, humans have evolved psychological mechanisms to rapidly detect and subsequently avoid such threats to promote survival (Öhman & Mineka, 2001). Research has provided some support for this phenomenon, with infants, children, and adults displaying rapid detection of snakes and spiders compared to benign controls (e.g., Lobue & DeLoache, 2008, 2010; see LoBue & Rakison, 2013, for a review). Research has also shown that adults form associations between evolutionary threats and aversive outcomes (e.g., an unpleasant shock) that are more resistant to extinction than similar associations with nonthreatening stimuli (see Mallan et al., 2013; Öhman & Mineka, 2001).

Importantly, although some work supports the role of evolutionary prepared learning, this research does not suggest that snake and spider fears are innate. Indeed, several studies have shown that

Lori B. Reider  <https://orcid.org/0000-0001-9436-2253>

Vanessa LoBue  <https://orcid.org/0000-0002-4386-3549>

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Correspondence concerning this article should be addressed to Lori B. Reider, Department of Psychology, Rutgers University – Newark, 101 Warren Street, Room 301, Newark, NJ 07102, United States. Email: lori.reider@rutgers.edu

infants and young children do not display fearful behaviors toward snakes and spiders, and they even approach these animals (Deloache & Lobue, 2009; Lobue et al., 2013). Moreover, snake and spider fears are typically not reported in children younger than 7 years of age (Muris et al., 1997; Ollendick & King, 1991) and are often related to the occurrence of these same fears in parents (Muris et al., 1996). Thus, proponents of the “prepared learning” model suggest that fear of threat-relevant stimuli is not necessarily innate but can be learned quickly (Öhman & Mineka, 2001; Seligman, 1971).

There are three potential pathways for fear learning proposed in the literature—through a direct experience (e.g., being bitten by a snake), through vicarious observation (e.g., observing someone behave fearfully toward a snake), or via the transmission of negative information (e.g., hearing that a snake can bite or kill you; Rachman, 1977, 1991). Given the discussion above on the rarity of people’s threatening encounters with these animals, it is unlikely that fears of snakes and spiders are primarily acquired from direct experience (Murray & Foote, 1979). In fact, children most often attribute the origin of their fears to the indirect learning pathways, with negative information being the most commonly cited source of their fears (Ollendick & King, 1991). Indeed, children are constantly exposed to information through various forms of media (e.g., radio, TV, books) and interactions with others (e.g., parents, peers, adults). According to several studies, hearing negative information about a novel animal leads to children’s heightened fear beliefs (Field et al., 2001; Field & Lawson, 2003; Muris et al., 2003), avoidant behaviors (Field & Lawson, 2003; Rifkin et al., 2016), and heightened physiological responses (Field & Schorah, 2007; see Muris & Field, 2010, for a review). Importantly, negative information most significantly increases children’s fear beliefs when the information comes from an adult compared to a peer (Field et al., 2001). In a study by Muris et al. (2010), parents provided children with negative, positive, or ambiguous information about a novel animal, and children who heard negative information showed an increase in fear, children who heard positive information showed a decrease in fear, and children who heard ambiguous information showed an increase in fear only when high trait anxious parents provided children with their own negative information about the animals. Taken together, this work suggests that negative information—particularly from parents—may be an important source for children’s fear learning.

Importantly, for very young children who have not yet entered formal schooling, parents can serve as a critical source of information, especially about animals (e.g., Jipson & Gelman, 2007; Tarlowski, 2006). And while some parents likely do provide accurate and unbiased information about animals like snakes and spiders, this is probably not the case for some or even most parents. Indeed, most parents are not experts in biology and instead must rely on their prior knowledge, attitudes, and experiences, which are often influenced by cultural biases (Shtulman, 2017). Heightened fear or anxiety in parents has already been linked to the same fears and anxieties in children (e.g., Gerdes et al., 2021; Ollendick & Horsch, 2007). Thus, it is possible that parents with existing snake and spider fears provide more negative information about these animals when compared to other animals, enabling fear learning in their child. Further, according to evolutionary theories discussed above, these fears might be quite easy to learn, and research suggests that when children hear negative information, it

is remembered more accurately than neutral or positive information (e.g., Conrad et al., 2021; Shtulman et al., 2021).

Unfortunately, while we already know that hearing negative information impacts children’s fear of animals, we still know very little about the kinds of information parents typically provide to children about animals like snakes and spiders. In one of the only studies that has directly examined this issue, Conrad and colleagues (2021) explored parent–child conversations while families walked through a reptile house at a local zoo. They found that parents and children provided more negative and less positive information about snakes and spiders compared to other animals—all of which were reptiles, amphibians, or insects—suggesting that negative information about snakes and spiders is more available to children, relative to other animals. It is thus possible that the frequency of negative information about snakes and spiders in the environment might be related to the greater incidence of snake and spider fears. However, this study consisted of families who had already elected (and were thus not afraid) to enter a reptile house at the zoo, which might have underestimated parents’ natural use of negative language about snakes and spiders. Further, the types of animals were not controlled in any way, consisting of only the animals that the zoo provided. It is also possible that the basic facts about the animals provided by the zoo molded parent–child conversations in a way that was less positive and more negative.

Here, we aimed to explore the kinds of information that parents provide about snakes and spiders during naturalistic conversations in a more constrained informal learning environment—in the context of a parent–child picture book reading. In Study 1, parents and preschool-aged children read through a simple picture book of animals, and we recorded their conversations. Our primary question was whether parents would spontaneously provide more negative information about snakes and spiders than other animals. We hypothesized that both parents and children would provide more negative information about snakes and spiders than frogs, turtles, and lizards. Our secondary question was whether parents’ use of negative information was related to their own and their child’s fears of snakes and spiders. We hypothesized that parents’ fear would predict their own use of negative information about snakes and spiders and that their use of negative information would predict children’s fear of snakes and spiders.

In Study 2, we took a step further and examined whether explicit instruction about the impact of negative information on children’s fears would reduce the amount of negative information parents provided about snakes and spiders and whether this reduction would reduce children’s fear. We hypothesized that parents in the instruction condition would provide less negative information and that children in the instruction condition would report less fear of snakes and spiders after the book reading (as a result of hearing less negative information) when compared to the control condition. As a secondary aim, we again examined relations between parent’s fear, use of negative information, and children’s fear of snakes and spiders.

Study 1

Materials and Method

Data and stimuli can be accessed on Databrary (Study 1: LoBue & Reider, 2020a; <https://nyu.databrary.org/volume/1074>). The design

and analysis plans were preregistered on [aspredicted.org](https://aspredicted.org/#37595) (#37595; <https://aspredicted.org/ds3kk.pdf>). All data were collected online during the COVID-19 pandemic.

Participants

Participants were recruited for an online study of parent–child interactions during a picture book reading. The initial sample included 30 parents and children. Sample size was based on previous research using similar methodologies with parents and children (e.g., Conrad et al., 2021). Three parent–child dyads were excluded from the final analyses due to issues with video recordings. The final sample included 27 parents (22 mothers, five fathers) and children (12 girls, 15 boys). The mean age of children in this sample was 5.33 years ($SD = .83$, range = 4.05–6.83). Parents identified themselves as White ($n = 20$), Asian/Pacific Islander ($n = 2$), Native American ($n = 1$), or more than one race ($n = 4$) and their children as White ($n = 18$), Hispanic ($n = 1$), or more than one race ($n = 8$). Parents reported completing some school with no diploma ($n = 2$), holding an AA/BA degree ($n = 4$), or holding an advanced degree ($n = 21$). Parents also reported an annual household income of \$27,249 or less ($n = 1$), \$45,600–\$67,999 ($n = 3$), \$68,000–\$99,999 ($n = 3$), or above \$100,000 ($n = 20$).

Materials

Picture Book. All study materials were provided to parents using Qualtrics (Qualtrics, Provo, UT) during a live online Zoom session with a researcher. The researcher and picture book provided initial introductions to parents about how to navigate the book. First, the researcher said:

For this study, we would like you and your child to sit in front of your computer screen as you read through the following storybook of animals. This storybook will provide information about where the different animals live, but will not provide additional written information, so it will be your job to generate information about the images you see on each page. Please take as much or as little time as you would like on each page, but please try to say something about each page you see. Your child is allowed to ask any questions or chime in at anytime, just as if you were reading a story together at home.

This was followed by instructions provided in the picture book:

Today you are going to hear about different animals around the world. As you go through the book, please spend as much or as little time on each page as you'd like. Please make sure to read all information on each page, starting with the number at the top of each page. Are you ready for an adventure?

The remaining 20 pages of the book each contained a single neutral image of an animal, followed by a brief sentence with the animal category and where the animal lives (e.g., “This is a snake. This kind of snake can be found in Africa”). The book included five animal categories—snakes, spiders, frogs, turtles, and lizards—with one animal image shown per page and four different species represented from each animal category (for a total of 20 pages presented in a randomized order). We selected snakes and spiders because they are animals that commonly elicit fear in both adults and children (Costello & Angold, 1995; Essau et al., 2000). For comparison, we selected three animals (frogs, turtles, and lizards)

that do not commonly elicit fear within the general population. These animals have been commonly used in prior research comparing perceptions of snakes and spiders to other animals because of their physical similarities to snakes and spiders (e.g., Conrad et al., 2021; Lobue & DeLoache, 2008, 2010; see LoBue & Rakison, 2013, for a review). Further, while frogs and spiders are not reptiles like snakes, turtles, and lizards, these animals are commonly found and discussed in similar contexts with children, such as zoos, animal books, and other interactions.

Table 1 presents the full list of specific animals included in the book. Animals from each category were selected such that the threat relevance of the animals was balanced within each category. For example, within the snake category, the king cobra was considered an animal with highly threatening qualities such as being venomous and having the potential to cause extreme physical damage, while the garter snake was considered an animal with low threatening qualities as it is not venomous and does not pose a significant threat to humans. For the lizard category, the Gila monster was considered an animal with high threatening qualities given its venomous saliva and ability to give painful bites, while the skink was considered an animal with low threatening qualities since it is nonvenomous and generally does not bite humans. We did this to ensure that we did not provide only threatening species of one animal category and only nonthreatening species of another. All animal images were found through Google searches or from zoo websites and included a full body image of each real animal, pictured in isolation and in a neutral position (i.e., not eating or attacking) in their natural habitat.

