SPIDER DANCES THROUGH THE WEB

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Spider Dances Through the Web

--Ayush Gupta (27-5-2025)

One day on a random evening I was strolling in the park when I observed a spider weaving its net(on a rectangular metal bar shaped) in its early form, well I didn't had the luxury to see the process from the start but when I came then it had completed making a big outer circle and then 5 to 6 strings as the diameters of that circle, I was amazed how it can't fly but follows the path of its own string to make another string across the center to the outer circle, also after placing of 1 or 2 strings it also make a tiny circular weave very close to the center to make the center stronger and also maybe to tighten the strings. Then after placing many strings from the center to the outer string, it started continuously weaving around the center to bigger the radius in circular/radial pattern, then I thought it would continue to weave like this till it reaches the outer circle but to my surprise it didn't, after some revolves around the center it skipped the middle portion and went to the outer area and started to weave there in radial direction...but why?

I am still curious, the way I think is that after placing many strings and tightening them in the center it might "think" that what if the border strings attached to the metal bar might snap if the pressure from the center got too much so it might have gone to tighten the outer circle and skipping the middle area for later. I was so amazed by this and also the wind was rapid but still the web was vibrating very less. It got me into thinking that I am pretty sure the spider's parent were not that smart that they could even teach it to make this in so mechanistic way that it's so perfect down to the last minute detail, and also it's certainly impossible to think that the spider would have learned from seeing other spiders...so where did it learn? Then I thought what if it's genetically encoded to not only see but also to feel the tension and mechanics of the strings and the good and perfect way to do that?

How does a spider build a web so precisely without being taught?

Spiders don't learn to weave webs by observation or teaching, they rely purely on their instincts which are actually encoded in the genetics. These instincts have been made by the only rule "survival of the fittest", the spiders who weaved correctly survived and their kids carried the legacy made it more precise, and those who didn't died so this web-building precision has been refined over millions of years. Every motion, tension adjustment, and structure are coded in their DNA as neural patterns firing in their brain almost like an algorithm. It's like a machine executing code, with feedback loops from its sensors(legs) feeling the tension, angle, and vibration of the strings. It's like a spiking neural network that evolved to solve this structural physics problem without being conscious of it.

Spiders can feel their web with their leg hairs called trichobothria (which can detect minute air currents, vibrations, or sound waves in the environment) and their claws are mechanoreceptors that can detect the tiniest vibrations and tensions in the silk. It's likely that as it builds, it's constantly testing the strength and

geometry of the structure, making adjustments based on tactile feedback, this is a biomechanical feedback loop.