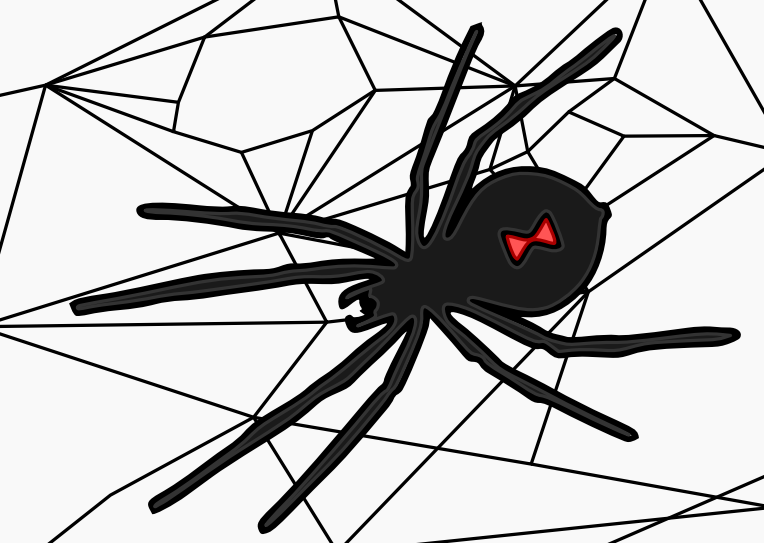




# Quantifying the Structure of *Latrodectus* Spiderwebs

Jack Featherstone, Mahesh Bandi