Children's Fear Beliefs. Children completed a modified version of the Fear Beliefs Questionnaire (FBQ; Field & Lawson, 2003). This questionnaire consisted of seven items regarding children's beliefs about each animal category using a 5-point Likert scale presented visually, ranging from 1 = *no, not at all* to 5 = *yes, definitely* (Online Supplemental Materials 1). The seven items were repeated for each animal category for a total of 35 questions.

Table 1
List of Animal Species Included in Both Studies

| Animal category | Species | Threat relevance |
|---------------------|------------------------------|------------------|
| Snake 1 | Black mamba | High |
| Snake 2 | King cobra | High |
| Snake 3 | Garter snake | Low |
| Snake 4 | Bull snake | Low |
| Spider 1 | Brown recluse | High |
| Spider 2 | Funnel web spider | High |
| Spider 3 | Jumping spider | Low |
| Spider 4 | Huntsman spider | Low |
| Lizard 1 | Gila monster | High |
| Lizard 2 | Crocodile monitor | High |
| Lizard 3 | Skink | Low |
| Lizard 4 | Bearded dragon | Low |
| Turtle 1 | Alligator snapping turtle | High |
| Turtle 2 | Matamata turtle | High |
| Turtle 3 | Central American wood turtle | Low |
| Turtle 4 | Galapagos tortoise | Low |
| Frog 1 ^a | Blue poison dart frog | High |
| Frog 2 ^a | Golden poison frog | High |
| Frog 3 ^a | Goliath frog | Low |
| Frog 4 ^a | Red-eyed tree frog | Low |

^a Study 1 only.

Items were verbally presented to the child by the researcher. This measure has been used previously with preschool-aged children (e.g., Rifkin et al., 2016). However, when children deviated from the scale (e.g., only said “yes” in response to a question), we asked the child to specify between the two options on that side of the scale (e.g., “yes, probably” or “yes, definitely”), and when a child was unable to make this distinction, the less extreme response was selected (“yes, probably” or “no, not really”). Scores for the seven items (four reverse scored) for each animal category were averaged to obtain a fear belief score, with higher scores indicating higher fear beliefs. We also created a fear belief score for snakes/spiders and frogs/turtles/lizards as our comparison groups.

Parent Knowledge and Fear Belief Survey. Parents answered questions regarding their fear and knowledge of each of the 20 animals presented in the picture book. For each animal, parents were asked, “Do you know what kind of [animal] this is?” with the option to respond with “yes” or “no.” If the parent’s response was “yes,” they were asked to label the specific animal. As a measure of fear, parents were asked three questions regarding the level of threat, fear, and willingness to approach each animal (Online Supplemental Materials 2). Responses to these three items were averaged across all four species within each of the five animal categories to create a fear belief score for each animal category, with higher scores indicating higher fear beliefs.

Demographic Questionnaire. Parents completed a demographic questionnaire. This questionnaire included information about their own and their child’s racial and ethnic background, relationship to child, sex of the child, zip code, annual household income, and level of education.

Procedure

All procedures and materials were approved by the institutional review board at Rutgers University (study title: “Learning, Perception, and Belief Revision in Infants, Children, and Adults”; Pro-2020000399). Participants were recruited through social media, our lab website, and the ChildrenHelpingScience.com website. The study took place using an online video call using Skype ($n = 14$) or Zoom ($n = 16$). Parents and children completed the study from home with a researcher on the other end of the call. The researcher informed the parent of the nature of the study and asked the parent if the call may be recorded. If the parent agreed, the researcher recorded the call and went over the consent form and procedure of the study, and parents provided verbal consent as well as completed an online consent form.

Parents were then asked to review a picture book of animals with their child. Following the instructions, the researcher turned off their camera and audio and the parent made the picture book full screen so that it was the only thing the parent and child saw on their screen. Parents and children went through the 20 pages of the book in a randomly presented order.

Once the participants finished the book, the researcher provided instructions for the child FBQ, reviewed the response scale, and verbally asked each question to each child. Children were given the option to respond to questions verbally or physically using a hand gesture scale with thumbs up and down options, consistent with previous research (Rifkin et al., 2016; see Online Supplemental Materials 1). Items were grouped by animal category, and the order in which the categories appeared was randomized, as was the order

of the items within each block. Following the child questionnaire, parents completed a series of questions regarding their own knowledge and fear of each of the 20 animals from the picture book. Parents completed the demographic questionnaire at the end of the study.

After completing the study, participants were debriefed regarding the nature of the study, and any questions were answered prior to the end of the session. Families were compensated \$10 in the form of an Amazon gift card as a thank you for their time and participation.

Coding Conversations

Conversations were transcribed by individual utterances provided by parents and children for the specific animal page on the screen during the discussion and were checked by a second researcher prior to coding. Conversations were then coded for positive, negative, or neutral information about the animals on each page using a coding scheme developed in a previous study (Conrad et al., 2021). Utterances that were not directly related to the picture book discussion were not coded (e.g., statements about asking for snack, statements about other animals not included in the book). The coding scheme was not mutually exclusive, meaning that utterances referencing both positive and negative information could be coded as more than one category (e.g., “uhm, it’s kind of nice, but if it has fangs, it’s poisonous”). A total of 13 statements were coded as both positive and negative. Neutral statements were coded anytime information was read directly from the book or when any questions or statements regarding the book content were provided but were not emotional (e.g., discussions about what continent the animal lives on). Positive and negative utterances were further coded by the type of emotional language used (see Online Supplemental Materials 3 for the detailed coding scheme and Online Supplemental Materials 4 for samples of parent–child conversations).

A primary coder was trained and coded all the videos. To establish interrater reliability, an additional coder was trained and independently coded 11 (40%) of the 27 transcripts. Cohen’s kappa (κ) was used to calculate reliability, with values between .60 and .79 considered as moderate agreement and values above .80 considered as strong agreement between raters (Landis & Koch, 1977). We obtained an average Cohen’s κ of .88 for positive, negative, and neutral codes, indicating a very good level of agreement. The primary coder’s data were used for all analyses. Following this, the total number of utterances within each emotion category (positive information and negative information) for each animal category (snakes/spiders and frogs/lizards/turtles) were then summed for each participant (parent and child) to create eight outcome variables—the total number of (a) negative and (b) positive statements provided by (c) parents and (d) children about snakes/spiders and the total number of (e) negative and (f) positive statements provided by (g) parents and (h) children about frogs/turtles/lizards. In addition to this, we also ran all of the following analyses using proportion scores, defined as the total number of positive or negative utterances divided by the total number of utterances for each speaker, to control for the length of conversations about each animal. The results were the same with few exceptions (each noted below). We report the findings from the total number of positive and negative information provided by each speaker for ease of interpretation because we believe that the use of *any* emotional information may be important, in addition to the proportion of emotional information.

Table 2

Study 1: Results for 2 (Information: Positive Versus Negative) × 2 (Animal: Snakes/Spiders Versus Frogs/Turtles/Lizards) × 2 (Speaker: Parent Versus Child) Repeated-Measures ANOVA

| Predictor | <i>df</i> | <i>F</i> | <i>p</i> | η^2 | 95% CI |
|--------------------------------|-----------|----------|----------|----------|------------|
| Between-subjects | | | | | |
| Speaker | 1 | 2.07 | .16 | .04 | [.00, .19] |
| Error | 49 | | | | |
| Within-subjects | | | | | |
| Information | 1 | 7.86 | .01* | .14 | [.01, .31] |
| Speaker × Information | 1 | 4.39 | .04* | .08 | [.00, .25] |
| Error (information) | 49 | | | | |
| Animal | 1 | .81 | .37 | .02 | [.00, .14] |
| Animal × Speaker | 1 | .98 | .33 | .02 | [.00, .15] |
| Error (animal) | 49 | | | | |
| Information × Animal | 1 | 11.06 | .002* | .18 | [.03, .36] |
| Information × Animal × Speaker | 1 | .73 | .40 | .02 | [.00, .13] |
| Error (Information × Animal) | 49 | | | | |

Note. CI = confidence interval.

**p* < .05.

Analytic Plan

Our method, research questions, and main analytic plan were pre-registered through [aspredicted.org](https://aspredicted.org/#37595) (#37595; <https://aspredicted.org/ds3kk.pdf>). In previous work, parents and children reported higher fear beliefs about snakes and spiders relative to other animals and other commonly feared stimuli (e.g., Conrad et al., 2021; Muris et al., 1997). For this reason, all analyses compared snakes and spiders to frogs, turtles, and lizards. When appropriate, we explored differences for snakes and spiders independently. We first asked whether parents spontaneously provided more negative information about snakes and spiders than other animals. We expected that parents would provide more negative and less positive information about snakes and spiders relative to the other animals. We then asked whether children's fear beliefs were related to parents' fear beliefs and parents' use of negative information. We expected that children who heard more negative

information about the animals would report higher fear about those animals. We also expected that, in general, children would report higher fear toward snakes and spiders compared to the other animals and that parents who reported fear of snakes and spiders would have children who also reported higher fear beliefs about these animals. All other analyses were not preregistered and were thus exploratory. Analyses were conducted using SPSS Version 27.

