




IN THE WEB OF FEAR

TEXT: LAURA BECK

PHOTO: BIOSPHOTO / FOTOFINDER.COM



In reality, this Australian peacock spider is only five millimeters long. But even this tiny creature can trigger fear in arachnophobes. Peacock spiders have up to eight eyes; the frontal pair are especially well developed and can even see colors. The spider uses them to focus on its prey and choose the right mate.

People who run away screaming from tiny spiders are often ridiculed by their peers. But a pronounced fear of spiders is anything but funny if you're the person affected. Florian Binder, a member of Victor Spoormaker's research group at the Max Planck Institute of Psychiatry in Munich, is using virtual reality to gain a better understanding of anxiety disorders and to develop a standard therapy. The author tried it out on herself to find out how it works.

A virtual reality headset transports Florian Binder's colleague Dorothee Pöhlchen into another world. Her movements are measured by acceleration sensors attached to her body, and then a computer translates them into movements of her virtual body.



PHOTOS: STEFANIE AUMILLER FOR MPG

“In the future, anxiety sufferers could receive fully automated treatment by entering virtual reality in their own homes.”

FLORIAN BINDER



You usually don't have to make a lot of excuses for being afraid of spiders. After all, almost everyone is a little bit nervous about these eight-legged creepy-crawlies. Not pleasant, maybe rather annoying – but not that bad, you might think.

But what about when this unease becomes downright panic? Like it does with me? When I'd rather sleep on the couch than walk past a spider into the bedroom? When the sight of a spider drives practically every other thought out of my head? That's when fear of spiders, also known as arachnophobia, becomes a burden. And not just that – it can even put me in danger, for example if a spider lowers itself from the sun visor of my car and I am so overcome by panic that I can only just manage to pull over to the side of the road. This phobia causes accidents every year, some of them serious. Arachnophobia can therefore become a real problem for those affected.

Florian Binder is a doctoral researcher in the group led by Victor Spoomaker at the Max Planck Institute of Psychiatry. Although the reactions of arachnophobes may seem excessive to outsiders, he doesn't dismiss the phobia as irrational. Instead, he asks himself whether a behavior is adaptive, i.e. whether it could be useful for survival. After all, people have good reason to be afraid of spiders. A bite from a *Phoneutria nigriventer*, for example – commonly known as a Brazilian wandering spider – is so poisonous that it can kill a human adult. When the Voluntary Fire Department in Lauterbach in the German federal state of Hesse were called out to deal with one at the beginning of 2021, they could not be blamed for not daring to catch the spider alive and finishing it off with a fire extinguisher instead.

Measuring an emotion

Anxiety disorders, which include phobias, are the most common type of psychiatric disorder – around a quarter of the population will develop an anxiety disorder at some time in their lives. The most common of these are specific phobias, i.e. the fear of a specific object or situation. Spoomaker's team aims to understand phobias better and to make their symptoms measurable. Fear of spiders is particularly suitable as a research object, since it is the most common phobia in Germany. Moreover, it is directed at a specific object. Women are affected five times as often as men.

Florian Binder is testing people with and without arachnophobia for his study. His experiment is a pioneering project: for the first time, researchers are studying the behavior and movements of phobia sufferers who are completely immersed in virtual reality. This enables Binder – who is an information scientist, mathematician and psychologist – to program environments that may be only virtual but that trigger real emotions, like fear of spiders or heights. And he can then measure these feelings. Measuring anxiety – how is this possible? The people taking part in the study wear a virtual reality headset. This enables them to see a virtual environment like that in a 3D movie theater – with the difference that they are right in the middle of the virtual world. Sensors attached to the body record their movements and transfer them into this virtual reality landscape. When wearing the headset, the test subjects see a representation of their body and can control their virtual arms and legs by moving their real limbs. These visual impressions are so strong that participants perceive the virtual environment as real.



SUMMARY

Phobias are often treated by exposing the patient to the object or situation they are afraid of.

However, depending on the type of phobia, this can be stressful or even dangerous. But in virtual environments, the behavior and physical reactions of persons suffering from anxiety can be recorded by standardized means.

In the future, virtual reality could be another part of the treatment plan for phobia patients.

The test subjects' reactions then serve as a measure of what they are feeling: the virtual reality headset measures their pupil sizes and tracks their eye movements, while electrodes record their heartbeat. Their movements are logged at the same time. The researchers put all these data together and can then use them, for example, to analyze the avoidance behavior typical of anxiety sufferers. This has enabled them to obtain objective data about anxiety for the first time. In contrast, our previous knowledge of psychological distress and avoidance behaviors in phobia sufferers came from self-assessments. However, subjective statements like these are difficult to compare, since each respondent interprets the questions differently.

Confrontation as therapy

36 Thus the therapies available today are highly individualized and difficult to standardize. Arachnophobia is treated using exposure therapy, which involves exposing the patient to the object of their fear, initially by showing them pictures and videos of spiders, such as tarantulas. Many people with anxiety disorders deal with their fear by avoiding the trigger. However, this does not solve the sufferer's problem – on the contrary, it can make the phobia worse. Patients therefore need to learn to conquer their fear to such an extent that they can gradually approach a real spider and even touch it. However, tarantulas aren't often on hand for therapy sessions. Moreover, a lot of patients find this type of therapy extremely stressful. That's why it is only rarely used.