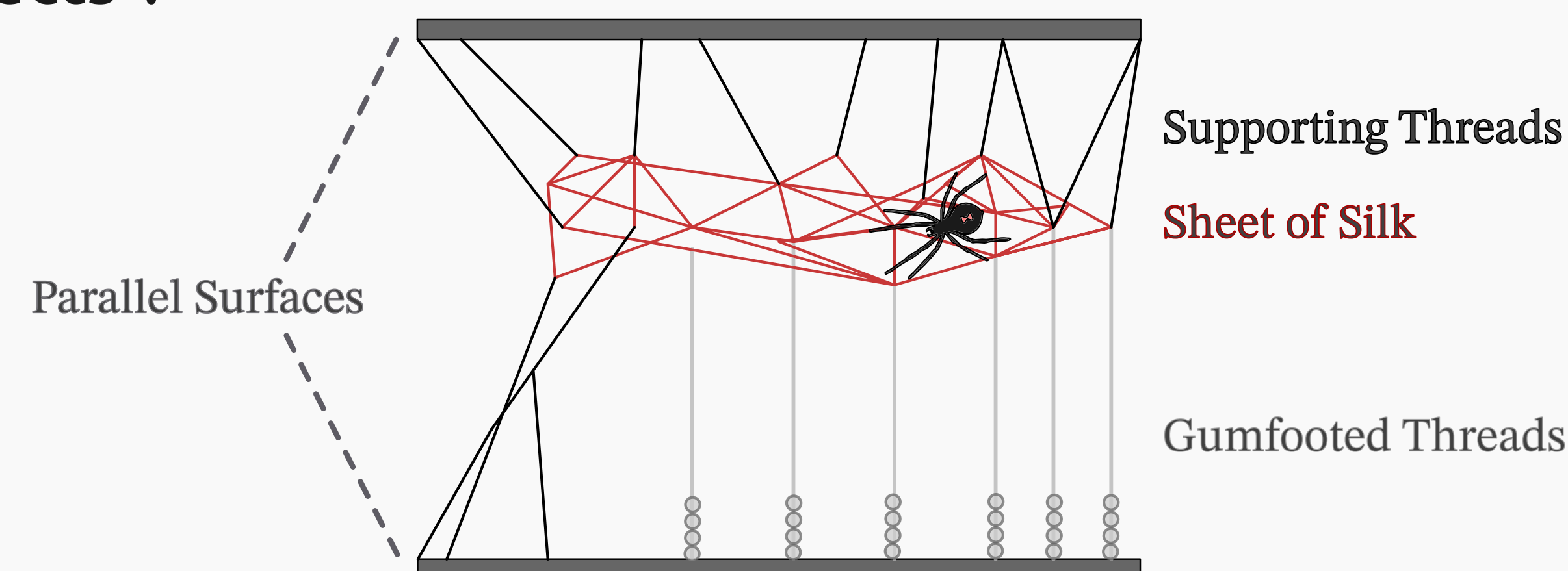
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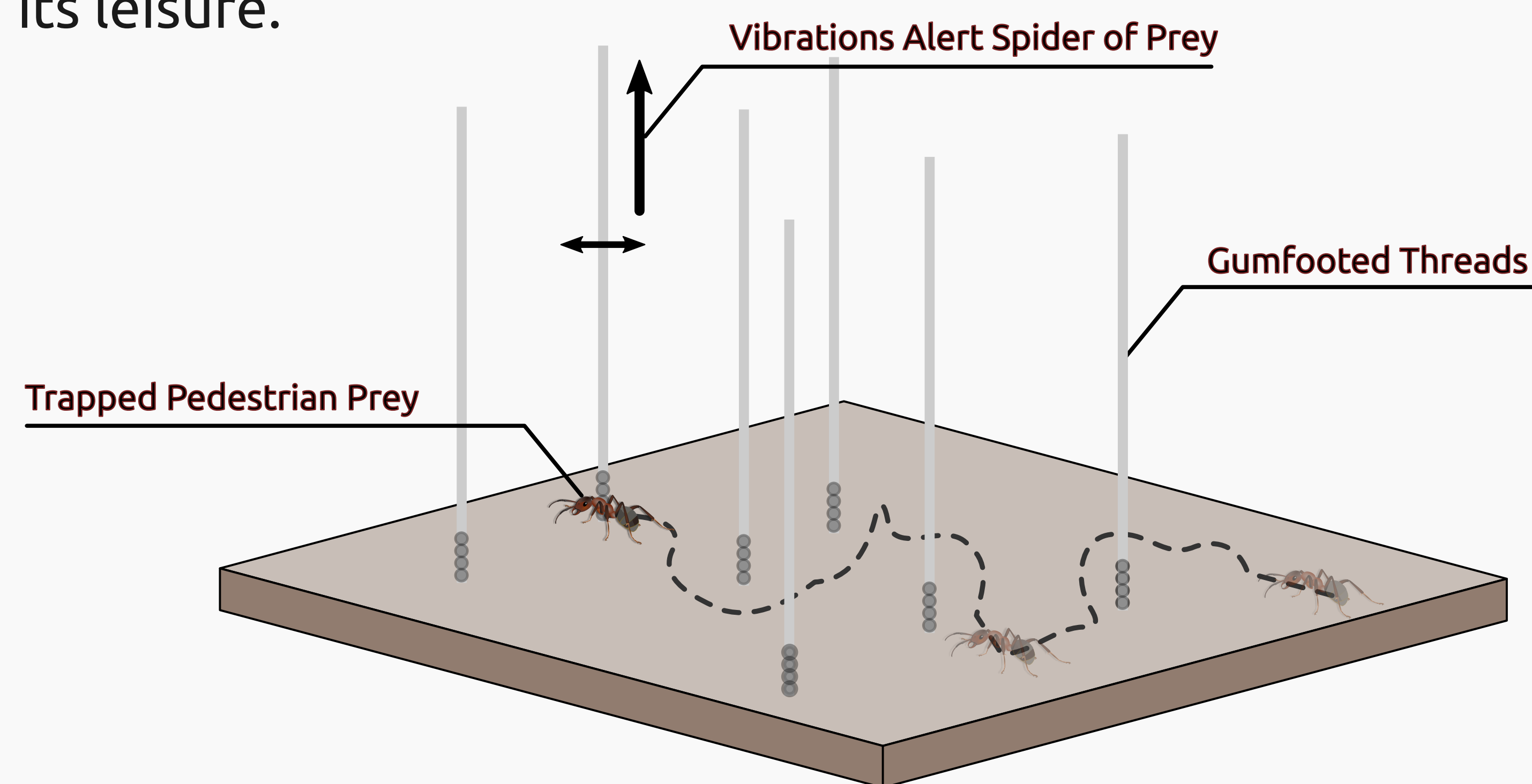
## Spiders and Their Webs