Results

Parents' Prior Knowledge

In the Qualtrics survey following the picture book activity, parents were asked whether they could identify the species of each of the 20 animals presented in the picture book. The majority of parents were unable to accurately identify specific species when

Figure 1
Study 1: Two-Way Interaction: Information by Animal

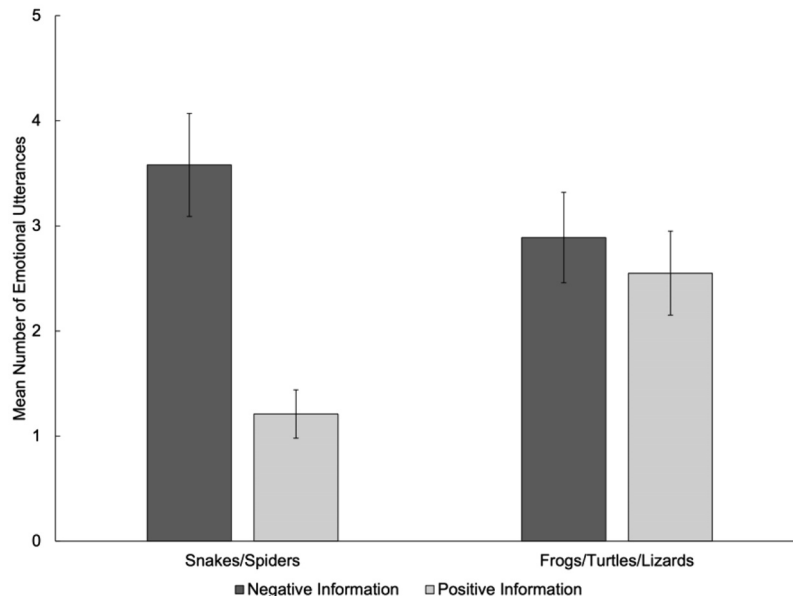
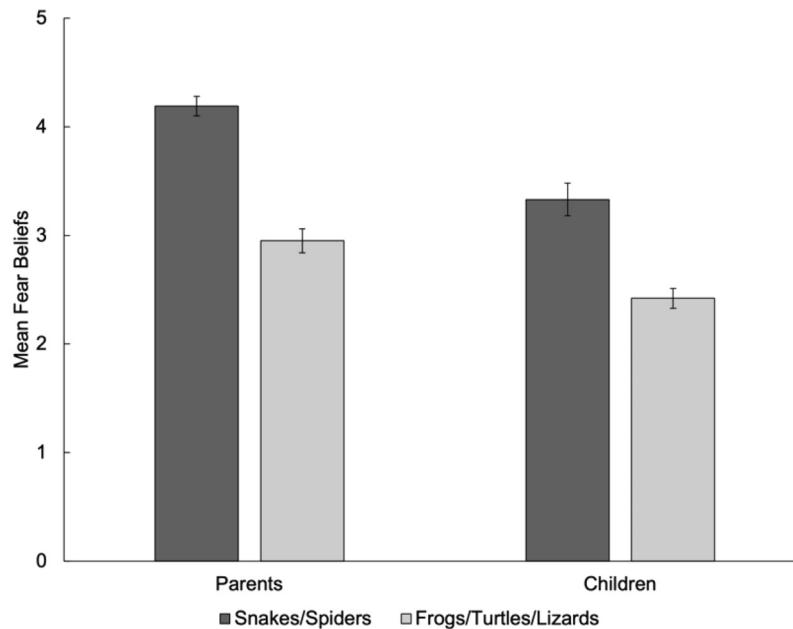


Figure 2
Study 1: Parent and Child Fear Ratings



Note. Parents and children were not provided with the same items for the fear beliefs score, but the scales for each speaker were the same (1–5).

prompted. A few parents were able to accurately identify certain animal species, including the king cobra snake (47%), tree frog (20%), and snapping turtle (20%). However, even for the cobra, which was the most identified animal species in the task, most parents (53%) were unable to identify and accurately name the species. This indicates that most, if not all, of the parents in this sample were not experts on these animal species and therefore were likely drawing from a broader conceptual framework about each animal category while discussing these animals with their children.

Conversation Analyses

Parent–child dyads included in the final sample spent an average of 13.80 minutes ($SD = 7.21$, range = 3.75–33.07) going through the picture book together. Parents provided slightly more information (measured by the total number of utterances) overall ($M = 135.67$, $SD = 62.21$) than children ($M = 85.96$, $SD = 47.43$), $t(52) = 3.30$, $p = .002$, $d = .90$, 95% confidence interval (CI) [.33,

1.46]. This was not surprising given that parents were asked to read and generate information about the animals on each page. However, there were no differences in the amount of emotional (total number of positive or negative) information provided by children ($M = 11.49$, $SD = 11.00$) and parents overall ($M = 8.29$, $SD = 5.12$), $t(52) = 1.37$, $p = .18$, $d = .37$, 95% CI [–.17, .91]. Age was not related to the amount of information children provided during the task (all $ps > .41$). Gender was not related to the amount of information children produced overall ($ps > .05$), except for a significant difference in the amount of negative information provided about lizards, with male children providing more negative information ($M = 1.67$, $SD = 2.35$) than female children ($M = .17$, $SD = .39$), $F(1, 25) = 4.75$, $p = .04$, $\eta^2 = .16$, 95% CI [.00, .40]. Given that, overall, children generally provided similar amounts of information for the animals regardless of age and gender, we did not include these variables in our main analyses.

For the remaining analyses, we removed four data points as outliers, defined by more than 3 standard deviations from the mean of

Table 3
Study 1: Linear Model of Parent Fear of Snakes and Spiders Predicting Child Fear

| Models | b [95% CI] | $SE B$ | β | p value |
|------------------------------|--------------------|--------|---------|-----------|
| Model 1: Snake/spider | | | | |
| Constant | 1.96 [–1.05, 4.05] | 1.46 | | .19 |
| Parent fear | .33 [–.39, 1.04] | .35 | .18 | .36 |
| Model 2: Snakes only | | | | |
| Constant | .81 [–2.76, 4.39] | 1.74 | | .64 |
| Parent fear | .60 [–.25, 1.46] | .42 | .28 | .16 |
| Model 3: Spiders only | | | | |
| Constant | 2.61 [–.004, 5.22] | | | .05 |
| Parent fear | .17 [–.44, .78] | .30 | .11 | .57 |

Note. CI = confidence interval. Model 1: $R^2 = .03$, $p = .36$; Model 2: $R^2 = .08$, $p = .16$; Model 3: $R^2 = .01$, $p = .57$.

Table 4
Study 1: Linear Model of Parent Fear of Snakes and Spiders Predicting Use of Negative Language

| Models | <i>b</i> [95% CI] | <i>SE B</i> | β | <i>p</i> value |
|-----------------------|----------------------|-------------|---------|----------------|
| Model 1: Snake/spider | | | | |
| Constant | -5.95 [-20.22, 8.31] | 6.93 | | .40 |
| Parent fear | 2.32 [-1.07, 5.70] | 1.65 | .27 | .17 |
| Model 2: Snakes only | | | | |
| Constant | -1.16 [-7.49, 5.18] | 3.08 | | .71 |
| Parent fear | .65 [-.86, 2.17] | .74 | .18 | .38 |
| Model 3: Spiders only | | | | |
| Constant | -4.59 [-13.88, 4.70] | 4.51 | | .32 |
| Parent fear | 1.61 [-.58, 3.79] | 1.06 | .29 | .14 |

Note. CI = confidence interval. Model 1: $R^2 = .07, p = .17$; Model 2: $R^2 = .03, p = .38$; Model 3: $R^2 = .08, p = .14$.

positive and negative information for each speaker (parent and child) and animal category (snakes/spiders and frogs/turtles/lizards). This included two children’s positive information about snakes and spiders, one child’s positive information about frogs/turtles/lizards, and one parent’s negative information about snakes and spiders. The remaining analyses are reported with these data points removed, but participants’ data were retained for all other analyses. For transparency, we also reran the conversation analyses including the outliers, and the results are reported in the online supplemental materials and differences are noted throughout the article.

First, we ran a 2 (Information: positive vs. negative) \times 2 (Animal: snakes/spiders vs. frogs/turtles/lizards) \times 2 (Speaker: parent vs. child) repeated-measures analysis of variance (ANOVA) to examine whether parents and children provided different amounts of emotional information about snakes and spiders compared to frogs, turtles, and lizards (see Table 2). Probability values are reported using a Greenhouse-Geisser correction for the repeated-measures ANOVA. Here, we found a significant main effect of information, a speaker by information interaction, and an animal by information interaction. Note that this analysis was rerun with the outliers included and can be found in online Supplemental Table S1 (the speaker by information interaction was no longer significant, and all other interpretations were the same). For the main effect of information, $F(1, 49) = 7.86, p = .01, \eta^2 = .14, 95\% \text{ CI} [.01, .31]$, a follow-up paired-samples *t* test revealed that participants provided more negative information ($M = 6.36, SD = 5.95$) than positive information overall ($M = 3.74, SD = 3.94$), $t(52) = 2.82, p < .01, d = .39, 95\% \text{ CI} [.11, .67]$. There was no main effect of animal ($p = .37$) or speaker ($p = .16$).

We also found two significant interactions. First, we found a significant speaker by information interaction, $F(1, 49) = 4.39, p = .04, \eta^2 = .08, 95\% \text{ CI} [.00, .25]$. This interaction was marginal when using the proportion data ($p = .06$). To probe this interaction, we conducted four follow-up ANOVAs with a Bonferroni correction (critical $p = .0125$). We found that parents provided more positive information about snakes/spiders ($M = 1.81, SD = 2.04$) than their children ($M = .56, SD = .82$), $F(1, 50) = 8.23, p = .01, \eta^2 = .14, 95\% \text{ CI} [.01, .32]$. Parents also provided more positive information about frogs/turtles/lizards ($M = 3.59, SD = 3.05$) than their children ($M = 1.46, SD = 2.40$), $F(1, 51) = 7.93, p = .01, \eta^2 = .14, 95\% \text{ CI} [.01, .31]$. There were no significant differences in negative utterances about snakes/spiders ($p = .64$) or frogs/lizards/turtles ($p = .80$).

