frontiers FOR YOUNG MINDS

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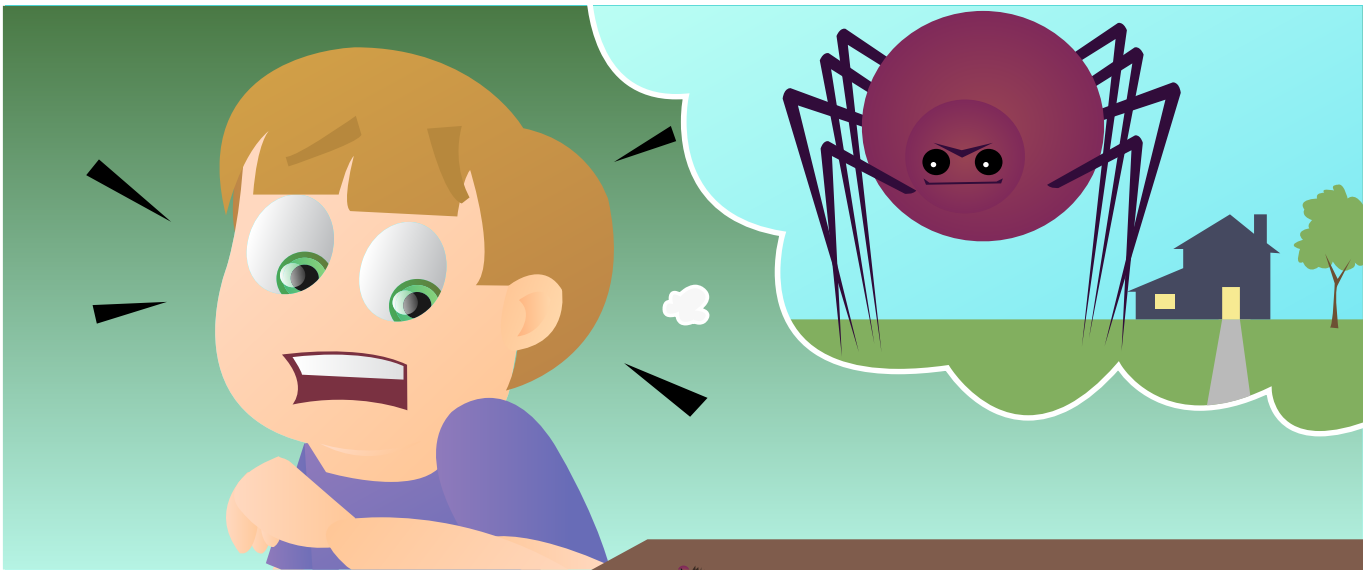

ITSY BITSY SPIDER? IT DEPENDS...

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REVIEWED BY:

BEN AND NATE
10 YEARS OLD

†THESE AUTHORS HAVE CONTRIBUTED EQUALLY TO THIS WORK.

You have probably heard it before. "The bug was huge!" (said your friend who is afraid of bugs), or "The needle was so big!" (said another friend who is afraid of shots). Can such statements be more than just figures of speech? We asked if fear could change the way people estimate size. To answer that question, we asked people who were afraid of spiders, and people who were not, to estimate the size of pictures of spiders and other animals. We also asked how unpleasant each picture was to look at. People who were afraid of spiders estimated spider size to be larger than did people who were not afraid of spiders. This result shows that our emotions can affect the way we evaluate the size of things around us. In other words, each of us experiences the world in our own special way.

ONCE UPON A TIME IN A LAB FAR FAR AWAY...

It started like any other day in the lab, when suddenly a spider decided to invade the work area and started crawling across my desk. I am afraid of spiders, so when I saw it, I immediately yelled for Noga to get it out of the lab! Noga could not understand what the fuss was all about. "It is a small spider," Noga replied. I was surprised by this response. To me, it looked gigantic!

Noga and I started arguing about the "real" size of the spider. If we both saw the same spider, why did we perceive it so differently? After Noga released the vicious spider back into the wild, we decided to settle the argument by coming up with an experiment that scientifically tested whether fear can affect the way people estimate size.