Spiderwebs, in their myriad forms, act as an extended phenotype — they are marvelously multipurpose tools, aiding in **defense, prey capture, and reproduction**<sup>1</sup>.

Members of the *Latrodectus* family ("true widows") weave unique, **three-dimensional webs** adapted to capture pedestrian insects<sup>2</sup>.

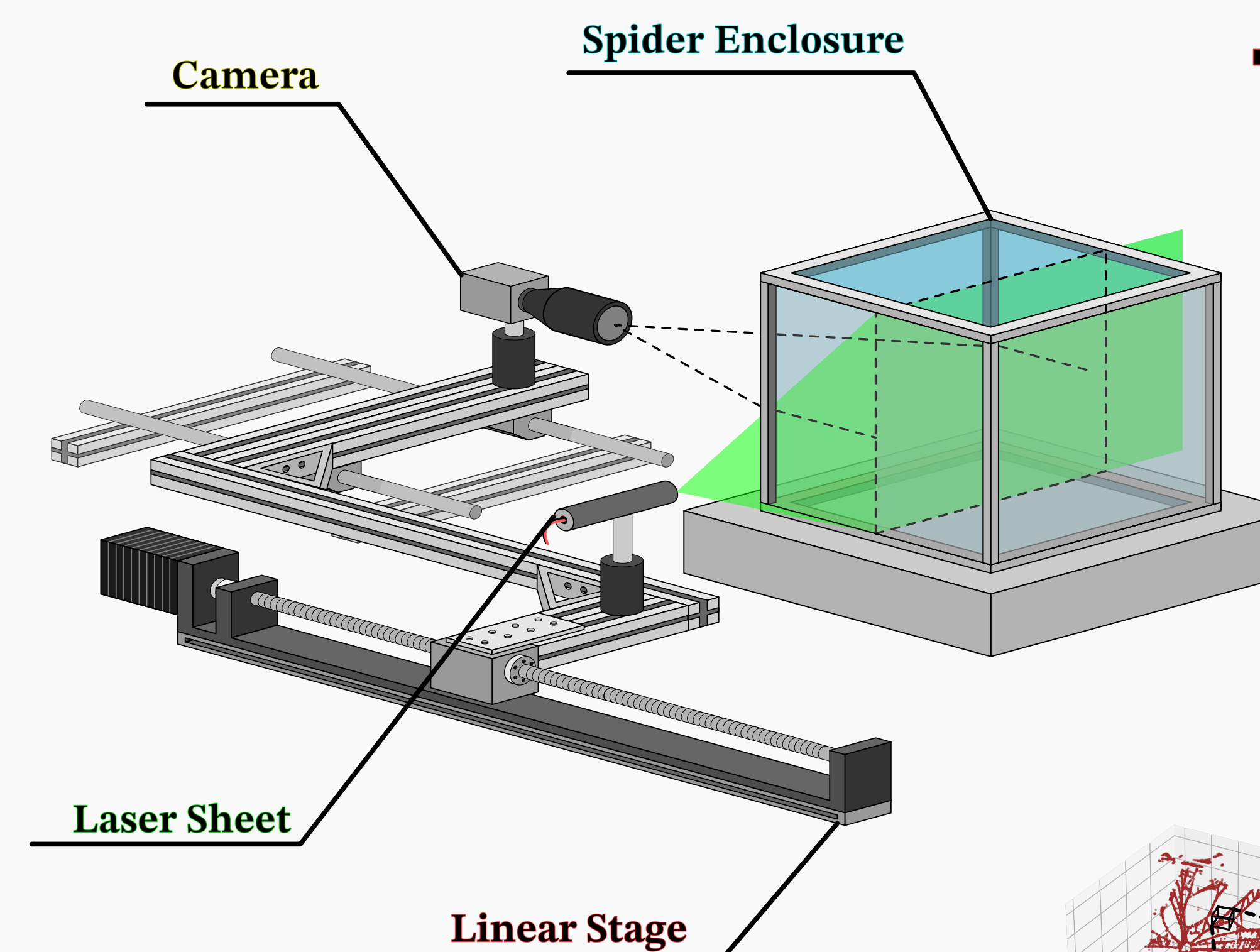