We also found a significant information by animal interaction, $F(1, 49) = 11.06, p = .002, \eta^2 = .18, 95\% \text{ CI} [.03, .36]$ (see Figure 1). We probed this interaction with four follow-up ANOVAs using a Bonferroni correction (critical $p = .0125$). Participants provided significantly more negative information ($M = 3.58, SD = 3.55$) than positive information ($M = 1.21, SD = 1.68$) about snakes/spiders, $F(1, 53) = 17.13, p < .001, \eta^2 = .24, 95\% \text{ CI} [.07, .41]$, and also provided less positive information about snakes/spiders ($M = 1.21, SD = 1.68$) compared to frogs/turtles/lizards ($M = 2.55, SD = 2.93$), $F(1, 51) = 11.99, p < .01, \eta^2 = .19, 95\% \text{ CI} [.03, .36]$. There were no significant differences between positive and negative information about frogs/lizards/turtles ($p = .64$) or between the amount of negative information provided for snakes/spiders compared to frogs/turtles/lizards ($p = .06$). Taken together, parents and children provided more negative information about snakes/spiders than positive information, and they also provided less positive information about snakes and spiders compared to frogs, turtles, and lizards.

Table 5
Study 1: Linear Model of Parent Negative Language Predicting Child Fear of Snakes and Spiders

| Models | <i>b</i> [95% CI] | <i>SE B</i> | β | <i>p</i> value |
|-----------------------|-------------------|-------------|---------|----------------|
| Model 1: Snake/spider | | | | |
| Constant | 3.10 [2.66, 3.53] | .21 | | <.001** |
| Parent Negative Info | .06 [-.02, .14] | .04 | .30 | .13 |
| Model 2: Snakes only | | | | |
| Constant | 3.22 [2.71, 3.75] | .25 | | <.001** |
| Parent Negative Info | .06 [-.18, .29] | .12 | .10 | .63 |
| Model 3: Spiders only | | | | |
| Constant | 3.18 [2.87, 3.59] | .20 | | <.001** |
| Parent Negative Info | .07 [-.04, .18] | .05 | .25 | .20 |

Note. CI = confidence interval. Model 1: $R^2 = .09, p = .13$; Model 2: $R^2 = .01, p = .63$; Model 3: $R^2 = .06, p = .20$. ** $p < .001$.

Table 6

Study 2: Results for 2 (Information: Positive Versus Negative) \times 2 (Animal: Snakes/Spiders Versus Frogs/Turtles/Lizards) \times 2 (Speaker: Parent Versus Child) Repeated-Measures ANOVA (Control Group Only)

| Predictor | <i>df</i> | <i>F</i> | <i>p</i> | η^2 | 95% CI |
|--|-----------|----------|----------|----------|------------|
| Between-subjects | | | | | |
| Speaker | 1 | 1.44 | .24 | .03 | [.00, .17] |
| Error | 47 | | | | |
| Within-subjects | | | | | |
| Information | 1 | .31 | .58 | .01 | [.00, .11] |
| Speaker \times Information | 1 | 1.21 | .28 | .03 | [.00, .16] |
| Error (information) | 47 | | | | |
| Animal | 1 | 13.80 | .001* | .23 | [.05, .41] |
| Animal \times Speaker | 1 | .16 | .70 | .003 | [.00, .10] |
| Error (animal) | 47 | | | | |
| Information \times Animal | 1 | 31.50 | <.001** | .40 | [.18, .56] |
| Information \times Animal \times Speaker | 1 | 1.43 | .24 | .03 | [.00, .17] |
| Error (Information \times Animal) | 47 | | | | |

Note. CI = confidence interval.

* $p < .05$. ** $p < .001$.

Animal Beliefs

We next examined self-reported fear ratings from children and parents. Children reported greater fear of snakes/spiders ($M = 3.33$, $SD = .79$) than frogs/turtles/lizards ($M = 2.42$, $SD = .69$), $t(26) = 7.24$, $p < .001$, $d = 1.39$, 95% CI [.85, 1.89]. Parents followed the same pattern, with greater self-reported fear of snakes/spiders ($M = 4.19$, $SD = .45$) than frogs/turtles/lizards ($M = 2.95$, $SD = .56$), $t(26) = 12.00$, $p < .001$, $d = 2.31$, 95% CI [1.57, 3.03] (see Figure 2).

Relations Between Parent Language and Parent/Child Fear

Given that both parents and children provided more negative information and reported higher fears of snakes/spiders than frogs/turtles/lizards, we then explored whether parents' fear of snakes/spiders was predictive of children's fear of snakes/spiders, whether parents' fear was predictive of the amount of negative information they provided about snakes/spiders, and whether parents' production of negative information was predictive of children's fear of snakes and spiders. For

each analysis, we ran regressions on the combined snake/spider data and also ran additional analyses for snakes and spiders individually. None of these were statistically significant ($ps > .12$), and all findings are reported in Tables 3–5. Note that the analyses involving negative information were rerun with the outliers included and can be found in online Supplemental Tables S2 and S3 (results were nearly identical).

Discussion

In Study 1, we found that, overall, participants provided more negative information than positive information about snakes/spiders. In line with previous research (e.g., Conrad et al., 2021), participants also provided less positive information about snakes and spiders compared to other animals. These findings highlight the availability of negative information and lack of positive information in parent–child conversations about snakes and spiders. Interestingly, while we also found that both parents and children reported greater fear of snakes and spiders compared to frogs, turtles,

Figure 3
Study 2: Information by Animal Interaction (Study 1 Replication)

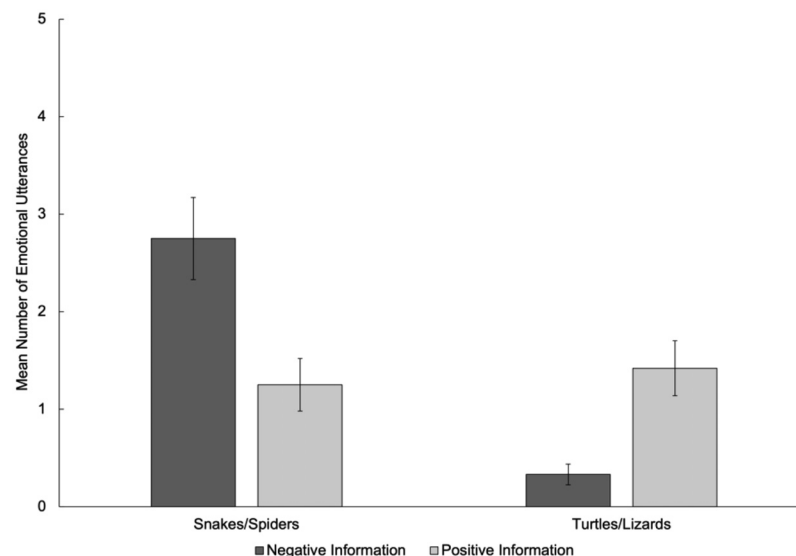


Table 7

Study 2: Results for 2 (Condition: Instruction Versus Control) × 2 (Animal: Snakes/Spiders Versus Lizards/Turtles) Repeated-Measures ANOVA on Parent's Use of Negative Information

| Predictor | <i>df</i> | <i>F</i> | <i>p</i> | η^2 | 95% CI |
|--------------------|-----------|----------|----------|----------|------------|
| Between-subjects | | | | | |
| Condition | 1 | 2.35 | .13 | .05 | [.00, .20] |
| Error | 48 | | | | |
| Within-subjects | | | | | |
| Animal | 1 | 32.54 | <.001** | .40 | [.19, .56] |
| Animal × Condition | 1 | 2.40 | .13 | .05 | [.00, .20] |
| Error (animal) | 48 | | | | |

Note. CI = confidence interval.

***p* < .001.

and lizards, parents' fear of snakes and spiders was not related to their production of negative information about snakes/spiders, nor was parents' production of negative information about snakes and spiders related to children's fear of snakes and spiders. Given that negative information is readily available to children about snakes and spiders (as opposed to positive information, which is provided much less frequently), and given that children report greater fear of snakes and spiders than other animals, in Study 2, we examined whether we could reduce parent's use of negative information about snakes and spiders and whether a reduction of negative information would lead to a reduction in children's fear of snakes and spiders.

Study 2

Materials and Method

Data and stimuli can be accessed on Databrary (Study 2: LoBue & Reider, 2020b; <https://nyu.databrary.org/volume/1209>). The design and analysis plans were preregistered on AsPredicted.org (#50688; <https://aspredicted.org/pv2p8.pdf>). All data were collected online during the COVID-19 pandemic.

Participants

Participants were recruited as part of an online study of parent-child interactions while viewing a picture book together. Participants who participated in Study 1 were not eligible to participate in Study 2. Our main research question for Study 2 was whether we could reduce the amount of negative information about snakes and spiders provided by parents. As such, we preregistered to collect 52 parent-child dyads, with 26 in each condition, based on a power analysis to detect a large effect for our repeated-measures ANOVA with an $\alpha = .05$ and power = .80 (G*Power Version 3.1; Faul et al., 2007). The final sample included 54 parent (44 mothers, eight fathers, and two other legal guardians) and child (27 girls, 27 boys) dyads across two conditions via random assignment ($n = 27$ parents and children per condition). The mean age for children was 5.52 years ($SD = .87$, range = 3.67–7.07). Parents identified themselves as White ($n = 33$), Asian/Pacific Islander ($n = 14$), South Asian/Indian ($n = 4$), Black/African American ($n = 1$), or more than one race ($n = 2$). Parents identified their children as White ($n = 30$), Asian/Pacific Islander ($n = 7$), South Asian/Indian ($n = 4$), Hispanic ($n = 1$), or more than one race ($n = 12$). Parents reported completing high school/GED

Figure 4

Study 2: Mean Number of Negative Utterances Provided by Parents by Condition

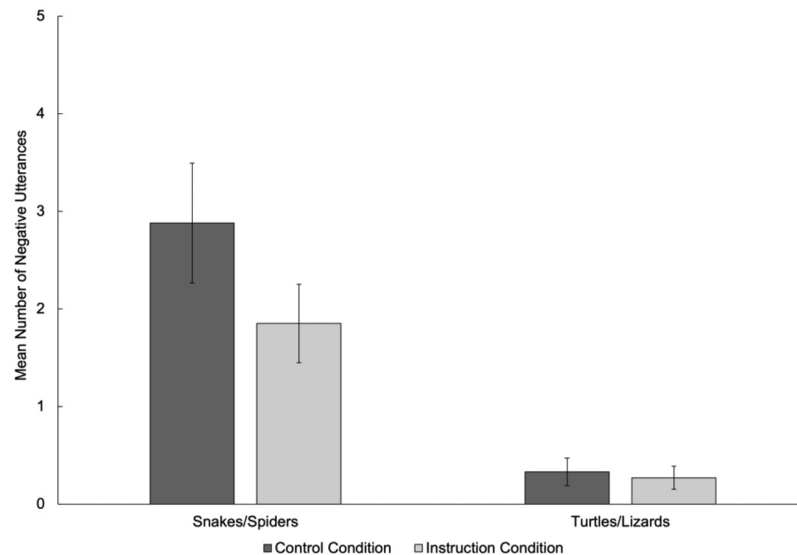


Table 8

Study 2: Results for 2 (Condition: Instruction Versus Control) × 2 (Animal: Snakes/Spiders Versus Lizards/Turtles) Repeated-Measures ANOVA on Parent's Use of Positive Information

| Predictor | <i>df</i> | <i>F</i> | <i>p</i> | η^2 | 95% CI |
|--------------------|-----------|----------|----------|----------|------------|
| Between-subjects | | | | | |
| Condition | 1 | .55 | .46 | .01 | [.00, .12] |
| Error | 50 | | | | |
| Within-subjects | | | | | |
| Animal | 1 | .64 | .43 | .01 | [.00, .13] |
| Animal × Condition | 1 | .85 | .36 | .02 | [.00, .14] |
| Error (animal) | 50 | | | | |

Note. CI = confidence interval.

