Watching a rat’s rapidly shivering whiskers, you might be forgiven for thinking that the animal was nervy, but Mitra Hartmann, from Northwestern University, USA, explains that far from expressing anxiety, the animals are deftly exploring their surroundings. ‘Rats use their whiskers to navigate, to search for objects and explore them, to socialize with other rats, to sense fine textures and to catch prey’, explains Hartmann.

However, it wasn’t clear how sweeping their whiskers back and forth (whisking) affected the extent of the surface probed by the animal’s tactile hairs. ‘We wanted to learn where around the rat’s head the rat could feel with its whiskers and how this “sensing region” changes during whisking’, explains Hartmann. Measuring the area covered by the whisking whiskers in a live rat is almost impossible, so Hartmann and her colleague Lucie Huet modified the digital-rat simulation that had been built previously in the Hartmann lab to include realistic whisking motions, to investigate how rats perceive the world through the curved hairs (p. 3365).

After incorporating the complex equations that describe the whiskers’ quivering motions into the digital-rat algorithm and tracking the whiskers’ motions, the duo found that the tips of the hairs lay on the surface of an imaginary sphere centred between the animal’s eyes. ‘This suggests a tight coordination between the rat’s whisker and visual systems’, says Hartmann. In addition, the arrangement allows them to sense close approaching objects from almost all directions. The team also found that the curvature of the rat’s whiskers allowed the animals to search 40% more space than if the hairs were simply straight. And the way that the rats tipped and twisted their whiskers while whisking to and fro allowed them to probe regions of space that were not searched by other whiskers. ‘These small amounts of “elevation” and “roll” during whisking [were] long thought to be insignificant motions’, says Hartmann. She concludes by explaining that the rats appear to be able to tightly control how finely they investigate an object. ‘The rat often moves its front and back whiskers differently on the same side of the face’, says Hartmann, adding that this could potentially allow rats to cluster the hairs close together when they want to build a detailed understanding of an object or spread them wide to search a larger space.

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