The first thing we did was to find out if there were already any studies showing that fear affects the way people estimate size. We discovered some studies about how emotions can affect the way people see the world. For example, van Ulzen and his colleagues [1] showed people circles with a picture inside each one. The picture inside the circles had either something that would create a positive emotion (a dollar sign) or something that would create a negative emotion (a gun). After they were shown the picture, the people participating in the study were asked to match the size of a comparison circle with the size of the target circle. Although the original circles were same size, participants perceived the circles with the negative picture inside as larger than the other circles. This result demonstrated that objects associated with negative emotions are estimated (or seen) to be larger than they actually are. Another study reported that women suffering from an eating disorder called bulimia overestimated the size of their own bodies [2]. Getting back to spiders, Vasey and his colleagues [3] asked people who were afraid of spiders to look at real spiders (in a jar) and estimate their size. Participants in the study estimated the spiders to be larger in size than they actually were.

In all of these studies, people were asked to estimate the size of something that they saw right in front of them (a circle, a spider, their own body, etc.). We were interested in something a bit different. We wanted to know if people who are afraid of spiders imagine them to be larger than they actually are. In other words, we asked if people who are afraid of spiders "walk around" with an image in their head of a spider that is larger in size than the image people have if they are not afraid of spiders.

Another question in our study was whether people who are afraid of spiders also see other unpleasant animals as larger than people who are not afraid of spiders.

OUR STUDY

To summarize, we asked two questions. First—do people who are afraid of spiders "walk around" with an image in their head of a spider that is larger in size than the image held by people who are not afraid of spiders? Second—do people who are afraid of spiders overestimate only spiders or also other unpleasant animals?

Our hypothesis (what we thought the results would be, based on what we learned from all the other studies) was that people who are afraid of spiders

FIGURE 1

Hypothesis.
Our thought was that people who are afraid of spiders (red face) would estimate their size to be larger compared with people who are not afraid of spiders (green face).

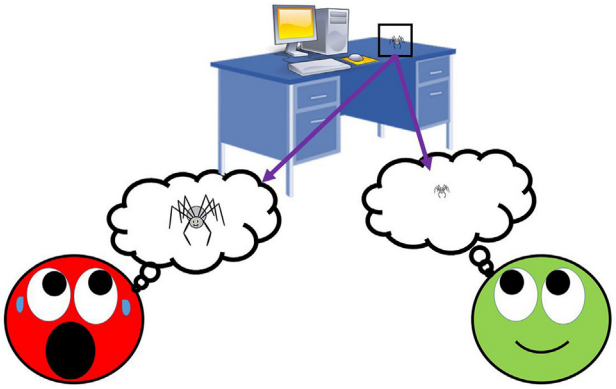

FIGURE 1

would estimate their size to be larger compared with people who are not afraid of spiders (Figure 1).

HOW BIG IS THIS SPIDER? THE TASKS THAT WE USED IN THE EXPERIMENT

First, we had to find people who were afraid of spiders and people who were not. To do that, we asked people to fill out a questionnaire that evaluated how afraid they were of spiders. For every answer that indicated that they did not love spiders, they got one point. The higher they scored, the more they were afraid of spiders. For examples of some questions, see part 1 in Figure 2. We selected only people who scored very high (at least 11 points out of 30) or very low (maximum of 6 points) to participate in the experiment. In the second part of the study, our participants saw a line with a picture of a fly at the left end and a picture of a rabbit at the right end, like you can see in part 2 of Figure 2. Below the line, there was a picture of an animal (wasp, beetle, spider, or butterfly). We chose these animals for a reason. Butterflies were chosen because they are usually something that people are not afraid of (none of our participants reported being afraid of butterflies). Wasps were chosen because they are usually something that people are afraid of. Beetles were chosen because they are similar in shape to spiders.

We asked our participants to position the computer cursor (an arrow) on the line between the fly and the rabbit, according to the real-world size of the animal pictured below the line, relative to the real-world size of a fly and a rabbit. For example, if they thought that a butterfly was closer in size to a fly, they would place the cursor closer to the fly. You can see examples of the different comparisons the participants carried out in part 2 of Figure 2. In the third and final parts of the experiment, participants saw a picture of each animal again. This time they were asked to use the line to indicate how unpleasant (not at all unpleasant or very unpleasant) each picture made them feel. You can see examples in part 3 of Figure 2.