I find out how upsetting a confrontation with the object of my fear can be when I test the University of Basel's Phobys app in preparation for Binder's experiment. A study has shown that people feel less afraid of spiders after they have practiced with Phobys. The program uses "augmented reality" – in other words, it merges the real and virtual worlds. It enables me to project a virtual spider into my real world using my smartphone. I then have to cope with the spider's presence in situations at various "levels of difficulty". However, this type of confrontation is too much for me. As soon as the virtual spider in my cell-phone is sitting on the dining room table, my pulse accelerates and my hands start to shake. And when the spider suddenly appears to jump out of my phone, I hurl it across the room in sheer fright. (The app has

since modified the test; you can now choose between "mild" and "terrifying".)

This is the state I'm in when I meet Florian Binder at the Max Planck Institute. But he laughs and says, "Don't worry, you don't have to be afraid of shocks in our virtual world." He places the virtual reality headset over my face, and we are ready to start. I am standing in a tiled room. A viewing window descends in the wall opposite me, and I see the spider – far away under a glass bell. I am asked to describe how unpleasant I find the sight of it. Then I am shown a turtle. These two animals will be my companions for the next half hour. The world around me changes; I am now standing hip-deep in water. The pool I am standing in is edged with planks of wood. The spider is on my left, the turtle on my right. My task now is to catch fish and put them into a bucket. How close do I fish to the spider, and how close to the turtle? I prefer to start fishing on the right and keep a close eye on the spider on the other side.

My surroundings change again. Now I'm in a large office, where my task is to take books from a counter and put them on a bookshelf. To do this, I have to walk past a table – the spider is sitting to the left of it, the turtle to the right. I prefer to pass it on the right. But when I go back for the next book, the spider and the turtle have changed places. Although the route past the turtle is longer, I now choose to pass the table on the left. I'm now back in the first room. In front of me on a small table: the spider. After a countdown, I have to walk over – and touch it. I start walking. The spider is black and hairy and crawling around a little. I stretch out my real hand. Through my headset, I see how my virtual hand approaches the spider. At first, I can't bring myself to touch it. My fear gradually mounts. Inside, I'm cheering myself on and laughing at myself. When I finally manage to touch it, the spider recoils in shock. I did it! I am so relieved.

My excursion into the virtual world took a good half hour. Florian Binder removes my headset. It takes a moment for me to remember where I am. Afterwards, Florian Binder explains the data he has obtained from other people taking part in the study. These data largely conform to my own perceptions and behavior. When the test subjects are asked to touch the spider, they initially approach it quickly but hesitate when they are right in front of it. And just like me,

FEAR OF NEEDLES

People with a phobia of needles refuse to be vaccinated or avoid going to the doctor in case they have to give a blood sample. This avoidance behavior can cause immense damage to the patient's health and may be an underestimated reason why some people do not want to be vaccinated against COVID-19.

Angelika Erhardt and her team at the Max Planck Institute of Psychiatry offer a treatment program for people who are scared of needles. It is designed to help people tolerate having blood drawn with a syringe. During the

confrontation therapy, which lasts for six sessions, the participants initially learn about the causes of fear. They are then shown images of needles and later hold a syringe in their hand. At the end of the therapy, they have blood drawn with a needle and syringe. The patients are thus required to face up to their fear and break through their avoidance behaviors. The therapy is very successful: afterwards, two out of every three patients find that they are less afraid of being pricked or injected with a needle.

people with arachnophobia maintain a greater distance from spiders than non-arachnophobes, even in virtual reality. They also look at the spider more often and are less likely to turn their back on it. They prefer to fish closer to the turtle than the spider, deliberately make detours around it in the virtual of- fice, and need a longer period of time to touch it. "One test subject needed three minutes before she could bring herself to touch the spider. But she did it in the end – just like everyone else," says Binder.

Overcoming fear

Afterwards, there is a feeling of relief at having overcome the fear. This is an important experience for the brain, since it learns that positive feelings come from conquering fear and not from avoiding it. In real life, however, phobia sufferers don't ever get to this point because they invariably avoid confrontation. Virtual reality therefore enables researchers to collect objective data about the behavior of people with anxiety disorders under standardized conditions. During the next stage, Florian Binder wants to investigate whether a perceived loss of control influences the way people behave towards the spider. This postulation makes sense, since anxiety patients are generally likely to feel less in control, i.e. they believe that events around them are less dependent on their own behavior.

Insights like these could also be used to treat phobias. Patients could be given more control over the spider's behavior in the virtual world, thus making subsequent confrontations in the real world more pleasant – for ex-

ample, by demonstrating in virtual reality how spiders react to people. Spoomaker's team also aims to use the software to reduce avoidance behavior. Virtual reality therapy could determine the patient's level of anxiety and adjust the tasks accordingly. Psychiatrists and psychotherapists would be able to measure the patient's progress directly and use the results to decide on the next steps in their treatment. The framework conditions could also be changed as needed: the spider, for example, could be replaced with other objects of fear. It could even be used to treat social phobias, such as claustrophobia. The patient could then stand in a virtual subway train surrounded by passengers, for instance; the number of passengers could then be increased or decreased and the direction in which they are looking changed, depending on how severe the phobia is.

"The day might come when virtual reality sets are available for self-treatment at home," Spoomaker tells me. Then arachnophobes would no longer have to touch a real spider in order to learn how to overcome their fear. And spiders would no longer stop me from going to bed.

www.mpg.de/podcasts/emotionen (in German)