Passerby insects that blunder into one of the many vertically-oriented **gumfooted threads** become ensnared by the **viscid glue**, allowing the spider to collect the prey at its leisure.



How, if at all, does the spider optimize its placement of the gumfooted threads?

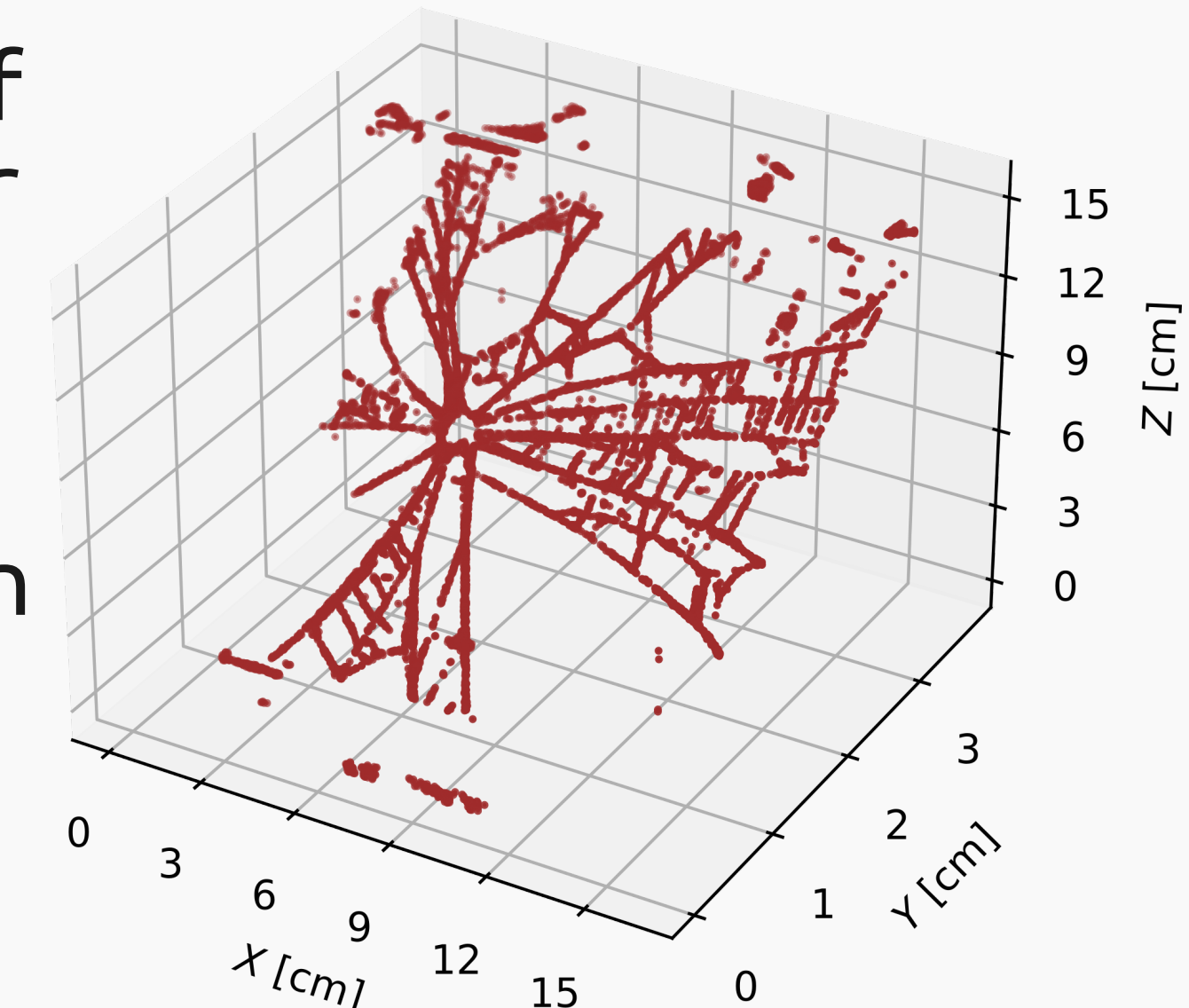
How does the geometry of the web affect the propagation of vibrations to alert the spider of captured prey?