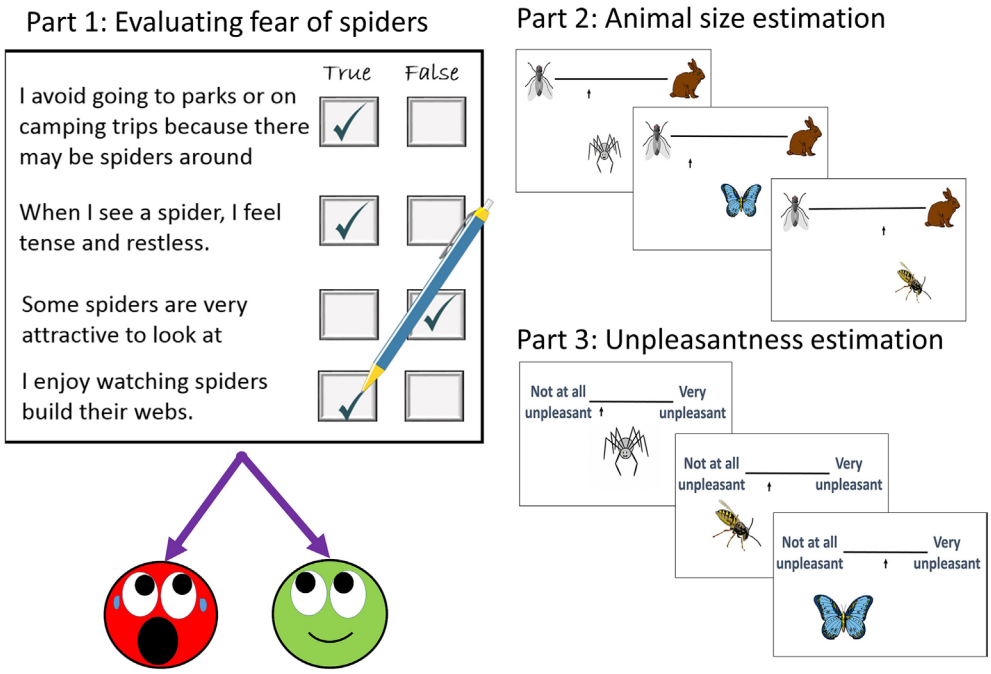

FIGURE 2

Parts of the study. Part 1—examples of the fear-of-spiders questionnaire. The real questionnaire had 30 questions. Part 2—examples of size estimation tests. Importantly, participants had to estimate the real-world size of the animals in the pictures and not the size of the animals as they appeared on the screen. These pictures are just examples and not the real ones we used. Part 3—estimating how unpleasant each picture made the participants feel.

OUR FINDINGS

To process the results, we divided the participants into two groups: those afraid of spiders and those not afraid of spiders. For each group, we calculated the average size estimation for each animal, based on where the individuals clicked on the line in the experiment. We did the same for the unpleasantness estimation. You can see the results in Figure 3. Looking at the graphs, you can see that for every animal, the average size given by participants in the "afraid of spiders" group is different than that of the "not afraid of spiders" group. We used a kind of math called statistics to evaluate whether this difference happened just by coincidence or whether this difference was real and reliable (meaning that if we repeated the same experiment, we would likely get this difference again). A difference that is repeatable is called "significant."

For the unpleasantness scores, we saw that, as we expected, the group that was afraid of spiders rated them as more unpleasant than the other group. The same occurred for wasps and beetles. Butterflies had the same unpleasantness rating in both groups.

For the size estimation, we saw that the group that was afraid of spiders estimated the size of spiders to be significantly larger than the group that was not afraid of them. We saw the same thing for beetles. Other animals (wasps and butterflies) were estimated similarly by participants in both groups. These results allowed us to answer our first question: participants who were afraid