($n = 1$), completing some college or trade school ($n = 2$), holding an AA/BA degree ($n = 17$), or holding an advanced degree ($n = 34$). Parents reported an annual household income of less than \$20,000 ($n = 2$), \$20,000–\$40,000 ($n = 2$), \$40,000–\$60,000 ($n = 2$), \$60,000–\$100,000 ($n = 15$), or above \$100,000 ($n = 32$) or did not report this information ($n = 1$).

Materials

Picture Book. The picture book used in Study 1 was modified for Study 2. First, we removed the frog category from the book as we found that most participants knew that brightly colored poison frogs were different from other frogs and may have biased the conversations about this category. This resulted in four pages removed from the book, making the book slightly shorter than the one used in Study 1. Second, we created two different sets of instructions for the instruction and control conditions. Those in the control condition received the same instructions as Study 1, while those in the instruction condition received additional information about the importance of the parent–child conversations and book readings on children's learning and its potential to increase or decrease children's fears. Specifically, they were told the following:

Previous research suggests that children learn from the books that adults read to them, both from the content of the book, as well as the conversations it may inspire. This is one of the great things about reading books to our children, but it also means that children can learn negative information from books too and develop fears as a result (e.g., "this animal is scary" or "this animal is gross"). Please consider this while you're reading the storybook today and try to focus on the information you most want your child to learn about the animals.

Children's Fear Beliefs. Children completed the same modified version of the FBQ (Field & Lawson, 2003) from Study 1, for

snakes, spiders, turtles, and lizards. The seven items were repeated for each animal category for a total of 28 questions. Four of the seven items for each animal were reverse scored. Scores for each animal were averaged to obtain a fear belief score for each animal, with higher scores suggesting higher fear beliefs. We also created a fear belief score for snakes/spiders and lizards/turtles as our comparison groups.

Parent Knowledge and Fear Belief Survey. Parents completed the same questionnaires provided in Study 1. Parents were asked if they could identify each of the 16 animals presented in the book and, if yes, to provide the species name of the animal. As a measure of fear, parents completed the same questions asked in Study 1, but the questions were asked about each animal category in general (e.g., snakes, lizards) instead of each species presented in the book (e.g., king cobra). We did this because in Study 1, we found that most parents could not identify any of the specific animal species and that asking about the animal category generally would provide a better marker of fear and would be in line with the children's fear beliefs scales.

Demographic Questionnaire. Parents completed the same demographic questionnaire as Study 1. This questionnaire included information about their own and their child's racial and ethnic background, relationship to child, sex of the child, zip code, annual household income, and level of education.

Procedure

All procedures and materials were approved by the institutional review board at Rutgers University (study title: "Learning, Perception, and Belief Revision in Infants, Children, and Adults"; Pro-2020000399). Participants were randomly assigned to the instruction or control condition prior to study participation. To ensure the instructions were provided similarly across participants

Table 9

Study 2: Results for 2 (Condition: Instruction Versus Control) × 2 (Animal: Snakes/Spiders Versus Lizards/Turtles) Repeated-Measures ANOVA on Parent's Use of Neutral Information

| Predictor | <i>df</i> | <i>F</i> | <i>p</i> | η^2 | 95% CI |
|--------------------|-----------|----------|----------|----------|------------|
| Between-subjects | | | | | |
| Condition | 1 | .51 | .48 | .01 | [.00, .12] |
| Error | 51 | | | | |
| Within-subjects | | | | | |
| Animal | 1 | .20 | .66 | .004 | [.00, .10] |
| Animal × Condition | 1 | .77 | .38 | .02 | [.00, .13] |
| Error (animal) | 51 | | | | |

Note. CI = confidence interval.

Table 10
Study 2: Results for 2 (Condition: Instruction Versus Control) × 2 (Animal: Snakes/Spiders Versus Lizards/Turtles) Repeated-Measures ANOVA on Children’s Use of Negative Information

| Predictor | <i>df</i> | <i>F</i> | <i>p</i> | η^2 | 95% CI |
|--------------------|-----------|----------|----------|----------|------------|
| Between-subjects | | | | | |
| Condition | 1 | .00 | .99 | <.001 | [.00, .00] |
| Error | 49 | | | | |
| Within-subjects | | | | | |
| Animal | 1 | 25.48 | <.001** | .34 | [.14, .51] |
| Animal × Condition | 1 | .32 | .57 | .01 | [.00, .11] |
| Error (animal) | 49 | | | | |

Note. CI = confidence interval.
 ***p* < .001.

within each condition, parents read and listened to a prerecorded audio track of a researcher providing the instructions for each condition. All other procedures were identical to Study 1.

Coding Conversations

The same coding scheme was used from Study 1. A primary coder was trained and coded all the videos. To establish interrater reliability, an additional coder independently coded 16 (30%) of the transcripts, eight from each condition. Cohen’s κ was .95 for category coding of positive, negative, and neutral utterances, indicating a very good level of agreement (Landis & Koch, 1977). The primary coder’s data was used for all analyses. Following this, the total number of positive and negative utterances for each animal category (snakes/spiders, turtles/lizards) were summed for each participant (parent, child). Coding was not mutually exclusive, and a total of 11 statements were coded as both positive and negative. Since our experimental manipulation was specific to parental language, our main analyses focused on the information provided by the parent, but we also ran the same analyses using the child data.

Results

Analytic Plan

Our main research questions, analytic plan, and methodology were preregistered through [aspredicted.org](https://aspredicted.org/#50688) (#50688; <https://aspredicted.org/pv2p8.pdf>). We first asked whether parents provided different amounts of positive and negative information about snakes/spiders than turtles/lizards and whether this differed by condition. We expected that parents in the control group would provide more negative information about snakes/spiders than other animals,

and we expected no difference in the amount of negative information provided for turtles/lizards across the two conditions. We also explored whether parents in the instruction condition provided more positive information about snakes/spiders than lizards/turtles. We then asked whether parents’ fear of snakes/spiders and turtles/lizards was related to their production of negative information about each animal category. We expected parent’s fear of snakes/spiders would be related to their production of negative information about these animals in the control condition. We expected no such relation for the instruction condition. We then asked whether there were differences in children’s fear beliefs between the two conditions. We expected that children would report greater fear toward snakes/spiders than turtles/lizards overall and that children in the control condition would report greater fear of snakes/spiders than children in the instruction condition. We then explored whether parents’ fears of snakes, spiders, turtles, and lizards were related to children’s fears of snakes, spiders, turtles, and lizards. Finally, we asked whether parents’ production of negative information about snakes/spiders and turtles/lizards was related to children’s fear in each condition. We expected that parents’ production of negative information about snakes/spiders would be positively related to children’s fear of snakes/spiders for the control condition only. We expected no such relation in the instruction condition as we also predicted that parents in the instruction condition would use less negative information overall. All other analyses were not preregistered and were thus exploratory.

Descriptives About Conversations

For the following analyses, we removed nine data points as outliers, defined as more than 3 standard deviations from the mean of

Table 11
Study 2: Results for 2 (Condition: Instruction Versus Control) × 2 (Animal: Snakes/Spiders Versus Lizards/Turtles) Repeated-Measures ANOVA on Children’s Use of Positive Information

| Predictor | <i>df</i> | <i>F</i> | <i>p</i> | η^2 | 95% CI |
|--------------------|-----------|----------|----------|----------|------------|
| Between-subjects | | | | | |
| Condition | 1 | .65 | .42 | .01 | [.00, .13] |
| Error | 49 | | | | |
| Within-subjects | | | | | |
| Animal | 1 | .57 | .45 | .01 | [.00, .13] |
| Animal × Condition | 1 | .03 | .86 | .001 | [.00, .06] |
| Error (animal) | 49 | | | | |

Note. CI = confidence interval.

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Table 12

Study 2: Results for 2 (Condition: Instruction Versus Control) × 2 (Animal: Snakes/Spiders Versus Lizards/Turtles) Repeated-Measures ANOVA on Children's Use of Neutral Information

| Predictor | <i>df</i> | <i>F</i> | <i>p</i> | η^2 | 95% CI |
|--------------------|-----------|----------|----------|----------|------------|
| Between-subjects | | | | | |
| Condition | 1 | 2.42 | .13 | .05 | [.00, .19] |
| Error | 51 | | | | |
| Within-subjects | | | | | |
| Animal | 1 | .03 | .86 | .001 | [.00, .06] |
| Animal × Condition | 1 | .25 | .62 | .01 | [.00, .10] |
| Error (animal) | 51 | | | | |

Note. CI = confidence interval.

emotional information (positive and negative) for each speaker (parent and child), animal category (snakes/spiders and lizards/turtles), and condition (control and instruction). This included one child's positive information about snakes/spiders, one child's and one parent's positive information about lizards/turtles, and three parents' and two children's negative information about lizards/turtles. Of these, five data points were from the instruction condition, and three were from the control condition. One parent-child dyad from the control condition could not be transcribed because their conversation was in a non-English language and thus was removed from all conversation analyses but retained for questionnaire analyses. Participants were retained for all analyses except analyses that involved the outlier response. For analyses using the conversation data, we also reran the analyses including the outliers, and the results are reported in the online supplemental materials and are noted throughout the article for transparency.