## Three-Dimensional Scanning

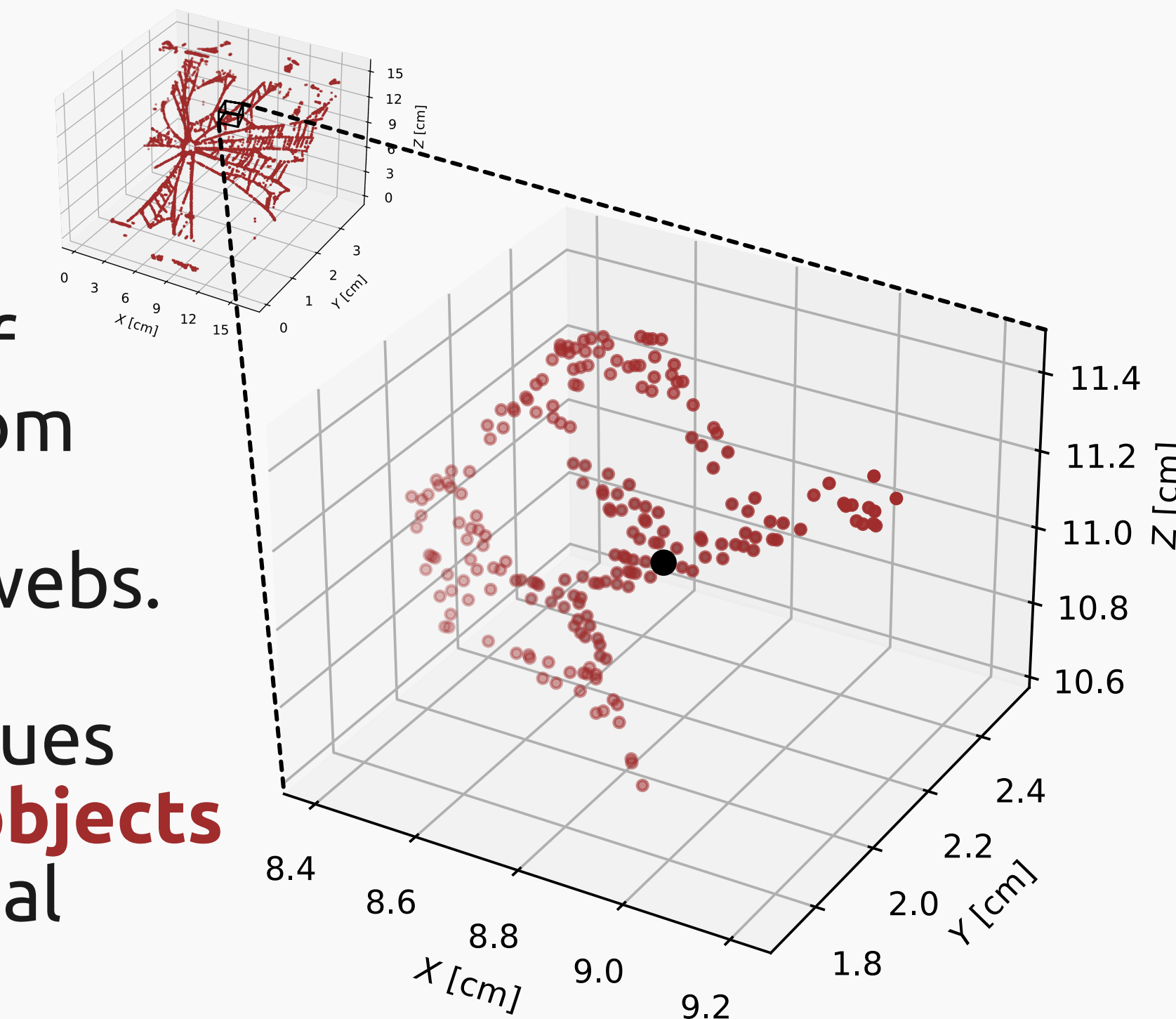
We perform **three-dimensional scans** of spiderwebs using a sheet laser to scatter light off of the silk<sup>3</sup> (left).