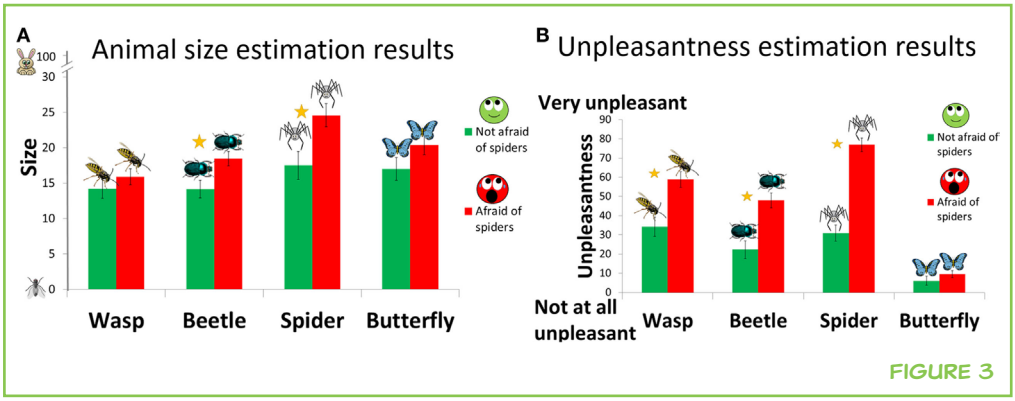

FIGURE 3

In **A.**, you can see the *size estimation results*. The bars represent the group average estimation of the size of each animal. The *Y* axis represents the estimated size, and the *X* axis represents the different animals. The yellow stars indicate that the difference between the averages of the two groups is significant, using statistics, meaning that it is not due to coincidence. In **B.**, you can see the *unpleasantness estimation results*. The *Y* axis represents the unpleasantness score and the *X* axis represents the animals.

of spiders overestimated the size of a spider compared with participants who were not afraid of spiders.

To answer our second question—whether people who are afraid of spiders overestimate the size of other unpleasant animals—we looked at the wasps' size and unpleasantness scores. Participants who were afraid of spiders rated wasps as more unpleasant than participants who were not afraid of spiders (Figure 3B). However, the size estimation of both groups was similar (Figure 3A). So that means that if an object was unpleasant but the participants were not actually afraid of it on a daily basis, overestimation of size was less likely to occur. We also saw that the group that was afraid of spiders overestimated the size of beetles. We think that this is because people who are afraid of spiders are usually afraid of beetles [4]. Some of the people who participated in the study mistakenly confused the beetles with cockroaches.

EACH OF US SEES THE WORLD IN OUR OWN SPECIAL WAY

The initial motivation for conducting this study was to ask how it is possible that two people in the same lab saw the same spider but estimated its size so differently. We learned from our results that people who are afraid of spiders imagine them to be bigger. We also learned that in order to overestimate the size of an object, that object needs to cause the person to feel fear and unpleasantness on a daily basis.

We demonstrated in this work that negative emotions (fear and unpleasantness) cause people to overestimate size. But what about positive emotions? Some studies found that positive emotions could also change size estimation. For example, expert golf players estimate the physical size of the hole the ball is hit into to be larger than non-expert players estimate the hole to be [5].

The next question to be asked is what causes what? Do some people have an image of a big spider in their mind and this is why they are afraid of spiders? Or are they afraid of spiders because when they see one, they see it as bigger than it really is? This question requires some more studies. Such

additional studies are important because understanding why people are afraid of spiders can help scientists develop ways to help such people get over their fear.

So, this study is one example that our eye is not just a camera, taking accurate pictures of the world. Instead, each of us sees the world in our own special way. So, the next time a friend asks you to deal with a spider because he or she is afraid, remember that while you might see this spider as tiny and non-harmful, your friend might see it as huge and intimidating.

AUTHOR CONTRIBUTIONS

TL and NC conducted the study and contributed equally to the original manuscript. TL, NC, and AH analyzed the data and wrote the original manuscript.

ORIGINAL SOURCE ARTICLE

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CONFLICT OF INTEREST STATEMENT: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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BEN AND NATE, 10 YEARS OLD

Both like finding things out, how things work with their friends, and they like exploring stuff. Nate is interested in all science, especially astronomy, physics, and computer science. Ben is specifically interested in Paleontology; his favorite dinosaur is a Parasaurolophus. Nate's favorite game is Minecraft; Ben's favorite game is Jurassic World. Both love reading.

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Professor Emeritus at Ben-Gurion University of the Negev. I was trained as a psychologist and I am interested in how people acquire knowledge (such as arithmetic) and abilities (such as attention). I examine how these functions are used and how they can be improved. My recent research examines whether familiarity with sizes and amounts is related to development of basic arithmetic. As part of my research, I examine brain areas involved in acquiring knowledge and abilities, and reasons for atypical functioning.