Parent-child dyads included in the final sample spent an average of 9.46 minutes ($SD = 5.94$, range = 2.03–25.55) going through the picture book together. There were no differences in time spent reading the book between conditions, $t(52) = 1.67$, $p = .10$, $d = 5.84$, 95% CI [−.09, .99]. Parents provided slightly more information (measured by the number of utterances) overall ($M = 107.06$, $SD = 67.58$) than children ($M = 71.75$, $SD = 50.82$), $t(104) = 3.04$, $p = .003$, $d = .59$, 95% CI [.20, .98]. There were no differences in the amount of emotional (positive and negative) information provided by children ($M = 4.28$, $SD = 4.54$), and parents ($M = 5.47$, $SD = 4.95$), $t(97) = 1.25$, $p = .22$, $d = .25$, 95% CI [−.15, .65]. Age was only related to children's positive information about lizards/turtles ($r = .42$, $p = .03$) and to lizards specifically ($r = .44$, $p = .02$) in the instruction condition. Age was not related to the amount of information children provided about any of the other animals across conditions (all $ps > .06$). Similarly, gender was not related to the amount of information children produced overall ($ps > .15$), except for a nonsignificant difference in the amount of positive information provided about turtles in the instruction condition, with female children providing more positive information ($M = 1.06$, $SD = 1.39$) than male children ($M = .11$, $SD = .33$), $F(1, 25) = 3.96$, $p = .06$, $\eta^2 = .14$, 95% CI [.00, .37]. Given that, overall, children provided similar amounts of information for different animal categories regardless of age and gender, and that our primary analyses were focused on parent language, we did not include these variables in the remaining analyses. Additionally, as in Study 1, we reran all analyses using proportion scores, and the results were generally the same (differences are noted throughout).

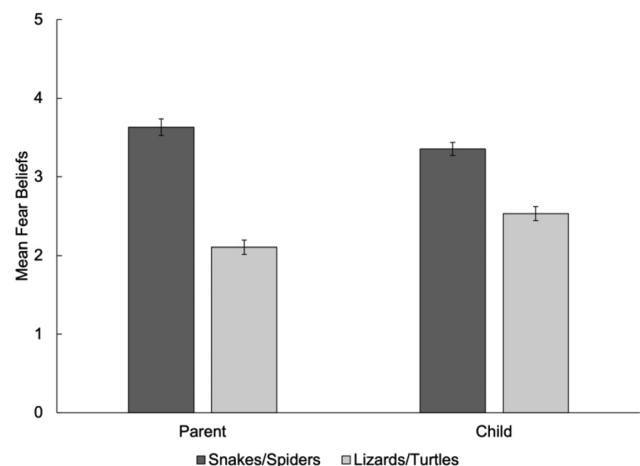
Parents' Prior Knowledge

In the Qualtrics survey following the picture book task and child FBQ, parents were asked to identify each of the animal species presented in the book to assess prior knowledge. As in Study 1, the majority of parents were unable to identify the animal species presented in the book, with the exception of the king cobra snake, which was correctly identified by 70% of parents. All other animal species were correctly identified by a small number of parents, with the second most accurately identified species being the Galapagos tortoise (28% accuracy), followed by the garter snake (17%), bearded dragon (15%), and snapping turtle (15%).

Replication of Study 1

The following analyses were conducted using the control group data in an attempt to replicate the findings from the omnibus ANOVA from Study 1. We ran a 2 (Information: positive vs. negative) × 2 (Animal: snakes/spiders vs. lizards/turtles) × 2 (Speaker: parent vs. child) repeated-measures ANOVA to examine whether parents and children from the control group provided different amounts of emotional information about snake/spiders compared to lizards/turtles (see Table 6). Probability values are reported using a Greenhouse-Geisser correction for the repeated-

Figure 5
Study 2: Fear Beliefs by Speaker and Animal



Note. Parents and children were not provided with the same items for the fear beliefs score, but the scales for each speaker were the same (1–5).

Table 13
Study 2: Results for 2 (Condition: Control Versus Instruction) × 2 (Animal: Snakes/Spiders Versus Lizards/Turtles) Repeated-Measures ANOVA on Children’s Fear of Animals

| Predictor | df | F | p | η ² | 95% CI |
|--------------------|----|-------|---------|----------------|------------|
| Between-subjects | | | | | |
| Condition | 1 | 1.61 | .21 | .03 | [.00, .16] |
| Error | 52 | | | | |
| Within-subjects | | | | | |
| Animal | 1 | 78.78 | <.001** | .60 | [.42, .71] |
| Animal × Condition | 1 | 3.74 | .06 | .07 | [.00, .22] |
| Error (animal) | 52 | | | | |

Note. CI = confidence interval.
 **p < .001.

measures ANOVA. There was no main effect of information ($p = .58$) or information by speaker interaction ($p = .28$), both of which were found in Study 1. However, we found a main effect of animal, $F(1, 47) = 13.80, p = .001, \eta^2 = .23, 95\% \text{ CI } [.05, .41]$. A follow-up paired-samples t test revealed that participants provided more emotional (positive and negative) information overall about snakes/spiders ($M = 3.82, SD = 4.00$) than lizards/turtles ($M = 1.71, SD = 2.42$), $t(48) = 3.76, p < .001, d = .54, 95\% \text{ CI } [.23, .83]$.

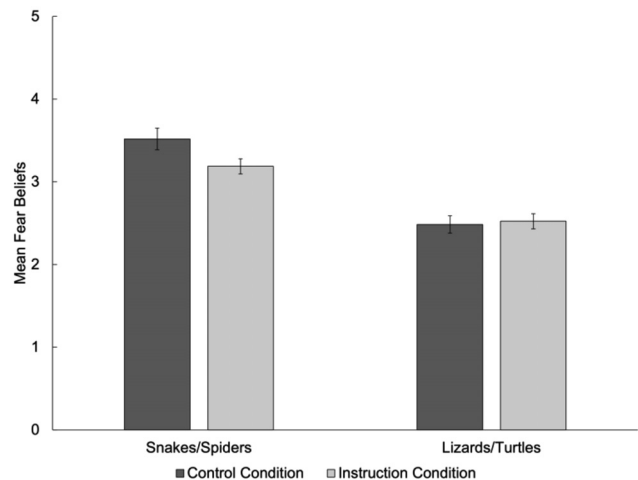
As in Study 1, we found a significant information by animal interaction, $F(1, 47) = 31.50, p < .001, \eta^2 = .40, 95\% \text{ CI } [.18, .56]$ (see Figure 3). We conducted four follow-up ANOVAs with a Bonferroni correction (critical $p = .0125$), which indicated that participants provided significantly more negative information ($M = 2.75, SD = 3.04$) than positive information ($M = 1.25, SD = 1.91$) about snakes/spiders, $F(1, 51) = 14.31, p < .001, \eta^2 = .22, 95\% \text{ CI } [.05, .39]$, and provided more positive information ($M = 1.39, SD = 2.06$) than negative information ($M = .33, SD = .75$) about lizards/turtles, $F(1, 48) = 14.65, p < .001, \eta^2 = .23, 95\% \text{ CI } [.06, .41]$. Participants also provided more negative information about snakes/spiders ($M = 2.59, SD = 2.90$) than lizards/turtles ($M = .33, SD = .75$), $F(1, 48) = 32.31, p < .001, \eta^2 = .40, 95\% \text{ CI } [.19, .56]$, but no difference in the amount of positive information provided between the animals ($p = .55$). When we ran the same analyses with the proportion data, we obtained the same main effect of animal ($p = .01$) and information by animal interaction ($p < .001$). Note that this analysis was also rerun with the outliers included and can be found in online Supplemental Table S4 (all interpretations were the same). In sum, we were able to replicate the information by animal interaction, with participants in both studies providing more negative and less positive information about snakes/spiders, and in Study 2 specifically, providing more negative information about snakes/spiders compared to other animals.

Conversation Analyses

A 2 (Condition: instruction vs. control) × 2 (Animal: snakes/spiders vs. lizards/turtles) repeated-measures ANOVA was conducted to examine whether parents provided different amounts of emotional (positive and negative) information about snakes/spiders and lizards/turtles and whether this differed by condition. We ran separate ANOVAs for positive and negative information to avoid unpacking a three-way interaction that may be underpowered. Probability values are reported using a Greenhouse–Geisser correction for the repeated-measures ANOVA. For the 2 (Condition: instruction vs. control) × 2 (Animal: snakes/spiders vs. lizards/turtles) repeated-measures ANOVA on parent’s use of negative information

(see Table 7), we found a main effect of animal, $F(1, 48) = 32.54, p < .001, \eta^2 = .40, 95\% \text{ CI } [.19, .56]$. A follow-up paired-samples t test revealed that parents provided a greater amount of negative information about snakes/spiders ($M = 2.18, SD = 2.47$) than turtles/lizards ($M = .30, SD = .65$), $t(50) = 5.57, p < .001, d = .79, 95\% \text{ CI } [.47, 1.10]$. Interestingly, we found a nonsignificant effect of condition that was approaching significance in the expected direction, $F(1, 48) = 2.35, p = .13, \eta^2 = .05, 95\% \text{ CI } [.00, .20]$, with parents in the instruction condition providing slightly less negative information ($M = 1.92, SD = 2.06$) than parents in the control condition ($M = 3.08, SD = 3.22$). The animal by condition interaction also did not reach significance ($p = .13$) but was in the expected direction, with parents in the instruction condition providing less negative information about snakes/spiders ($M = 1.85, SD = 2.09$) than the control condition ($M = 2.88, SD = 3.13$) and to a lesser extent for lizards/turtles ($M = .27, SD = .60$) than the control condition ($M = .33, SD = .70$; see Figure 4). We then ran a 2 (Condition: instruction vs. control) × 2 (Animal: snakes/spiders vs. lizards/turtles) repeated-measures ANOVA on parent’s use of positive information (see Table 8) and found no effect of animal ($p = .43$), condition ($p = .46$), or animal by condition interaction ($p = .36$). We then ran the same ANOVA to examine differences in parents’ use of neutral information by condition and animal (see Table 9), and we found no effect of animal ($p = .66$), condition