This process yields a **point-cloud representation** of the spiderweb, shown for a sample orb-weaver web (right).

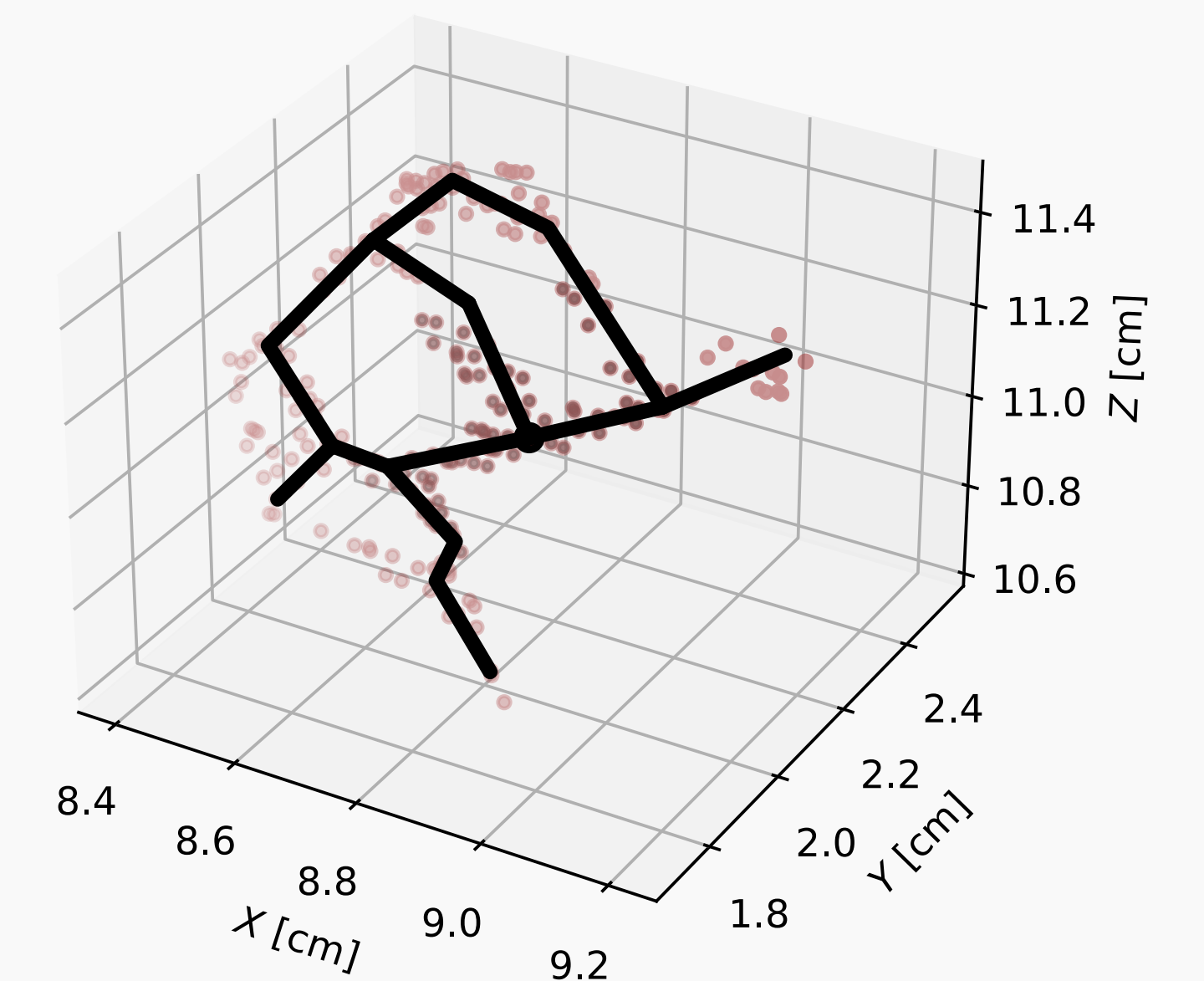


**Skeletonization**, the process of constructing a proper **graph** from point-cloud data, is needed to quantitatively understand the webs.

We develop specialized techniques for skeletonization **suited for objects with many holes**, for which usual methods<sup>4</sup> fail.



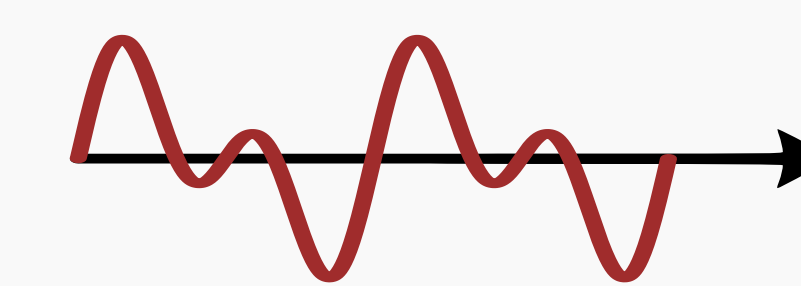
Skeletonization



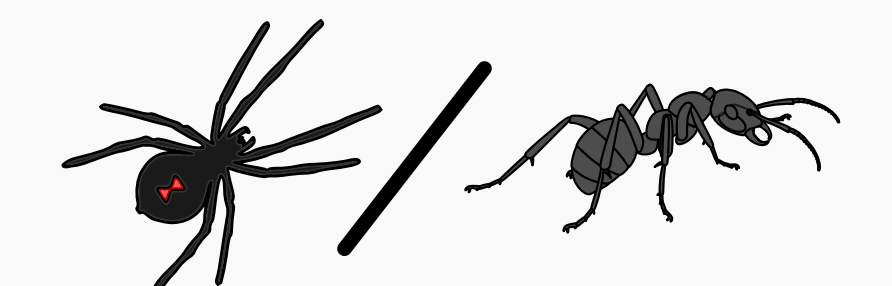
## Future Work



Continue developing **skeletonization techniques** for **topologically complex objects**



Use scanned web structures to investigate **acoustic properties** of *Latrodectus* webs.



Investigate **placement of gumfooted threads**, and **spider-prey interactions**.

## References

1. Benjamin & Zschokke (2003). Biological Journal of the Linnean Society, 78(3), 293–305.
2. Forster (1995). Rec. West. Aust. Mus, 52, 13–24.
3. Su *et al.* (2018). Journal of the Royal Society, Interface, 15(146), 20180193.
4. Bucksch *et al.* (2012). The Visual Computer, 26, 1283–1300.

Contact details, more information about our research, and further reading