Figure 6
Study 2: Animal by Condition Interaction on Children’s Fear



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Table 14

Study 2: Linear Model of Parent Fear of Animals Predicting Use of Negative Language (Control Condition)

| Model | <i>b</i> [95% CI] | <i>SE B</i> | β | <i>p</i> |
|---------------|--------------------|-------------|---------|----------|
| Constant | 7.93 [1.00, 14.86] | 3.36 | | .03* |
| Snake/spider | -1.35 [-3.16, .47] | .88 | -.30 | .14 |
| Constant | 3.02 [-1.30, 7.33] | 2.09 | | .16 |
| Snake only | -.43 [-1.49, .64] | .52 | -.17 | .42 |
| Constant | 2.43 [-.80, 5.65] | 1.56 | | .13 |
| Spider only | -.24 [-1.14, .65] | .43 | -.11 | .58 |
| Constant | -.35 [-1.53, .82] | .57 | | .54 |
| Lizard/turtle | .30 [-.20, .80] | .24 | .26 | .22 |
| Constant | .57 [-.41, 1.56] | .48 | | .24 |
| Lizard only | -.13 [-.50, .23] | .18 | -.15 | .46 |
| Constant | .25 [-1.22, 1.71] | .711 | | .73 |
| Turtle only | .12 [-.63, .86] | .36 | .07 | .75 |

Note. CI = confidence interval. Snake/spider: $R^2 = .09$, $p = .14$; snake only: $R^2 = .03$, $p = .42$; spider only: $R^2 = .01$, $p = .58$; lizard/turtle: $R^2 = .07$, $p = .22$; lizard only: $R^2 = .02$, $p = .46$; turtle only: $R^2 = .004$, $p = .75$.

* $p < .05$.

($p = .48$), or animal by condition interaction ($p = .38$). This suggests that the intervention specifically targeted negative information only and did not reduce the amount of information provided overall. The interpretation of significant results was the same using the proportion data, as well as the data with the outliers included (see online Supplemental Tables S5–S7).

Next, we ran the same set of analyses on children's production of negative and positive information to explore whether the instructional manipulation influenced children's use of emotional language. For the 2 (Condition: instruction vs. control) \times 2 (Animal: snakes/spiders vs. lizards/turtles) repeated-measures ANOVA on children's negative information (see Table 10), we found a main effect of animal, $F(1, 49) = 25.48$, $p < .001$, $\eta^2 = .34$, 95% CI [.14, .51]. A follow-up paired-samples t test showed that children provided more negative information about snakes/spiders ($M = 2.33$, $SD = 2.83$) than lizards/turtles ($M = .43$, $SD = .81$), $t(50) = 5.07$, $p < .001$, $d = .71$, 95% CI [.40, 1.02]. There was no significant effect of condition ($p = .99$) or condition by animal interaction ($p = .57$). For the 2 (Condition: instruction vs. control) \times 2 (Animal: snakes/spiders vs. lizards/turtles) repeated-measures ANOVA on children's production of positive information

(see Table 11), we found no main effect of animal ($p = .45$), condition ($p = .42$), or animal by condition interaction ($p = .86$). We also ran the same ANOVA to examine whether there are differences in children's use of neutral information by condition and animal (see Table 12), and we found no main effect of animal ($p = .86$), condition ($p = .13$), or animal by condition interaction ($p = .62$). The interpretation of the results was the same using the proportion data and the data with the outliers included (see online Supplemental Tables S8–S10 for additional details).

Animal Beliefs

We then examined children's and parents' fear beliefs across conditions. First, we examined whether parents and children reported greater fear of snakes/spiders than lizards/turtles. As in Study 1, we found that both parents and children reported greater fear of snakes/spiders ($M_{\text{parent}} = 3.63$, $SD_{\text{parent}} = .78$; $M_{\text{child}} = 3.35$, $SD_{\text{child}} = .60$) than lizards/turtles ($M_{\text{parent}} = 2.10$, $SD_{\text{parent}} = .66$; $M_{\text{child}} = 2.50$, $SD_{\text{child}} = .50$), and this difference was significant for both parents $t(53) = 15.14$, $p < .001$, $d = 2.06$, 95% CI [1.58, 2.53], and children, $t(53) = 8.66$, $p < .001$, $d = 1.18$, 95% CI [.83, 1.52] (see Figure 5). These results did not change when we

Table 15

Study 2: Linear Model of Parent Fear of Animals Predicting Use of Negative Language (Instruction Condition)

| Model | <i>b</i> [95% CI] | <i>SE B</i> | β | <i>p</i> |
|---------------|--------------------|-------------|---------|----------|
| Constant | -.34 [-3.93, 3.25] | 1.74 | | .85 |
| Snake/spider | .63 [-.37, 1.63] | .49 | .25 | .21 |
| Constant | -.71 [-2.83, 1.41] | 1.03 | | .50 |
| Snake only | .41 [-.13, .96] | .26 | .30 | .13 |
| Constant | 1.43 [-.87, 3.73] | 1.12 | | .21 |
| Spider only | -.14 [-.83, .56] | .34 | -.08 | .69 |
| Constant | .44 [-.34, 1.21] | .37 | | .26 |
| Lizard/turtle | -.08 [-.45, .29] | .18 | -.10 | .64 |
| Constant | .73 [-.03, 1.49] | .37 | | .06 |
| Lizard only | -.20 [-.53, .13] | .16 | -.24 | .23 |
| Constant | .51 [-.37, 1.40] | .43 | | .24 |
| Turtle only | -.18 [-.64, .28] | .22 | -.16 | .42 |

Note. CI = confidence interval. Snake/spider: $R^2 = .06$, $p = .21$; snake only: $R^2 = .09$, $p = .13$; spider only: $R^2 = .01$, $p = .69$; lizard/turtle: $R^2 = .01$, $p = .64$; lizard only: $R^2 = .06$, $p = .23$; turtle only: $R^2 = .03$, $p = .42$.

Table 16
Study 2: Linear Model of Parent Use of Negative Language Predicting Children’s Fear (Control Condition)

| Model | <i>b</i> [95% CI] | <i>SE B</i> | β | <i>p</i> |
|---------------|-------------------|-------------|---------|----------|
| Constant | 3.17 [2.84, 3.49] | .16 | | <.001** |
| Snake/spider | .11 [.03, .19] | .04 | .52 | .007* |
| Constant | 3.30 [2.99, 3.62] | .15 | | <.001** |
| Snake only | .14 [.001, .27] | .07 | .40 | .05 |
| Constant | 3.25 [2.84, 3.65] | .20 | | <.001** |
| Spider only | .16 [−.01, .33] | .08 | .37 | .07 |
| Constant | 2.43 [2.22, 2.65] | .10 | | <.001** |
| Lizard/turtle | .13 [−.15, .42] | .14 | .21 | .33 |
| Constant | 2.60 [2.31, 2.89] | .14 | | <.001** |
| Lizard only | −.09 [−.49, .30] | .19 | −.10 | .63 |
| Constant | 2.33 [2.06, 2.60] | .13 | | <.001** |
| Turtle only | .16 [−.07, .38] | .11 | .28 | .17 |

Note. CI = confidence interval. Snake/spider: $R^2 = .27, p = .007$; snake only: $R^2 = .15, p = .05$; spider only: $R^2 = .13, p = .07$; lizard/turtle: $R^2 = .04, p = .33$; lizard only: $R^2 = .01, p = .63$; turtle only: $R^2 = .08, p = .17$. * $p < .05$. ** $p < .001$.

examined fear beliefs separately for each condition ($ps < .001$). We then ran a series of Pearson correlations on each condition to examine whether parent and children’s fears of snakes, spiders, turtles, and lizards were correlated with one another. There were no relations between parents’ and children’s fears of animals in the control ($ps > .07$) or the instruction condition ($ps > .28$).

To test whether children’s fear beliefs differed by condition, we ran a 2 (Condition: control vs. instruction) \times 2 (Animal: snakes/spiders vs. lizards/turtles) repeated-measures ANOVA (see Table 13). We found a main effect of animal, $F(1, 52) = 78.78, p < .001, \eta^2 = .60, 95\% \text{ CI} [.42, .71]$. A follow-up paired-samples t test revealed that, overall, children reported significantly greater fear of snakes/spiders ($M = 3.53, SD = .60$) than lizards/turtles ($M = 2.50, SD = .50$), $t(53) = 8.66, p < .001, d = 1.18, 95\% \text{ CI} [.83, 1.52]$. We also found a nonsignificant animal by condition interaction, $F(1, 52) = 3.74, p = .06, \eta^2 = .07, 95\% \text{ CI} [.00, .22]$ (see Figure 6). Though not significant at the $p < .05$ level, this effect was in the expected direction, with children in the instruction condition reporting less fear of snakes/spiders ($M = 3.19, SD = .48$) than the control condition ($M = 3.52, SD = .68$), $t(46.52) = 2.07, p = .04, d = .56, 95\% \text{ CI} [.02, 1.11]$.

Language and Fear Analyses

Finally, we ran a series of linear regressions for each condition to examine whether parents’ fear of snakes/spiders and turtles/lizards predicted their production of negative information for each animal category. Results are presented in Table 14 for the control condition and Table 15 for the instruction condition, and all tests were not significant ($ps > .12$). The interpretation of the results was the same using the proportion data and the data with the outliers included (see online Supplemental Tables S11a and S11b for additional details).

Next, we ran a series of linear regressions for each condition to examine whether parents’ production of negative information about snakes/spiders and lizards/turtles predicted children’s fear. All results are reported in Tables 16 and 17 for the control and instruction conditions, respectively, and noteworthy results are summarized here. We found that parents’ production of negative information about snakes/spiders predicted their children’s fear of snakes/spiders in the control condition $R^2 = .27, F(1, 24) = 8.79, p = .007$ (see Figure 7), but not in the instruction condition ($p = .43$). This finding was attenuated using the proportion data ($p = .08$). We found no significant relations between parents’ production

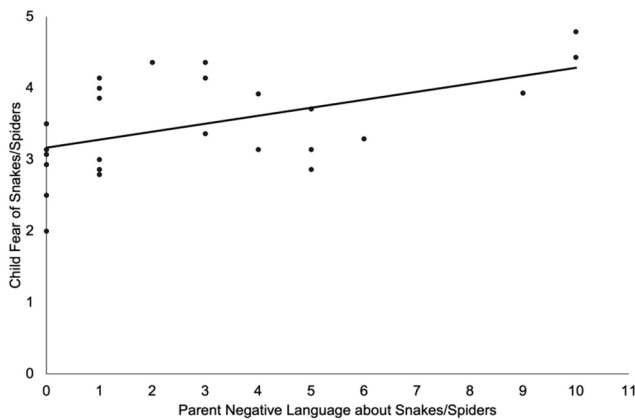
Table 17
Study 2: Linear Model of Parent Use of Negative Language Predicting Children’s Fear (Instruction Condition)

| Model | <i>b</i> [95% CI] | <i>SE B</i> | β | <i>p</i> |
|---------------|-------------------|-------------|---------|----------|
| Constant | 3.26 [3.00, 3.51] | .12 | | <.001** |
| Snake/spider | −.04 [−.13, .06] | .05 | −.16 | .43 |
| Constant | 3.16 [2.88, 3.45] | .14 | | <.001** |
| Snake only | .03 [−.16, .21] | .09 | .06 | .77 |
| Constant | 3.23 [2.96, 3.49] | .13 | | <.001** |
| Spider only | −.04 [−.17, .11] | .07 | −.10 | .61 |
| Constant | 2.44 [2.24, 2.65] | .10 | | <.001** |
| Lizard/turtle | .28 [−.04, .59] | .15 | .35 | .08 |
| Constant | 2.57 [2.30, 2.84] | .13 | | <.001** |
| Lizard only | .18 [−.20, .55] | .18 | .19 | .35 |
| Constant | 2.40 [2.20, 2.60] | .10 | | <.001** |
| Turtle only | .13 [−.12, .39] | .12 | .21 | .29 |

Note. CI = confidence interval. Snake/spider: $R^2 = .03, p = .43$; snake only: $R^2 = .003, p = .77$; spider only: $R^2 = .01, p = .61$; lizard/turtle: $R^2 = .12, p = .08$; lizard only: $R^2 = .04, p = .35$; turtle only: $R^2 = .05, p = .29$. ** $p < .001$.

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Figure 7
Study 2: Parent's Negative Utterances About Snakes/Spiders Predicting Children's Fear in the Control Condition



of negative information about lizards/turtles and children's fear of lizards/turtles in either condition ($ps > .07$). The interpretation of the results was the same using the proportion data and the data with the outliers included (see Online Supplemental Tables S12a and S12b for additional details).

Discussion

In sum, we replicated the animal by information interaction from Study 1 with the control group from Study 2, strengthening the argument that conversations about snakes and spiders are consistently characterized by more negative and less positive information. In Study 2 specifically, we found that participants also provided more negative information about snakes and spiders than lizards and turtles. Interestingly, we found that by imposing a relatively minor manipulation in which participants were informed about the impact of their conversations on children's learning and fears, we were able to slightly reduce the amount of negative information that parents provided about the animals in the instruction condition, and in doing so, we also saw a nonsignificant ($p = .06$) difference in children's fear beliefs about snakes and spiders.

General Discussion

The current research explored the kinds of emotional information that parents provide about snakes and spiders during naturalistic parent-child conversations. In Study 1, we examined whether parents would spontaneously provide more negative information about snakes and spiders than other animals and whether parents' use of negative information was related to children's fear of snakes and spiders. We found that both parents and children provided more negative information than positive information about snakes and spiders and also reported more fear of snakes and spiders compared to other animals.

We replicated these findings in Study 2, suggesting that conversations about snakes and spiders are consistently characterized by more negative and less positive information, and parents and children report greater fear of snakes and spiders than other kinds of animals. Further, we found that providing parents with explicit

instruction about the impact of negative information on children's learning and fears—specifically, that negative information can cause children to be afraid—resulted in less negative information provided by parents and less fear of snakes and spiders reported by children. However, both findings were not statistically significant ($ps = .13, .06$, respectively), though they were in the expected direction. One possible explanation for the lack of significant findings is that Study 2 was powered for capturing differences in the amount of negative and positive information used for snakes and spiders versus other animals. These differences were quite robust and replicable across studies, and we were likely underpowered for the more subtle differences that resulted from our instruction manipulation. Future research replicating these results with a larger sample can speak to their robustness.

It is also noteworthy that in Study 1, we did not find a significant link between parent's fear and their use of negative information or a relation between parent's use of negative information and their children's fear of snakes and spiders. This was surprising as we predicted children's fears to be directly related to the amount of negative information that parents tend to provide, in line with previous research (e.g., Field et al., 2001). In Study 2, however, we did find this predicted relation between parent's use of negative information about snakes and spiders and children's fear of snakes and spiders in the control condition where parents were not primed to carefully think about their use of emotional information in parent-child conversations about animals. One potential explanation for these inconsistent results is that we were again underpowered to detect potentially meaningful effects in the regression analyses since our power analysis was tailored to the primary aim of detecting differences in the conversational content of parents and children. Again, future studies that employ larger sample sizes are necessary to better understand the nature of these relations.

Another interesting potential explanation for our nonsignificant trends is that children's prior knowledge and attitudes toward these animals may have led to variation in the extent to which emotional information from parents related to children's fear. Previous research suggests that preschool-aged children already cite more negative information about snakes and spiders than other animals (Conrad et al., 2021), suggesting that children of this age might have already formed fear beliefs and negative attitudes toward snakes and spiders prior to the picture book reading. Future studies can address this issue by examining both parents' and children's existing knowledge and prior experience with animals like snakes and spiders and by studying the development of children's knowledge and attitudes toward snakes and spiders at younger ages.

Nonetheless, the current work makes several important contributions to the literature. First, we were able to replicate and extend previous findings (e.g., Conrad et al., 2021) demonstrating that conversations about snakes and spiders are different than conversations about other kinds of animals; more specifically, parent-child conversations about snakes and spiders contain more negative information than conversations about other animals. Further, we used a picture book manipulation, allowing us to control for the number and types of animals presented, their threat relevance, as well as the appearance of the animal (all were neutral images). This task thereby allowed us to measure participants' spontaneous, unprompted positive and negative responses about each animal based solely on their existing knowledge of the animals. Finally, we found some (albeit small) evidence to suggest that parents' use of negative information

can shift after some instruction in a way that can potentially reduce children's fears of animals like snakes and spiders. Such findings have broad implications for using parent language about animals as a mechanism for preventing the development of excessive childhood fears.

Second, our results have important implications for theories about the development of specific fears. As mentioned above, evolutionary theories of fear acquisition propose that fears of evolutionarily relevant threats like snakes and spiders are either innate or learned very quickly. Although the current work does not speak to the facility of fear learning, it does suggest that there is an imbalance of negative information available to children about snakes and spiders in their natural environments, which could help account for why these animal fears are more common than others. Further, relations between parent and child fear, coupled with the relation between parents' negative information and children's fear in Study 2, further suggest that information from parents indeed plays a role in the development of these fears. In this way, evolutionary predispositions (in both children's and parents' learning) might interact with everyday experiences to shape the development of some of our most common fears.

Despite these strengths, there are also several limitations to the current research. First, we collected data online, which resulted in a self-selected sample consisting of mostly high-income and highly educated families, which limits the generalizability for these findings. Indeed, studies have found that demographic variables such as having a pet (a common feature of high-socioeconomic-status homes; e.g., Applebaum et al., 2020) have been linked to less fear and more positive attitudes about unpopular animals like snakes (e.g., Özel et al., 2009; Prokop & Tunnicliffe, 2010). Thus, future studies with a larger and more representative sample are necessary for understanding the generalizability of our findings to children from various socioeconomic and demographic backgrounds, who in turn may vary in terms of parents' attitudes toward threatening animals.

Further, while we were able to show a minor reduction in children's fear beliefs toward snakes and spiders using a very simple manipulation (though this reduction was not significant at the $p < .05$ level), across both studies, we still found that children's fear beliefs about snakes and spiders were consistently higher than fear of other animals. This suggests that attitudes toward snakes and spiders may develop at an earlier age than was represented in this sample (ages 4–7). It is also noteworthy that the majority of conversations we observed consisted of neutral content, with very few emotional utterances provided in proportion to the rest of the conversation. It is thus also possible that even sporadic use of emotional information is more salient and better remembered than neutral information (e.g., Shtulman et al., 2021). However, the fact that we were able to change fear beliefs at all with such a minor manipulation is promising, and future research with more rigorous manipulations may have the potential to reduce children's fear beliefs further.

In conclusion, this research demonstrates that parent–child conversations about snakes and spiders are characterized by more negative and less positive information and that these conversations are different from the kinds of conversations parents have with their children about other animals, such as frogs, lizards, and turtles. Previous research has consistently shown that negative information can lead to the development of fear and avoidance behaviors in children. It is likely that, when repeated over time and combined

with observational learning or direct experiences, this negative information can lead to persistent or maladaptive fears. Of most importance, we show that simply making parents aware of the impact of their conversations on children's fear beliefs resulted in a minor reduction in negative information provided by parents and a minor reduction in fear beliefs toward snakes and spiders in children. Overall, the results of these studies suggest that parent–child conversations about snakes and spiders may provide the basis for the development of some snake and spider fears and that we might be able to use the very same mechanism—verbal input from parents—to potentially reduce or prevent those fears from developing in the first place.

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